Queensland

AUS-SPEC #1

DEVELOPMENT SPECIFICATION SERIES

CONSTRUCTION

BURNETT SHIRE COUNCIL

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QUEENSLAND AUS-SPEC #1
DEVELOPMENT SPECIFICATION SERIES
CONSTRUCTION

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QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

CQS

QUALITY SYSTEM REQUIREMENTS

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION CQS - CONTRACT QUALITY SYSTEM REQUIREMENTS

CLAUSE **CONTENTS** **PAGE**

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 ISO 9001 ***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 requirements 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 ISO 9000 Quality management systems -- Fundamentals and vocabulary
   AS/NZS ISO 9001 Quality management systems -- Requirements
   AS/NZS ISO 10013 Guidelines for quality management system documentation
   AS/NZS ISO 19011 Guidelines for quality and/or environmentsl management systems auditing
   Handbook HB 90.3 The Construction Industry Guide to ISO 9001:2000

2. Clause references shown on the right margin (keyword column) relate to AS/NZS ISO 9001 Additional guidance is provided in HB 90.3.

CQS4 DEFINITIONS

Synonym or Abbreviation

1. For the purpose of this Specification, the definitions as in AS/NZS ISO 9000 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 will not require raising of a Nonconformance Report.

CAR

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

Synonym or

	Abbreviation
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***
Product Audit	
An assessment of the conformity of the product with the specified technical requirements.	***- Conformance Audit*** ***- Service 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***

	Synonym or Abbreviation

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 Requirements

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 SystemRequirements -***

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
SRD	-	System Requirement 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 as specified in AS/NZS ISO 9001, with guidance to preparation in AS/NZS ISO 10013 and HB 90.3.

2. It shall incorporate all applicable System Requirement 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. ***SRDs***

CQS7 QUALITY PLAN

1. The Quality System shall be incorporated in the project Quality Plan. The Company Quality Manual with its System Requirement Descriptions, standard Method Statements and Check Lists and the project specific components make up the Quality Plan. This is illustrated conceptually in Figure CQS1. ***Content of QP***

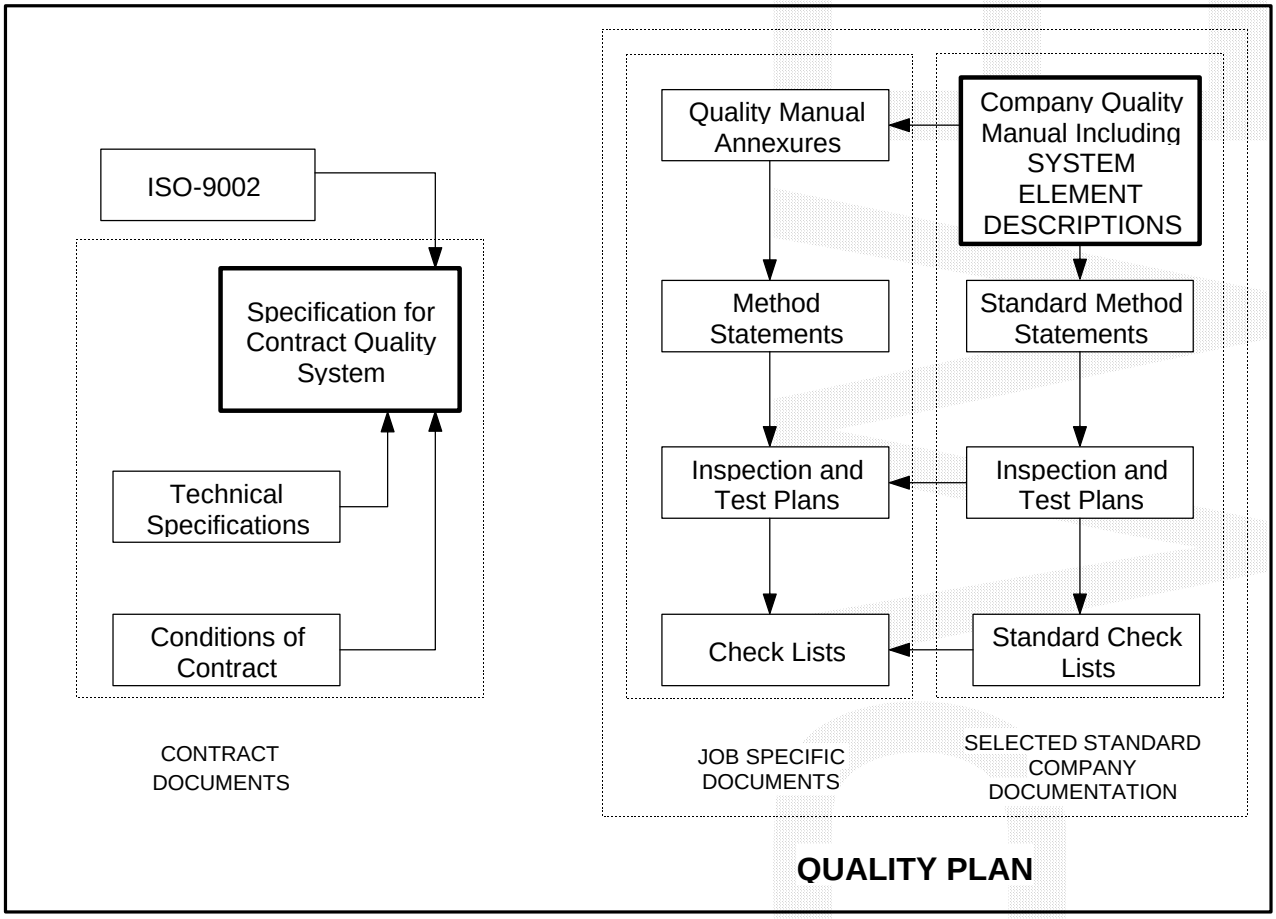

Figure CQS1 - Project Quality System Documentation

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 Requirement Descriptions

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

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 Requirement Descriptions in the Company Quality Manual may need augmentation to cover the requirements of AS/NZS ISO 9001 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.

Clause 7.1, 7.5

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***

Clause 4.2.3, 4.2.4

CQS11 DOCUMENT CONTROL

1. In addition to the requirements of AS/NZS ISO 9001,, the Quality Plan shall specify the method of keeping Quality Registers, tracking and handling of NCRs ***Records***

and NNCs and site correspondence.

2. A copy of AS/NZS ISO 9001 shall be kept on site. ***AS on Site***

Clause 7.6

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***

Clause 7.4

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 9001 and the requirements of this clause are included in all such subcontracts. ***Subcontracts***

Clause 7.1, 8.1

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. ***Clause 7.4.3, 8.2.4***

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. ***Clause 8.2.3, 8.2.4***

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. ***Clause 8.2.4***

4. The Contractor shall also establish and maintain a system for identifying the inspection status for all lots of work. ***Clause 7.5.3, 8.2.4***

Clause 7.5.3

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 ***Field***

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. ***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

Clause 7.5.3, 4.2.4

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 Requirement 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 describe the process control parameters for special processes which cannot be fully verified by subsequent inspection and test. ***Clause 7.5.2, 8.2.3***

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

Clause 4.2.4

1. The Contractor shall keep and maintain all Quality System records as required by AS/NZS ISO 9001 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. If requested by the Principal, within one month from the date of Practical Completion, the Contractor shall provide the Superintendent with a copy of the Quality Register, or parts thereof. ***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

Clause 8.3

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

original process, a NCR will be required but a Hold Point will not apply.

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***

Clause 8.3

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.

Clause 8.5.2

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 ***Clause 8.2.3, 8.2.4, 8.4***

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 ***Clause 8.2.2, 8.2.3***

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 AS/NZS ISO 19011.. ***Audit Schedule***

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

SPECIAL REQUIREMENTS

CQS25 RESERVED

CQS26 RESERVED

MEASUREMENT AND PAYMENT

CQS27 PAY ITEMS

1. Payment shall be made for all activities associated with the planning, establishment, implementation, operation and maintenance of the Quality System for the project. These costs shall include all investigation, inspections, testing, rectification and maintenance of the Quality Register.

2. Cost adjustments, if applicable, will apply the same as to any other Pay Item in the Schedule.

Pay Item QP1 QUALITY SYSTEM DOCUMENTS AND RECORDS

1. A lump sum for this item shall be provided for all costs associated with the preparation and submission of the Quality Plan, the provision of the QMR on site and the maintenance of the Quality Records during the course of the Contract.

2. Progress payments shall be calculated on the basis of 30% of the L.S. when the complete Quality Plan is available and the remainder on pro rata based on the monthly value of work done.

Pay Item QP2 QUALITY VERIFICATION AND CONTROL

1. The Lump Sum for this item shall include all costs for inspections, conformance surveys and testing required to verify that all aspects of the work under the Contract comply with the Quality Assurance provisions of the Contract.

2. Payments shall be made pro rata on the monthly value of work done.

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) in accordance with Table CQS-A1.

   (ii) Establish six grid lines within the lot, as illustrated in Figure CQS-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 CQS-A1;

   (v) Throw die twice to select two random numbers (between 1 and 6) for row and column in Table CQS-A2 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.

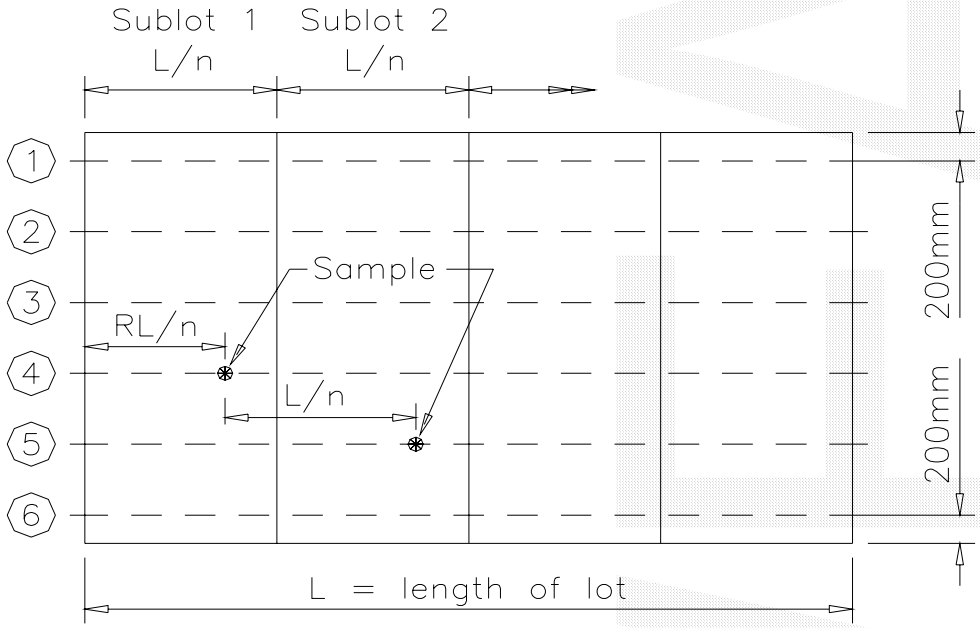

Figure CQS-A2 Sampling Locations for Rectangular Lot

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 Gutter	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 Asphaltic Concrete Pavement Layers	C245

Item	Enter * here if required	Activity	Specification Number
19		Sprayed Bituminous Surfacing	C244
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:.....

ANNEXURE CQS-C
MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

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.

4. Where no Queensland DMR Test Methods (Q) are available, Australian Standards or NSW RTA Test Methods (T) are specified.

Contents of Annexure CQS-C

Item	Sub-Annexure	Required (*) for this Contract	Reference Specification	Sub-Annexure Heading
1	C1		C213	Earthworks
2	C2		C220 C221 C222 C223 C224	Stormwater Drainage - Pipe Culverts, Box Culverts, Open Drains, Kerb & Gutter, Drainage Structures
3	C3		C230 C231 C232 C233	Subsurface Drainage
4	C4		C241	Stabilisation
5	C5		C242	Flexible Pavements
6	C6		C244	Sprayed Bituminous Surfacing
7	C7		C245	Asphaltic Concrete
8	C8		C247 C248	Ready Mixed Concrete Production and Supply
9	C9		C247	Mass Concrete Subbase
10	C10		C248	Plain or Reinforced Concrete Base
11	C11		C255	Bituminous Microsurfacing
12	C12		C254	Segmental Paving
13	C13		C271	Minor Concrete Works
14	C14		C261	Pavement Markings
15	C15		C262	Signposting
16	C16		C273	Landscaping
17	C17		C401	Water Reticulation
18	C18		C402	Sewerage System

Sub-Annexure C1
EARTHWORKS (Specification C213)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Stripping Topsoil	Surface Levels	10,000m^2	1 Cross Section per 25m	Survey
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 C2

STORMWATER DRAINAGE - PIPE CULVERTS, BOX CULVERTS, OPEN DRAINS INCLUDING KERB & GUTTER, 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	1 batch	1 per type/size/ class per batch	
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 20 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 Gutter	Geometry		1 Cross Section per 25m	Survey and 3m Straight Edge

* Note: or part thereof, per lot.

Sub-Annexure C3

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 of:			
	Pipe	1 contract/size	1 per type/size	
	Filter Material			
	- Grading (Type A, B, C, D)	1 contract/size	1 per type	AS1141.11
	- Coefficient of Permeability (Type B)	1 contract/size	1 per type	AS1289.E5.1 ASTM-D2434-68
	- Grading Variation after Treatment (Type B)	1 contract/size	1 per type	AS1141.11
	- Wet Strength (Type C, D)	1 contract/size	1 per type	AS1141.22
	- 10% Fines Wet/Dry (Type C, D)	1 contract/size	1 per type	AS1141.22
	Geotextile	1 contract	1 per type	
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 C4

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 of:			
	- Cement	1 contract	1 per 100t	AS3972
	- Quicklime			
	· Available Lime (CaO content)	1 contract	1 per 100t	AS3583.12
	· Slaking Rate	1 contract	1 per 100t	T432
	· Particle Size Dist'n	1 contract	1 per contract	AS1141.11
	- Hydrated Lime			
	· Available Lime ($CaOH_2$)	1 contract	1 per 100t	AS3583.12
	· Residue on Sieving	1 contract	1 per contract	AS3583.14
	- Ground Blast Furnace Slag	1 contract	1 per month	AS3583.2
	- Flyash	1 contract	1 per month	AS3583.1
	- Blended Stabilising Agent	1 contract	1 per month	
	- Water			
	Chloride ion content	1 contract	1 per contract	AS3583.13
	Sulphate ion content	1 contract	1 per contract	AS1289.4.2.1
	Undissolved solids	1 contract	1 per contract	
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 C5

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		
	- Particle Size Distribution		1 per 1,000t	AS1289.3.6.1
	- Fine Particle Size Distribution Ratio		1 per 1,000t	AS1289.3.6.3
	- Liquid Limit		1 per 1,000t	AS1289.3.1.1
	- Plastic Limit		1 per 1,000t	AS1289.3.3.1
	- Plasticity Index		1 per 1,000t	AS1289.3.3.1
	- Maximum Dry Compressive Strength		1 per 5,000t	T114
	- Particle Shape		1 per 1,000t	AS1141.14
	- Aggregate Wet Strength		1 per 5,000t	AS1141.22
	- Wet/Dry Strength Variation		1 per 5,000t	AS1141.22
	- Modified Texas Triaxial Classification		1 per contract	T171
	- Unconfined Compressive Strength (Modified)		1 per 5,000t	Q115
	- Unconfined Compressive Strength (Bound)	1 contract	1 per mix design	Q115
Placement	Geometry: Alignment & Level	One layer 2,000m^2 or max 1 day's placement	1 Cross Section per 15m	Survey
	Width & Surface Trim		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	Q701
	Compaction/Moisture Content/ Dry Density Testing	One layer 5,000m^2 or max 1 day's placement	10 per 5,000m^2 layer or 3 per lot if less	AS1289.5.2.1,Q110 C, AS1289.5.4.1 AS1289.5.8.1

* Note: or part thereof, per lot.

Sub-Annexure C6

SPRAYED BITUMINOUS SURFACING (Specification C244)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Suppliers documentary evidence and certification of:			
	- Class 170 Bitumen	1 tanker load	1 per tanker load	
	- Refinery Cutback Bitumen	1 tanker load	1 per tanker load	
	- Polymer Modified Binder	1 tanker load	1 per tanker load	
	- Bitumen Adhesion Agent	1 delivery	1 per delivery	
	- Cutback Oils	1 delivery/ tanker	1 per delivery/tanker	
	- Aggregate Precoating Agent	1 delivery/ tanker	1 per delivery/tanker	
	- Aggregate	1 contract	1 per 400m3	AS2758.2
Application Rates	Binder	1 day's operation	Calculate per spray run	
	Aggregate	1 day's operation	Calculate per spray run	

† One per Contract or change in material

* Note: or part thereof, per lot

Sub-Annexure C7

ASPHALTIC CONCRETE (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 of:			
	- Coarse & Fine Aggregates			AS2758.5
	· Grading	1 wk's prod'n	1 per day	AS1141.11
	· Moisture Content	1 wk's prod'n	1 per day	AS1289.2.1.1
	· Wet Strength	1 contract	)	AS1141.22
	· Wet/Dry Strength Variation	1 contract	) 1 per	AS1141.22
	· Particle Shape	1 contract	) contract	AS1141.14
	· Fractured Faces	1 contract	) or change in	AS1141.18
	· Polishing Agg Friction Value	1 contract	) material	AS1141.42
	- Mineral Filler	1 contract or 1 month's production	contract or 1 per month's production	AS2357
	- Bitumen Binder	1 refinery batching	1 per tanker load	AS2008
	- Polymer Modified Bitumen			
	· Elasticity Recovery at 60°C	1 production batch by supplier	1 per tanker load	MBT 21
	· Viscosity on ER at 60°C			MBT 21
	· Torsional Recovery at 25°C			MBT 22
	· Viscosity at 180°C			MBT 11
	- Bitumen Adhesion Agent · Resistance to Stripping	1 contract	1 per contract or change in material	Q212A, B, C
	- Reclaimed Asphalt Pavement (RAP)	1 stockpile	1 per stockpile	AS1141.11
	- Bitumen Emulsion	1 contract	1 per contract or change in material	AS1160
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

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
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 C8

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 of:-			
	Cement	1 mth's prod'n	1 per week	AS 3972
	Flyash	1 mth's prod'n	1 per month	AS 3582.1
	Water	1 contract	1 per contract	AS3583.13, AS1289.4.2.1
	Admixtures	1 mth's prod'n	1 per month	AS 1478
	Fine Aggregates (C248 only)			
	- Grading	1 wk's prod'n	1 per 200m^3 concrete*	AS1141.11
	- Moisture Content	N/A	1 per day	
	- Sulphate Soundness	1 contract	1 per contract	AS1141.24
	- Bulk Density	1 contract	1 per contract	AS 2758.1
	- Unit Mass (particle density)	1 contract	1 per contract	AS 2758.1
	- Water Absorption	1 contract	1 per contract	AS 2758.1
	- Material Finer 2μm	1 contract	1 per contract	AS 2758.1
	- Deleterious Material (Impurities/Reactive)	1 contract	1 per contract	AS 2758.1
	- Combined Aggregates (C247 and C248)			
	- Grading	1 wk's prod'n	1 per 200m^3 concrete*	AS1141.11
	- Moisture Content	1 wk's prod'n	1 per day	
	- Wet Strength	1 contract	1 per contract	AS1141.22
	- Wet/Dry Strength Variations	1 contract	1 per contract	AS1141.22
	- Sulphate Soundness	1 contract	1 per contract	AS1141.24
	- Particle Shape	1 contract	1 per contract	AS1141.14
	- Fractured Faces	1 contract	1 per contract	AS1141.18
	- Bulk Density	1 contract	1 per contract	AS 2758.1
	- Unit Mass (particle density)	1 contract	1 per contract	AS 2758.1
	- Water Absorption	1 contract	1 per contract	AS 2758.1
	- Material Finer 75μm	1 contract	1 per contract	AS 2758.1

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Raw Materials Supply (Cont'd)	- Weak Particles	1 contract	1 per contract	AS 2758.1
	- Light Particles	1 contract	1 per contract	AS 2758.1
	- Deleterious Materials (Impurities/Reactive)	1 contract	1 per contract	AS 2758.1
	- Iron Unsoundness	1 contract	1 per contract	AS 2758.1
	- Falling/Dusting Unsoundness	1 contract	1 per contract	AS 2758.1
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 C9

MASS CONCRETE SUBBASE (Specification C247)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Concrete Supply	Refer Sub-Annexure C8: Ready-Mixed Concrete Production and Supply			
	Concrete/Air Temperature	50m^3	1 per 50m^3	Measure
	Air Content	50m^3	1 per 50m^3	AS1012.4 Method 2
	Consistency - Slump	50m^3	1 per load	AS1012.3.1
	Compressive Strength (7 day)	50m^3	1 pair per 50m^3	AS1012.1 AS1012.8 AS1012.9
	Compressive Strength (28 day)	50m^3	1 pair per 50m^3	AS1012.1 AS1012.8 AS1012.9
Placement	Thickness	50m^3	5m grid on plan area	Survey and check with subgrade survey
	Geometry	50m^3	1 cross section per 15m	Survey and 3m Straight Edge
Curing	Material Quality - Supplier's documentary evidence and certification	1 contract	1 per production batch	AS3799 AS1160
	Application Rate	1 day's work	1 per 1000m^2*	
Joints	Geometry	50m^3	All joints	Survey

* Note: or part thereof, per lot

Sub-Annexure C10

PLAIN OR REINFORCED CONCRETE BASE (Specification C248)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Concrete Supply	Refer Sub-Annexure C8: Ready-Mixed Concrete Production and Supply			
	Concrete/Air Temperature	$50m^3$	1 per $50m^3$	Measure
	Air Content	$50m^3$	1 per $50m^3$	AS1012.4 Method 2
	Consistency - Slump	$50m^3$	1 per load	AS1012.3.1
	Compressive Strength (7 day)	$50m^3$	1 pair per $50m^3$	AS1012.1 AS1012.8 AS1012.9
	Compressive Strength (28 day)	$50m^3$	1 pair per $50m^3$	AS1012.1 AS1012.8 AS1012.9
Placement	Relative Compaction			
	- Machine Placed	$50m^3$	1 per $50m^3$*	AS1012.14
	- Hand Placed	Area between 2 consecutive const. joints or $50m^3$ (whichever is the lesser)	2 per lot	AS1012.14
	Thickness	$50m^3$	5m grid on plan area	Survey
	Geometry	$50m^3$	1 cross section per 15m	Survey and 3m Straight Edge
Ride Quality	Profile Factor	$1000m^2$	10/lane/lot	3m Straight Edge
Surface Texture	Texture Depth	$1000m^2$	2 per lot	Survey
Curing	Material Quality - Supplier's documentary evidence and certification	1 contract	1 per production batch	AS3799 AS1160
	Application Rate	1 day's work	1 per $1000m^2$*	
Joints	Sealant Material Quality Supplier's documentary evidence and certification	1 contract	1 per prod'n batch	
	Geometry	$50m^3$	All joints	Survey

* Note: or part thereof, per lot

Sub-Annexure C11

BITUMINOUS MICROSURFACING (Specification C255)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- Bitumen (prior to emulsification)	1 contract	1 per contract or change in material	AS2008
	- Bitumen Emulsion · Residual Binder Content (Residue from Evaporation)	1 contract	2 per bulk delivery	AS1160, App.D
	- Mineral Aggregates · Degradation Factor	1 contract	1 per contract or 6 month period	AS1141.25
	· Los Angeles Value	1 contract	"	AS1141.23
	· Aggregate Wet Strength	1 contract	"	AS1141.22
	· Wet/Dry Strength Variation	1 contract	"	AS1141.22
	· Polished Aggregate Friction Value	1 contract	"	AS1141.42
	· Sand Equivalent	1 contract	"	AS1289.3.7.1
	- Mineral Filler	1 month's prod'n	"	AS2357
	- Combined Aggregate Grading	1 contract	"	AS1141.11, AS1141.12
Mix Design - Nominated Mix	Approval of mix and NATA certification - Supplier's documentary evidence and certification	1 contract	1 per mix	
Production Mix	Grading	1 day's prod'n or 50m^3 (whichever is the lesser)	2 per 50m^3*	AS2891.3.1
	Residual Binder Content		2 per 50m^3*	AS2891.3.1
Laying	Levels	1 layer, max 200m^3	1 cross section per 15m	Survey
	Surface Quality	1 layer, max 200m^3	10 per 100m* lane length	3m Straight Edge

* Note: or part thereof, per lot

Sub-Annexure C12

SEGMENTAL PAVING (Specification C254)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- Concrete Segmental Paving Units	1 contract	1 per contract	
	- Clay Segmental Paving Units	1 contract	1 per contract	
	- Bedding Sand · Grading	1 contract	1 per contract or change in material	AS1141.11
	- Joint Filling Sand · Grading	1 contract	1 per contract or change in material	AS1141.11
Base	Geometry	One layer 5000m^2, max 1 day's placement	One cross section per 25m	Survey
	Surface Quality	"	10 per 200m^2 or lot	3m Straight Edge
Edge Restraints	Refer 'Minor Concrete Works'	1 day's placement	1 per 10 lin m	Measure/Survey
Laying Paver Units	Joint Width	1 day's placement	All joints	Measure
	Geometry	1 day's placement	One cross section per 15m	Survey
	Surface Quality	1 day's placement	10 per 200m^2 or lot	3m Straight Edge

* Note: or part thereof, per lot

Sub-Annexure C13

MINOR CONCRETE WORKS (Specification C271)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Subgrade	Compaction	1000 lin m or 1000m^2	1 per 200 lin m or 200m^2	AS1289.5.4.1
Gravel Subbase Construction	Compaction	1 day's placement	1 per 100 lin m or 100m^2	AS1289.5.4.1
	Subbase Geometry	1 day's placement	1 per 25 lin m	3m Straight Edge
Steel Supply	Material Quality - Suppliers documentary evidence and certification	1 delivery	1 per production batch	
Ready-Mixed Concrete Supply	Material Quality - Suppliers documentary evidence and certification	1 contract	1 per mix type	
	Consistency - Slump	15m^3	1 per load	AS1012.3 Method 1
	Compressive Strength (7 and 28 day)	15m^3	2 pairs per 15m^3	AS1012.1, AS1012.8, AS1012.9
Concrete Placement	Finished Levels	15m^3	1 cross section per 15m	Survey and 3m Straight Edge
	Surface Dimensions	Single fabrication	As required to confirm design dimensions	measure
Backfilling	Material Quality			
	- Maximum particle size	1 contract/ material type	1 per 200m^3 or lot	Q103
	- Plasticity Index	1 contract/ material type	1 per 200m^3 or lot	AS1289.3.3.1
	Compaction	1 day's work or max 200m^2	1 per 200m^2 or lot	AS1289.5.4.1
Sprayed Concrete	Test Panels and Cores	1 contract	3 test panels and 4 cores per mix design	AS1012.4, AS1012.9 AS1012.14
	Compressive Strength Cores	15m^3	2 per 15m^3	AS1012.4, AS1012.9 AS1012.14
	Curing Material Quality - Supplier's documentary evidence and certification	1 contract	1 per production batch	

* Note: or part thereof, per lot

Sub-Annexure C14

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 of:			
	- Paint	1 contract	1 per contract or change in material	
	- Glass Beads	1 contract	"	
	- Thermoplastic Material	1 contract	"	
	- Raised Pavement Markers	1 contract	"	
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

Sub-Annexure C15

SIGNPOSTING (Specification C262)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- Sign Blanks	1 contract	1 per contract, or change in material	
	- Aluminium Extrusion Backing	1 contract	"	
	- Retro-reflective Material	1 contract	"	
	- Non-reflective Paint	1 contract	"	
	- Non-reflective Sheet Material	1 contract	"	
	- Steel Sign Support Structures	1 contract	"	
Concrete Foundations	Refer 'Minor Concrete Works'			

Sub-Annexure C16

LANDSCAPING (Specification C273)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Seed	Certification of Authenticity for the prescribed Mix	1 contract	Certification for each production batch delivered	
Imported Topsoil	Material Quality			AS4419
	- pH	10,000m^2	1 per 500m^3	
	- Organic Content	10,000m^2	1 per 500m^3	
	- Soluble Salt Content	10,000m^2	1 per 500m^3	
Mulch for Planting	Material Quality	1 contract	1 contract	AS4454

Sub-Annexure C17

WATER RETICULATION (Specification C401)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- uPVC Pipes	1 contract	1 per contract	AS2977
	- Ductile Iron Pipes	1 contract	"	AS2280 and AS2129
	- Copper Pipe	1 contract	"	AS1432
	- Polyethylene Pipe	1 contract	"	AS1159
	- Stop Valves Material	1 contract	"	AS2638 and AS2129
	- Non Return Valves	1 contract	"	AS3578
	- Spring Hydrants	1 contract	1 per contract	AS2544 or AS3952
Siting and Excavation	Geometry	1 line	1 per line	Survey
Bedding	Material Quality - Grading	1 contract	1 per contract per source	AS2032
Thrust and Anchor Blocks	Refer Annexure C13			
Concrete Encasement	Refer Annexure C13			
Chamber Covers and Frames	Geometry	1 cover/frame	1 per cover/frame	survey
Testing of Pipelines	Pressure testing	1 line	1 per line	As specified C401.28
Backfill and Compaction	Compaction	1 line	1 per 2 layers max 100m^2	AS1289.5.7.1
Switchgear and Controlgear Assembly	Electrical function	each installation	1 factory test per installation	AS3439
Commissioning of Pumping Station	Certification testing of electrical installation in accordance with relevant Australian Standards	1 installation	1 per installation	

Sub-Annexure C18

SEWERAGE SYSTEM (Specification C402)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- uPVC Pipes	1 contract	1 per contract	AS1477
	- Ductile Iron Pipes	1 contract	"	AS2280 and AS2129
	- Vitrified Clay Pipes	1 contract	"	AS1741
	- Precast Access Chambers	1 contract	"	AS4198
Siting and Excavation	Geometry	1 line/ structure	1 per line/ structure	Survey
Bedding	Material Quality - Grading	1 contract	1 per contract per source	Q103
Concrete Bedding	Refer Annexure C13			
Laying and Jointing of Pipes, Access Chambers, Structures	Geometry	1 line	1 per line	Survey
Thrust and Anchor Blocks	Refer Annexure C13			
Concrete Encasement	Refer Annexure C13			
Cast-in-situ Access Chambers	Material Quality - Tri-Calcium Aluminate Content	1 contract	1 per contract per source	AS3972
	- Fineness Index	1 contract	"	AS3972
	- Minimum Cement Content	1 contract	"	AS3972
Acceptance Test of Gravitation Mains and Access Chambers	- Compressed Air Testing	1 line	1 per line	As specified C402.36 C402.37
	- Hydrostatic Testing	1 per test length Test length = 1370m / pipeline dia.(mm)	1 per line	As specified C402.38
Backfill and Compaction	Compaction	1 line	1 per 2 layers max 100m^2	AS1289.5.7.1
Switchgear and Controlgear Assembly	Electrical Compliance	each installation	1 factory test per installation	AS3439
Commissioning of Pumping Station	Certification testing of electrical installation in accordance with relevant Australian Standards	1 installation	1 per installation	

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

CQC

QUALITY CONTROL REQUIREMENTS

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION CQC
QUALITY CONTROL REQUIREMENTS

CLAUSE **CONTENTS** **PAGE**

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

MEASUREMENT AND PAYMENT

CQC6 PAY ITEMS

1. Payment shall be made for all activities associated with testing, survey and supplier's documentation required to demonstrate conformance to the specification requirements.

2. Cost adjustments, if applicable, will apply the same as to any other Pay Item in the Schedule.

Pay Item QCP1 QUALITY VERIFICATION AND CONTROL

1. The Lump Sum for this item shall include all costs for inspections, conformance surveys and testing required to verify that all aspects of the work under the Contract comply with the quality requirements of the Contract, including the ongoing compilation of quality records.

2. Payments shall be made pro rata on the monthly value of work done.

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) in accordance with Table CQC-A1.
   (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-A2 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.

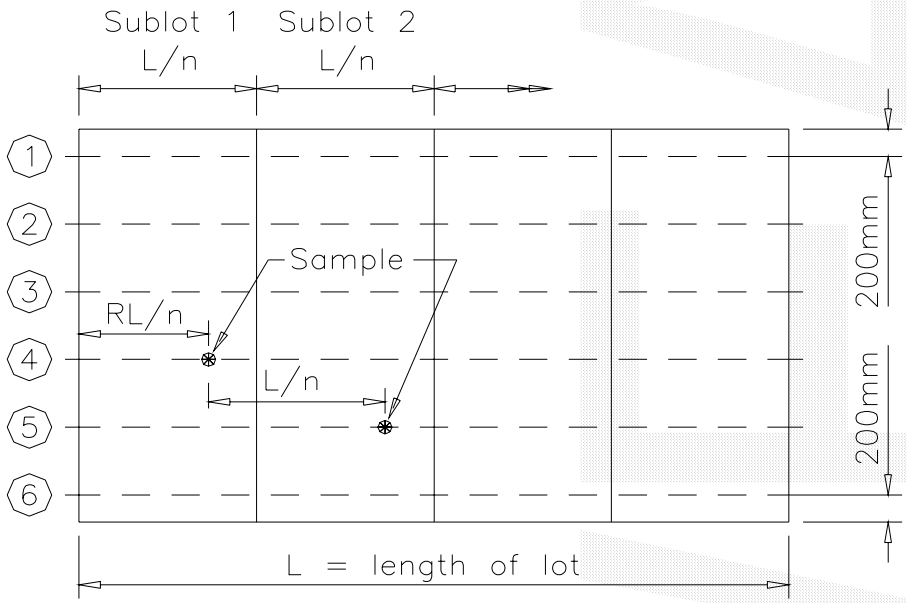

Figure CQC-A2 Sampling Locations for Rectangular Lot

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.

4. Where no Queensland DMR Test Methods (Q) are available, Australian Standards or NSW RTA Test Methods (T) are specified.

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 & Gutter, Drainage Structures
3	B3		C230 C231 C232 C233	Subsurface Drainage
4	B4		C241	Stabilisation
5	B5		C242	Flexible Pavements
6	B6		C244	Sprayed Bituminous Surfacing
7	B7		C245	Asphaltic Concrete
8	B8		C247 C248	Ready Mixed Concrete Production and Supply
9	B9		C247	Mass Concrete Subbase
10	B10		C248	Plain or Reinforced Concrete Base
11	B11		C255	Bituminous Microsurfacing
12	B12		C254	Segmental Paving
13	B13		C271	Minor Concrete Works
14	B14		C261	Pavement Markings
15	B15		C262	Signposting
16	B16		C273	Landscaping

Item	Sub-Annexure	Required (*) for this Contract	Reference Specification	Sub-Annexure Heading
17	B17		C401	Water Reticulation
18	B18		C402	Sewerage System

Sub-Annexure B1
EARTHWORKS (Specification C213)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Stripping Topsoil	Surface Levels	10,000m^2	1 Cross Section per 25m	Survey
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 & GUTTER, 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	1 batch	1 per type/size/ class per batch	
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 20 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 Gutter	Geometry		1 Cross Section per 25m	Survey and 3m Straight Edge

* 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 of:			
	Pipe	1 contract/size	1 per type/size	
	Filter Material			
	- Grading (Type A, B, C, D)	1 contract/size	1 per type	AS1141.11
	- Coefficient of Permeability (Type B)	1 contract/size	1 per type	AS1289.E5.1 ASTM-D2434-68
	- Grading Variation after Treatment (Type B)	1 contract/size	1 per type	AS1141.11
	- Wet Strength (Type C, D)	1 contract/size	1 per type	AS1141.22
	- 10% Fines Wet/Dry (Type C, D)	1 contract/size	1 per type	AS1141.22
	Geotextile	1 contract	1 per type	
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 of:			
	- Cement	1 contract	1 per 100t	AS3972
	- Quicklime			
	· Available Lime (CaO content)	1 contract	1 per 100t	AS3583.12
	· Slaking Rate	1 contract	1 per 100t	T432
	· Particle Size Dist'n	1 contract	1 per contract	AS1141.11
	- Hydrated Lime			
	· Available Lime ($CaOH_2$)	1 contract	1 per 100t	AS3583.12
	· Residue on Sieving	1 contract	1 per contract	AS3583.14
	- Ground Blast Furnace Slag	1 contract	1 per month	AS3583.2
	- Flyash	1 contract	1 per month	AS3583.1
	- Blended Stabilising Agent	1 contract	1 per month	
	- Water			
	Chloride ion content	1 contract	1 per contract	AS3583.13
	Sulphate ion content	1 contract	1 per contract	AS1289.4.2.1
	Undissolved solids	1 contract	1 per contract	
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		
	- Particle Size Distribution		1 per 1,000t	AS1289.3.6.1
	- Fine Particle Size Distribution Ratio		1 per 1,000t	AS1289.3.6.3
	- Liquid Limit		1 per 1,000t	AS1289.3.1.1
	- Plastic Limit		1 per 1,000t	AS1289.3.3.1
	- Plasticity Index		1 per 1,000t	AS1289.3.3.1
	- Maximum Dry Compressive Strength		1 per 5,000t	T114
	- Particle Shape		1 per 1,000t	AS1141.14
	- Aggregate Wet Strength		1 per 5,000t	AS1141.22
	- Wet/Dry Strength Variation		1 per 5,000t	AS1141.22
	- Modified Texas Triaxial Classification		1 per contract	T171
	- Unconfined Compressive Strength (Modified)		1 per 5,000t	Q115
	- Unconfined Compressive Strength (Bound)	1 contract	1 per mix design	Q115
Placement	Geometry: Alignment & Level	One layer 2,000m^2 or max 1 day's placement	1 Cross Section per 15m	Survey
	Width & Surface Trim		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	Q701
	Compaction/Moisture Content/ Dry Density Testing	One layer 5,000m^2 or max 1 day's placement	10 per 5,000m^2 layer or 3 per lot if less	AS1289.5.2.1, Q110C, AS1289.5.4.1 AS1289.5.8.1

* Note: or part thereof, per lot.

Sub-Annexure B6
SPRAYED BITUMINOUS SURFACING (Specification C244)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Suppliers documentary evidence and certification of:			
	- Class 170 Bitumen	1 tanker load	1 per tanker load	
	- Refinery Cutback Bitumen	1 tanker load	1 per tanker load	
	- Polymer Modified Binder	1 tanker load	1 per tanker load	
	- Bitumen Adhesion Agent	1 delivery	1 per delivery	
	- Cutback Oils	1 delivery/ tanker	1 per delivery/tanker	
	- Aggregate Precoating Agent	1 delivery/ tanker	1 per delivery/tanker	
	- Aggregate	1 contract	1 per 400m3	AS2758.2
Application Rates	Binder	1 day's operation	Calculate per spray run	
	Aggregate	1 day's operation	Calculate per spray run	

† One per Contract or change in material

* Note: or part thereof, per lot

Sub-Annexure B7
ASPHALTIC CONCRETE (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 of:			
	- Coarse & Fine Aggregates			AS2758.5
	· Grading	1 wk's prod'n	1 per day	AS1141.11
	· Moisture Content	1 wk's prod'n	1 per day	AS1289.2.1.1
	· Wet Strength	1 contract	)	AS1141.22
	· Wet/Dry Strength Variation	1 contract	) 1 per	AS1141.22
	· Particle Shape	1 contract	) contract	AS1141.14
	· Fractured Faces	1 contract	) or change in	AS1141.18
	· Polishing Agg Friction Value	1 contract	) material	AS1141.42
	- Mineral Filler	1 contract or 1 month's production	contract or 1 per month's production	AS2357
	- Bitumen Binder	1 refinery batching	1 per tanker load	AS2008
	- Polymer Modified Bitumen			
	· Elasticity Recovery at 60°C	1 production batch by supplier	1 per tanker load	MBT 21
	· Viscosity on ER at 60°C			MBT 21
	· Torsional Recovery at 25°C			MBT 22
	· Viscosity at 180°C			MBT 11
	- Bitumen Adhesion Agent · Resistance to Stripping	1 contract	1 per contract or change in material	Q212A, B, C
	- Reclaimed Asphalt Pavement (RAP)	1 stockpile	1 per stockpile	AS1141.11
	- Bitumen Emulsion	1 contract	1 per contract or change in material	AS1160
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

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
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 of:-			
	Cement	1 mth's prod'n	1 per week	AS 3972
	Flyash	1 mth's prod'n	1 per month	AS 3582.1
	Water	1 contract	1 per contract	AS3583.13, AS1289.4.2.1
	Admixtures	1 mth's prod'n	1 per month	AS 1478
	Fine Aggregates (C248 only)			
	- Grading	1 wk's prod'n	1 per 200m^3 concrete*	AS1141.11
	- Moisture Content	N/A	1 per day	
	- Sulphate Soundness	1 contract	1 per contract	AS1141.24
	- Bulk Density	1 contract	1 per contract	AS 2758.1
	- Unit Mass (particle density)	1 contract	1 per contract	AS 2758.1
	- Water Absorption	1 contract	1 per contract	AS 2758.1
	- Material Finer 2μm	1 contract	1 per contract	AS 2758.1
	- Deleterious Material (Impurities/Reactive)	1 contract	1 per contract	AS 2758.1
	- Combined Aggregates (C247 and C248)			
	- Grading	1 wk's prod'n	1 per 200m^3 concrete*	AS1141.11
	- Moisture Content	1 wk's prod'n	1 per day	
	- Wet Strength	1 contract	1 per contract	AS1141.22
	- Wet/Dry Strength Variations	1 contract	1 per contract	AS1141.22
	- Sulphate Soundness	1 contract	1 per contract	AS1141.24
	- Particle Shape	1 contract	1 per contract	AS1141.14
	- Fractured Faces	1 contract	1 per contract	AS1141.18
	- Bulk Density	1 contract	1 per contract	AS 2758.1
	- Unit Mass (particle density)	1 contract	1 per contract	AS 2758.1
	- Water Absorption	1 contract	1 per contract	AS 2758.1
	- Material Finer 75μm	1 contract	1 per contract	AS 2758.1

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Raw Materials Supply (Cont'd)	- Weak Particles	1 contract	1 per contract	AS 2758.1
	- Light Particles	1 contract	1 per contract	AS 2758.1
	- Deleterious Materials (Impurities/Reactive)	1 contract	1 per contract	AS 2758.1
	- Iron Unsoundness	1 contract	1 per contract	AS 2758.1
	- Falling/Dusting Unsoundness	1 contract	1 per contract	AS 2758.1
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 B9
MASS CONCRETE SUBBASE (Specification C247)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Concrete Supply	Refer Sub-Annexure B8: Ready-Mixed Concrete Production and Supply			
	Concrete/Air Temperature	50m^3	1 per 50m^3	Measure
	Air Content	50m^3	1 per 50m^3	AS1012.4 Method 2
	Consistency - Slump	50m^3	1 per load	AS1012.3.1
	Compressive Strength (7 day)	50m^3	1 pair per 50m^3	AS1012.1 AS1012.8 AS1012.9
	Compressive Strength (28 day)	50m^3	1 pair per 50m^3	AS1012.1 AS1012.8 AS1012.9
Placement	Thickness	50m^3	5m grid on plan area	Survey and check with subgrade survey
	Geometry	50m^3	1 cross section per 15m	Survey and 3m Straight Edge
Curing	Material Quality - Supplier's documentary evidence and certification	1 contract	1 per production batch	AS3799 AS1160
	Application Rate	1 day's work	1 per 1000m^2*	
Joints	Geometry	50m^3	All joints	Survey

* Note: or part thereof, per lot

Sub-Annexure B10
PLAIN OR REINFORCED CONCRETE BASE (Specification C248)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Concrete Supply	Refer Sub-Annexure B8: Ready-Mixed Concrete Production and Supply			
	Concrete/Air Temperature	50m^3	1 per 50m^3	Measure
	Air Content	50m^3	1 per 50m^3	AS1012.4 Method 2
	Consistency - Slump	50m^3	1 per load	AS1012.3.1
	Compressive Strength (7 day)	50m^3	1 pair per 50m^3	AS1012.1 AS1012.8 AS1012.9
	Compressive Strength (28 day)	50m^3	1 pair per 50m^3	AS1012.1 AS1012.8 AS1012.9
Placement	Relative Compaction			
	- Machine Placed	50m^3	1 per 50m^3*	AS1012.14
	- Hand Placed	Area between 2 consecutive const. joints or 50m^3 (whichever is the lesser)	2 per lot	AS1012.14
	Thickness	50m^3	5m grid on plan area	Survey
	Geometry	50m^3	1 cross section per 15m	Survey and 3m Straight Edge
Ride Quality	Profile Factor	1000m^2	10/lane/lot	3m Straight Edge
Surface Texture	Texture Depth	1000m^2	2 per lot	Survey
Curing	Material Quality - Supplier's documentary evidence and certification	1 contract	1 per production batch	AS3799 AS1160
	Application Rate	1 day's work	1 per 1000m^2*	
Joints	Sealant Material Quality Supplier's documentary evidence and certification	1 contract	1 per prod'n batch	
	Geometry	50m^3	All joints	Survey

* Note: or part thereof, per lot

Sub-Annexure B11
BITUMINOUS MICROSURFACING (Specification C255)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- Bitumen (prior to emulsification)	1 contract	1 per contract or change in material	AS2008
	- Bitumen Emulsion			
	· Residual Binder Content (Residue from Evaporation)	1 contract	2 per bulk delivery	AS1160, App.D
	- Mineral Aggregates			
	· Degradation Factor	1 contract	1 per contract or 6 month period	AS1141.25
	· Los Angeles Value	1 contract	"	AS1141.23
	· Aggregate Wet Strength	1 contract	"	AS1141.22
	· Wet/Dry Strength Variation	1 contract	"	AS1141.22
	· Polished Aggregate Friction Value	1 contract	"	AS1141.42
	· Sand Equivalent	1 contract	"	AS1289.3.7.1
	- Mineral Filler	1 month's prod'n	"	AS2357
	- Combined Aggregate Grading	1 contract	"	AS1141.11, AS1141.12
Mix Design - Nominated Mix	Approval of mix and NATA certification - Supplier's documentary evidence and certification	1 contract	1 per mix	
Production Mix	Grading	1 day's prod'n or 50m^3 (whichever is the lesser)	2 per 50m^3*	AS2891.3.1
	Residual Binder Content		2 per 50m^3*	AS2891.3.1
Laying	Levels	1 layer, max 200m^3	1 cross section per 15m	Survey
	Surface Quality	1 layer, max 200m^3	10 per 100m* lane length	3m Straight Edge

* Note: or part thereof, per lot

Sub-Annexure B12
SEGMENTAL PAVING (Specification C254)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- Concrete Segmental Paving Units	1 contract	1 per contract	
	- Clay Segmental Paving Units	1 contract	1 per contract	
	- Bedding Sand · Grading	1 contract	1 per contract or change in material	AS1141.11
	- Joint Filling Sand · Grading	1 contract	1 per contract or change in material	AS1141.11
Base	Geometry	One layer 5000m^2, max 1 day's placement	One cross section per 25m	Survey
	Surface Quality	"	10 per 200m^2 or lot	3m Straight Edge
Edge Restraints	Refer 'Minor Concrete Works'	1 day's placement	1 per 10 lin m	Measure/Survey
Laying Paver Units	Joint Width	1 day's placement	All joints	Measure
	Geometry	1 day's placement	One cross section per 15m	Survey
	Surface Quality	1 day's placement	10 per 200m^2 or lot	3m Straight Edge

* Note: or part thereof, per lot

Sub-Annexure B13
MINOR CONCRETE WORKS (Specification C271)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Subgrade	Compaction	1000 lin m or 1000m^2	1 per 200 lin m or 200m^2	AS1289.5.4.1
Gravel Subbase Construction	Compaction	1 day's placement	1 per 100 lin m or 100m^2	AS1289.5.4.1
	Subbase Geometry	1 day's placement	1 per 25 lin m	3m Straight Edge
Steel Supply	Material Quality - Suppliers documentary evidence and certification	1 delivery	1 per production batch	
Ready-Mixed Concrete Supply	Material Quality - Suppliers documentary evidence and certification	1 contract	1 per mix type	
	Consistency - Slump	15m^3	1 per load	AS1012.3 Method 1
	Compressive Strength (7 and 28 day)	15m^3	2 pairs per 15m^3	AS1012.1, AS1012.8, AS1012.9
Concrete Placement	Finished Levels	15m^3	1 cross section per 15m	Survey and 3m Straight Edge
	Surface Dimensions	Single fabrication	As required to confirm design dimensions	measure
Backfilling	Material Quality			
	- Maximum particle size	1 contract/ material type	1 per 200m^3 or lot	Q103
	- Plasticity Index	1 contract/ material type	1 per 200m^3 or lot	AS1289.3.3.1
	Compaction	1 day's work or max 200m^2	1 per 200m^2 or lot	AS1289.5.4.1
Sprayed Concrete	Test Panels and Cores	1 contract	3 test panels and 4 cores per mix design	AS1012.4, AS1012.9 AS1012.14
	Compressive Strength Cores	15m^3	2 per 15m^3	AS1012.4, AS1012.9 AS1012.14
	Curing Material Quality - Supplier's documentary evidence and certification	1 contract	1 per production batch	

* 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 of:			
	- Paint	1 contract	1 per contract or change in material	
	- Glass Beads	1 contract	"	
	- Thermoplastic Material	1 contract	"	
	- Raised Pavement Markers	1 contract	"	
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

Sub-Annexure B15
SIGNPOSTING (Specification C262)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- Sign Blanks	1 contract	1 per contract, or change in material	
	- Aluminium Extrusion Backing	1 contract	"	
	- Retro-reflective Material	1 contract	"	
	- Non-reflective Paint	1 contract	"	
	- Non-reflective Sheet Material	1 contract	"	
	- Steel Sign Support Structures	1 contract	"	
Concrete Foundations	Refer 'Minor Concrete Works'			

Sub-Annexure B16
LANDSCAPING (Specification C273)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Seed	Certification of Authenticity for the prescribed Mix	1 contract	Certification for each production batch delivered	
Imported Topsoil	Material Quality			AS4419
	- pH	10,000m^2	1 per 500m^3	
	- Organic Content	10,000m^2	1 per 500m^3	
	- Soluble Salt Content	10,000m^2	1 per 500m^3	
Mulch for Planting	Material Quality	1 contract	1 contract	AS4454

Sub-Annexure B17
WATER RETICULATION (Specification C401)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- uPVC Pipes	1 contract	1 per contract	AS2977
	- Ductile Iron Pipes	1 contract	"	AS2280 and AS2129
	- Copper Pipe	1 contract	"	AS1432
	- Polyethylene Pipe	1 contract	"	AS1159
	- Stop Valves Material	1 contract	"	AS2638 and AS2129
	- Non Return Valves	1 contract	"	AS3578
	- Spring Hydrants	1 contract	1 per contract	AS2544 or AS3952
Siting and Excavation	Geometry	1 line	1 per line	Survey
Bedding	Material Quality - Grading	1 contract	1 per contract per source	AS2032
Thrust and Anchor Blocks	Refer Annexure C13			
Concrete Encasement	Refer Annexure C13			
Chamber Covers and Frames	Geometry	1 cover/frame	1 per cover/frame	survey
Testing of Pipelines	Pressure testing	1 line	1 per line	As specified C401.28
Backfill and Compaction	Compaction	1 line	1 per 2 layers max 100m^2	AS1289.5.7.1
Switchgear and Controlgear Assembly	Electrical function	each installation	1 factory test per installation	AS3439
Commissioning of Pumping Station	Certification testing of electrical installation in accordance with relevant Australian Standards	1 installation	1 per installation	

Sub-Annexure B18
SEWERAGE SYSTEM (Specification C402)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- uPVC Pipes	1 contract	1 per contract	AS1477
	- Ductile Iron Pipes	1 contract	"	AS2280 and AS2129
	- Vitrified Clay Pipes	1 contract	"	AS1741
	- Precast Access Chambers	1 contract	"	AS4198
Siting and Excavation	Geometry	1 line/ structure	1 per line/ structure	Survey
Bedding	Material Quality - Grading	1 contract	1 per contract per source	Q103
Concrete Bedding	Refer Annexure C13			
Laying and Jointing of Pipes, Access Chambers, Structures	Geometry	1 line	1 per line	Survey
Thrust and Anchor Blocks	Refer Annexure C13			
Concrete Encasement	Refer Annexure C13			
Cast-in-situ Access Chambers	Material Quality - Tri-Calcium Aluminate Content	1 contract	1 per contract per source	AS3972
	- Fineness Index	1 contract	"	AS3972
	- Minimum Cement Content	1 contract	"	AS3972
Acceptance Test of Gravitation Mains and Access Chambers	- Compressed Air Testing	1 line	1 per line	As specified C402.36 C402.37
	- Hydrostatic Testing	1 per test length Test length = $\frac{1370}{\text{pipeline dia.(mm)}}$ m	1 per line	As specified C402.38
Backfill and Compaction	Compaction	1 line	1 per 2 layers max 100m^2	AS1289.5.7.1
Switchgear and Controlgear Assembly	Electrical Compliance	each installation	1 factory test per installation	AS3439
Commissioning of Pumping Station	Certification testing of electrical installation in accordance with relevant Australian Standards	1 installation	1 per installation	

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C101

GENERAL

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

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 North Arm Grove, Dubbo, Lots 16-90, D.P. 2315, in the Parish of Cork, City of Dubbo, NSW.

2. The subdivision involves the construction of five roads and the provision of services to 68 residential building sites.

3. Access to the subdivision is to be from Hastings Road and Gosford Circuit.

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 gutter, pipes, pits and headwalls.*
- *Sub-surface drainage.*
- *Pavement, consisting of unbound granular subbase and base, bituminous primer seal, and asphaltic concrete 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) Provision of Services

- *Water supply, including pumping station.*
- *Sewerage services, including pumping station.*

(e) Work by Others

- *Provision of electricity and gas services to the subdivision will be undertaken by the relevant Authorities/Corporations.*
- *The excluded work will be the responsibility of the Principal and Utility Authorities/Corporations. 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/Corporations 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 as nominated in the specification 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 Queensland

Other Test

Department of Main Roads shall be used. ***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 protection 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***

4. The Contractor shall ensure all aspects of Workplace Health and Safety are adhered to.

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. If no such notification is given and a control mark is disturbed or destroyed, then the ***Notice for Relocation*** ***Contractor's Cost***

cost of re-establishing the control shall be borne by the Contractor.

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 Contractor, all present at the meeting and others concerned with the matters discussed. ***Responsibility for Minutes***

C101.11 WORK-AS-EXECUTED DRAWINGS

1. The Contractor shall supply the Superintendent with fully marked-up and certified Work-as-Executed Drawings in the manner required by the relevant local authority 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-Executed Drawings for Roadworks shall show in the manner required by the relevant local authority 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-Executed Drawings for Bridgeworks shall show in the manner required by the relevant local authority, 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 an appropriately qualified Engineer or Surveyor commissioned 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.

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

C101.13 SCHEDULE RATES

1. Requirements in respect of all matters specified in this General Specification shall be considered as incidental to the Works and no separate Rates shall be provided in the Schedule in respect thereof. ***No Separate Rates***

ENVIRONMENTAL REQUIREMENTS

C101.14 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 requirements of the conditions of approval imposed by XXXX XXXX Council, the Environment Protection Agency under the Environmental Protection Act of 1994 and Amendments together with the Regulations and Policies on Noise, Water, Air and Waste.. No variation in costs or extensions of time will be considered due to these requirements. All necessary permits shall be obtained prior to the commencement of the works. ***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 and/or Councils authorised officer 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 in accordance with the requirements for development consent and building approval made under the Council's Planning Scheme Building Bylaws, Local Laws and Local Planning Policies. ***Noise, Smoke 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***

C101.15 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 retention basins, and temporary erosion and sedimentation control shall be completed prior to commencement of earthworks.

C101.16 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.

C101.17 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 7am to 5pm 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 and Councils authorised officer in accordance with the Act.. ***Working Hours***

3. Noise emanating from the construction site when measured at any noise sensitive location (such as a residential premise), as determined by the Environment Protection Agency shall not exceed an assigned L10 sound pressure level threshold (noise level exceeded for 10% of the sample time). 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. ***Maximum 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***

C101.18 LIMITS ON GROUND VIBRATION

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. ***Levels***

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

   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.

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. ***Peak Particle Velocity***

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. ***Contractor's Responsibility***

SPECIAL REQUIREMENTS

C101.19 RESERVED

C101.20 RESERVED

C101.21 RESERVED

ANNEXURE C101-A

XXXXXXXXXXXXXX COUNCIL
WORK-AS-EXECUTED CERTIFICATION REPORT

Project Title: _____

DA/BA No: _____

Design Consultant's Drawing No: _____

Name of Consultant: _____

Council's Drawing No: _____

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: _____

Contact Postal Address: _____

_____

_____

_____

_____
Consulting Engineer/Surveyor Date

_____
Qualifications

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C201

CONTROL OF TRAFFIC

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

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EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C201 - CONTROL OF TRAFFIC

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C201A SUPPLEMENTARY SIGNS TO AS 1742.3SPECIFICATION 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 QMUTCD, this Specification, and the Drawings. ***Standards***

4. Wherever the word 'should' occurs in QMUTCD 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 1743	-	Road Signs Specifications
AS 1744	-	Standard Alphabets for Road Signs
AS 1906	-	Retro reflective Materials & Devices for Road Traffic Control Purposes
AS/NZS 4602	-	High visibility safety garments

(b) AUSTROADS Publications

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

(c) Queensland Department of Main Roads Publications

QMUTCD	-	Queensland Manual of Uniform Traffic Control Devices.

(d) Other

MRS11.11
MRS11.30,
MRS11.33,
MRS11.34
MRS11.36

C201.03 TRAFFIC MANAGEMENT SCHEME

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 Superintendent's approval, a Traffic Management Scheme in accordance with Part 3 of the QMUTCD. ***Guidance Scheme***

4. The Traffic Management Scheme 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 Part 3 of QMUTCD, 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, line marking, pavement reflectors, guideposts, guard fence and barrier boards.

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

5. Where the Traffic Management Scheme 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, or in the case of an intersection with a gazetted or State controlled road the District Manager of DMR for the area, will be sought and obtained. Where significant traffic disruption will occur, the contractor shall advertise the potential traffic disruption in the public notice section with the local media. ***Notice***

6. The Traffic Management Scheme 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 Guidance Scheme. 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***

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 ***Notice to Property***

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. ***Owners***

C201.05 TRAFFIC CONTROLLERS

1. The Contractor shall advise the Superintendent of the names of proposed traffic controllers with a signed declaration that they are appropriately trained in the duties of traffic controllers in accordance with the QMUTCD. ***Trained Traffic Controllers***

C201.06 APPROVED CLOTHING FOR WORK PERSONNEL

1. All personnel shall wear high visibility clothing to the requirements of the QMUTCD. ***Safety Clothing***

C201.07 TEMPORARY SPEED ZONING

1. Where a temporary speed limit has been approved by the Council, or in the case of a gazetted or State controlled road the District Manager of DMR for the area, 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***

2. All costs associated with temporary speed zoning signposting shall be borne by the Contractor. ***Contractor's Cost***

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 6 m 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 principal shall supply the contactor with an approved 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 Guidance Scheme. ***Standards & Pavement***

C201.11 DESIGN DRAWINGS

1. Design drawings submitted for approval shall show:
   (a) Alignment and grading at a horizontal scale of an appropriate scale for rural roads and an appropriate scale 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. ***Contents***
   (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 an appropriate scale.
   (d) Pavement marking details.
   (e) Sufficient cross-sections to indicate the feasibility of making connections between various parts of the work.
   (f) Sufficient dimensions, especially lane widths, to make clear the geometry and clearances of the proposed Works.
   (g) 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 Gutter

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***

   MRS11.11
   And / or
   MRS11.30, MRS11.33, MRS11.34 and MRS11.36

C201.15 ROAD SAFETY BARRIER

1. Corrugated steel road 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 Road 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, guard fence 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. The costs associated with the redirection of traffic back onto the existing roadway shall be borne by the Contractor. ***Contractor's Cost***

5. 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 3.5 m lane width is available for through traffic on a two lane roadway and where 3.5 m 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 Guidance Scheme. ***Carriageway Restoration***

3. Full details of temporary signposting, traffic control devices and traffic control methods, in accordance with the appropriate arrangement diagrams in QMUTCD, are to be submitted for the Superintendent's approval at least five working days before undertaking any work which would involve construction under traffic. ***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 Guidance Scheme, and QMUTCD. The arrangement diagrams illustrate the more common examples of the arrangement of traffic control devices and set out the minimum requirements. ***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 QMUTCD 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***

2. The cost of providing and maintaining adequate traffic control devices arranged by the Superintendent shall be borne by the Contractor. ***Contractor's Cost***

C201.24 REGULATORY TRAFFIC CONTROL SIGNS AND DEVICES

1. A Regulatory Traffic Control Sign or Device shall be in accordance with the QMUTCD, and shall require approval by the Council, or in the case of a gazetted or State controlled road the District Manager of DMR for the area, before its erection. This approval should be obtained through the Superintendent, refer to Clause C201.07. ***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 the QMUTCD are shown in Annexure C201A. Approval must be obtained from QDMR prior to their use:

(a) Heavy Machinery Crossing

This temporary sign, shown as Sign SW5-22, if approved, may be used in lieu of W5-22, trucks entering.

(b) Cycle Hazard Grooved Road

This temporary sign, shown as Sign ST1-10, if approved, may be used in addition to T1-10 of AS 1742.3 where the road is grooved and is a hazard to cyclists.

(c) Tar Spraying Possible Short Delay

This temporary sign, shown as Sign ST3-1, if approved, may be used in addition to T3-1 for bituminous surfacing works.

C201.27 FLASHING ARROW SIGNS

1. Flashing arrow signs shall comply with QMUTCD.

C201.28 BARRIER BOARDS

1. Barrier boards shall comply with QMUTCD. ***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 Guidance Scheme or as directed by the Superintendent.

2. High visibility mesh fencing shall be constructed in accordance with QMUTCD, 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 QMUTCD, 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 QMUTCD and be placed in accordance with the arrangement diagrams in QMUTCD. ***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 QMUTCD. ***Reflectorised for Night Work***

C201.32 TRAFFIC WARNING LAMPS

1. Traffic warning lamps shall comply with QMUTCD and shall be installed in accordance with QMUTCD. The Contractor shall ensure that warning lamps are in good working order, correctly aligned and positioned with respect to the direction of traffic flow each night, before the site is left unattended. ***Standards and Positioning***

C201.33 TEMPORARY PAVEMENT MARKINGS

1. All pavement markings shall be reflectorised and consist of painted lines, road marking 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 QMUTCD. ***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. The cost of remarking the pavement lines shall be borne by the Contractor. ***Contractor's Cost***

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. The cost of replacing ineffective pavement markers shall be borne by the Contractor. ***Contractor's Cost***

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

SPECIAL REQUIREMENTS

C201.36 RESERVED

C201.37 RESERVED

C201.38 RESERVED

C201.39 RESERVED

C201.40 RESERVED

MEASUREMENT AND PAYMENT

C201.41 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification and shown on the Drawings in accordance with Pay Item C201(a) - Control of Traffic.

2. All activities for the construction, maintenance and removal of temporary roadways, including side-tracks and divided road crossovers, and detours detailed in this Specification to the requirements of specific activity Specifications are measured and paid in accordance with the Specifications for the specific activities.

Pay Item C201(a) CONTROL OF TRAFFIC

1. This shall be a Lump Sum item.

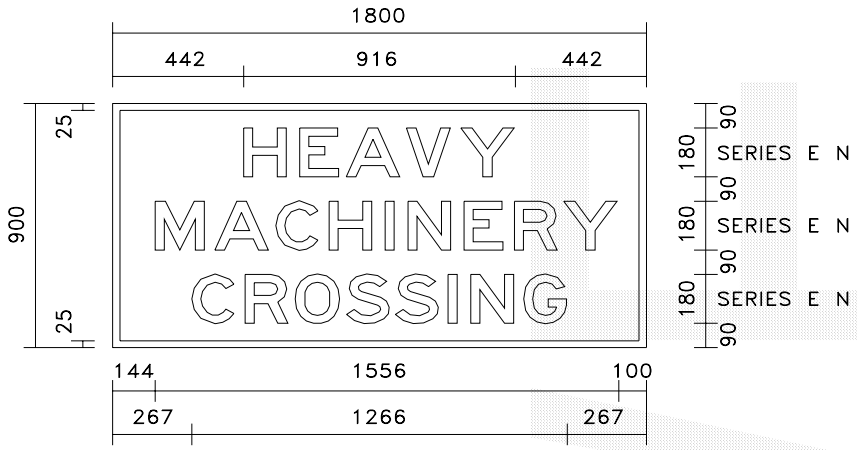
2. The Lump Sum shall include the design of temporary roadways and detours, traffic switching operations, the provision of traffic controllers, signposting, roadmarkings, raised pavement markers, lights, barriers and any other items required for the safe movement of traffic and the protection of persons and property in accordance with this Specification.

3. Progress payments shall be made on a pro-rata basis of work done under this item, having due regard to the duration of the Contract.

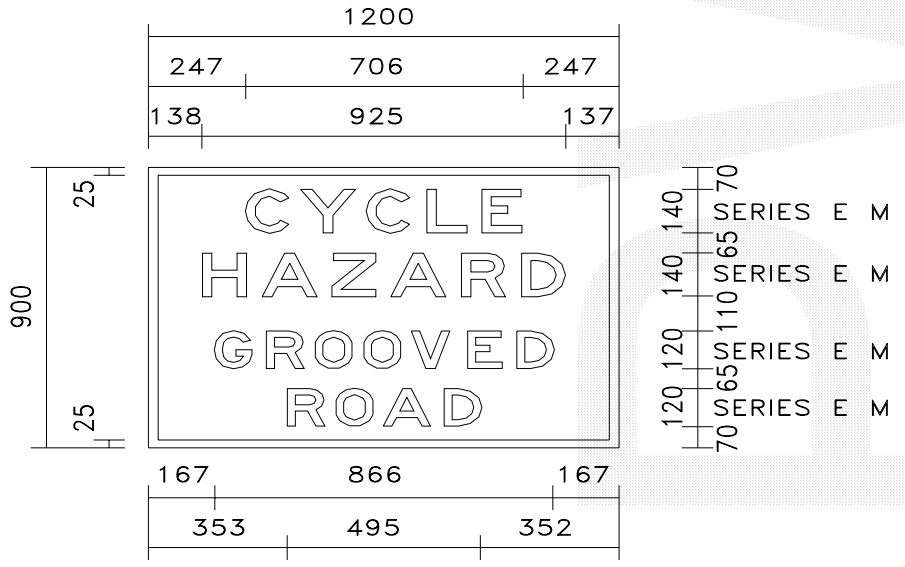
ANNEXURE C201A
SUPPLEMENTARY TEMPORARY WARNING SIGNS TO QMUTCD

Black letters and border on yellow reflectorised ground
Dimensions are in mm

(i) SW5-22



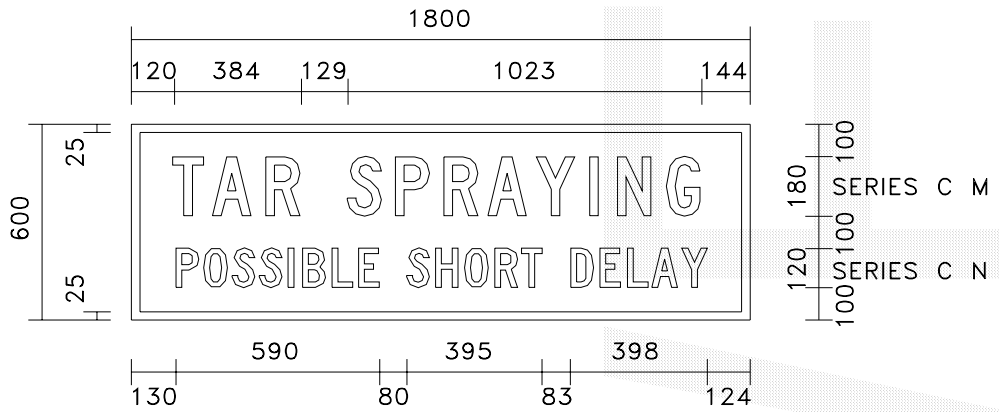
(ii) ST1-10



ANNEXURE C201A
SUPPLEMENTARY TEMPORARY WARNING SIGNS TO QMUTCD

Black letters and border on yellow reflectorised ground
Dimensions are in mm

(iii) ST3-1



QUEENSLAND

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C211

CONTROL OF EROSION AND SEDIMENTATION

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C211 - CONTROL OF EROSION AND SEDIMENTATION

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 in compliance with the requirements of the Environmental Protection Act, 1994 and Amendments, Regulations and Policies, and Council's Adopted Policies where available.

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 Gutter (Channel)
C273	-	Landscaping

(b) QLD State Legislation

The Environmental Protection Act, 1994 and Amendments, Regulations and Policies

(c) Other

Institution of Engineers Australia, Queensland Division (IEAQ)
- Soil Erosion and Sediment Control - Engineering Guidelines for Queensland Construction Sites, 1996.

Brisbane City Council (BCC)
- Integrated Environmental Management System Manual, 1997.

Institute of Public Works Engineering Australia (IPWEA)
- Local Government Salinity Management Handbook (Draft, July 2001)

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. At least fourteen days before the natural surface is disturbed on each of these sections, the Principal will supply the Contractor with an approved design for Erosion and Sedimentation Control Plan for that section. 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. The IEAQ Guidelines and the Brisbane City Council Manual provides guidance on typical permanent and temporary erosion and sedimentation control measures which may be required and guidance in the preparation of an Erosion and Sedimentation Control Plan. ***Guidance***

5. 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***

6. 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***

7. The Contractor shall adhere to the approved Erosion and Sedimentation Control 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

1. Earthworks for permanent erosion and sedimentation control basins shall be constructed to the planned levels and dimensions shown on the Drawings or such levels and dimensions as determined by the Superintendent. ***Planned Levels***

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. ***Site Preparation***

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

4. If payment for embankment construction is on a Schedule of Rates basis, at least three days before construction of the embankment the Contractor shall provide the Superintendent with survey information which will be sufficient to subsequently measure the volume of the constructed embankment. ***Contractor to Provide Survey Information***

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

1. Inlets and spillways shall be constructed using rock filled woven galvanised steel mattresses and geotextile, as shown on the Drawings or as directed by the Superintendent. 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 GUTTER (CHANNEL). ***Rock Mattresses***

2. A low flow outlet consisting of a 150mm diameter plastic pipe shall be installed as shown in the Drawings. No extra payment shall be made for this work which shall be regarded as part of the construction of the sedimentation control basin. ***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 25 mm 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 300 mm 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***

C211.09 RESERVED

(For additional Site Specific Permanent Control Measures.)

TEMPORARY EROSION AND SEDIMENTATION CONTROL

C211.10 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***

C211.11 TEMPORARY DRAINS

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

C211.12 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***

C211.13 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***

C211.14 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***

C211.15 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

C211.16 RESERVED

C211.17 RESERVED

C211.18 RESERVED

C211.19 RESERVED

MEASUREMENT AND PAYMENT

C211.20 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification, in accordance with Pay Items (a) to (e) inclusive.

2. A lump sum for any item other than Pay Item C211(a) shall not be accepted.

3. If any item for which a quantity of work listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in other items for the cost of the activity which has not been priced.

4. Clearing and grubbing is measured and paid in accordance with the Specification for CLEARING AND GRUBBING.

5. Landscaping works are measured and paid in accordance with the Specification for LANDSCAPING.

6. Topsoil stripping and removal of unsuitable material are measured and paid in accordance with the Specification for EARTHWORKS.

Pay Item C211(a) TEMPORARY EROSION AND SEDIMENTATION CONTROL

1. The unit of measurement shall be a lump sum for the installation, maintenance, inspection and removal of the temporary erosion and sedimentation control measures in accordance with Clauses C211.10 to C211.15 inclusive and the Drawings.

Pay Item C211(b) EARTHWORKS FOR PERMANENT EROSION AND SEDIMENTATION CONTROL BASINS

1. The unit of measurement shall be the cubic metre of compacted volume of embankment constructed in accordance with Clause C211.05 and the Drawings.

2. The volume shall be determined by calculation using the end area method.

3. The schedule rate shall cover the excavation of material from within the sedimentation control basin and embankment construction required under Clause C211.05 and shall be an average rate for all types of materials.

4. The cost of excavating and transporting material for embankment construction and obtained from within cuttings or from borrow shall be included in the schedule rate for General Excavation in the Specification for EARTHWORKS.

Pay Item C211(c) INLETS, SPILLWAYS AND LOW FLOW OUTLETS FOR SEDIMENTATION CONTROL BASINS

1. The unit of measurement shall be the square metre of horizontal surface area of rock filled mattress constructed in accordance with Clause C211.06 and the Drawings.

Pay Item C211(d) DROP INLET SEDIMENT TRAPS AND INLET CONTROL BANKS

1. The unit of measurement shall be 'each' drop inlet sediment trap including inlet control bank constructed in accordance with Clause C211.07 and the Drawings.

Pay Item C211(e) CLEANING OF PERMANENT SEDIMENTATION STRUCTURES

1. The unit of measurement shall be the in-place cubic metre of sediment removed from the structure in accordance with Clause C211.08.

2. The volume of sediment removed shall be determined by survey or by methods approved by the Superintendent. The schedule quantity is a provisional quantity.

QUEENSLAND

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C212

CLEARING AND GRUBBING

Amendment Record for this Specification Part

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1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C212 - CLEARING AND GRUBBING

CLAUSE **PAGE**

SPECIFICATION C212
CLEARING AND GRUBBING

C212.01 SCOPE

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. ***Extent of Work***

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. ***Erosion Control***

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. ***Boundary Fence Line***

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

C212.02 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,. The Contractor shall ensure that only the absolute minimum area for construction is cleared. ***Limits of Clearing***

2. Before clearing commences, the limits of clearing shall be marked by pegs placed by the Contractor at appropriate intervals around the area to be cleared. ***Indicator Pegs***

C212.03 CLEARING OPERATIONS

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. ***Extent***

2. The Contractor shall give the Superintendent written notice of seven days of the intention to clear any area of the work. The Superintendent shall mark or indicate to the Contractor the trees that shall be preserved. The Superintendent shall arrange for an inspection by Council's Tree Preservation Officer or other authorised Council 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. ***Trees to be preserved***

3. The Contractor shall take all measures to prevent damage to existing underground and overhead utility services. ***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 relevant council 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 by the Superintendent. ***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 Tree Preservation Officer or other authorised Council officer. ***Unsound trees in Road Reserve***

8. If directed by the Superintendent any branch, which overhangs the road formation, shall be cut back in an appropriate manner approved by the Superintendant 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.The cost of making good such damage shall be borne 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. Unless otherwise approved by the Superintendent and Councils authorised Officer in writing, disposal of timber and other combustible materials by burning shall not be permitted. Where the Contractor obtains the prior written approval of the Superintendent, the Contractor shall comply with all Statutory requirements applicable to burning off, and any such burning off shall be carried out in such a manner that no damage is done to any trees outside the limits of clearing. Smoke resulting from such burning off shall not cause a traffic hazard. ***Burning not Permitted***

MEASUREMENT AND PAYMENT

C212.07 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed under this Specification entitled Clearing and Grubbing in accordance with Pay Item C212(a).

Pay Item C212(a) CLEARING AND GRUBBING

1. The unit of measurement shall be the hectare of plan area bounded by the limits of clearing specified in Clause C212.02.

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C213

EARTHWORKS

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C213 - EARTHWORKS

CLAUSE **CONTENTS** **PAGE**

SPECIFICATION C213 : EARTHWORKS

GENERAL

C213.01 SCOPE

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

   (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.

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***

C213.02 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
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 and land transport
		Part 2 Use of explosives
AS 3798	–	Guidelines on Earthworks for Commercial and Residential Developments

(c) QLD Government Legislation

Explosives Act, 1952 and Regulations, 1955 and Amendments.
Environmental Planning Act, 1998
Environmental Protection Act, 1994 - Environmental Protection Noise Policy, 1997.
National Road Transport Commission/Federal Office of Road Safety, Joint Publication - Australian Code for the Transport of Explosives by Road and Rail

(d) Other

AUSTROADS - Explosives in Roadworks, Users Guide 1982.

C213.03 NATURAL SURFACE AND EARTHWORKS MATERIALS

(a) Natural Surface

1. The Contractor shall submit details of the Contractor's proposed survey system to the Principal for approval, prior to commencement of clearing and grubbing or earthworks.

Contractor's Survey System

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

(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. The cost of making good such deficiency of material shall be borne by the Contractor.

Contractor's Cost

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 embankments shall be sealed off by adequate compaction to provide a smooth tight surface. ***Wet Weather Precautions***

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 25 m 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 5 m 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***

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

(a) Cuttings

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

(b) Embankments

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.

C213.08 SURVEY AFTER REMOVAL OF TOPSOIL

1. Where payment is on a 'Schedule of Rates' basis, and unless alternative arrangements have been made by the Superintendent, after removing the topsoil the Contractor shall determine the surface levels in each cutting and embankment at sufficient locations to determine the volume of excavation for general earthworks and the volume of compacted fill. 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. Where payment is on a 'Schedule of Rates' basis, at least three working days before stockpiling of topsoil at any site, the Contractor shall submit, for the approval of the Superintendent, a site survey which will be sufficient to subsequently measure the volume placed in stockpile. ***Site Survey***

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

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

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

5. 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 by the Superintendent on the basis of site inspection and investigation during the excavation. ***Batter Slopes***

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***

7. Where the Superintendent redetermines the batter slope of any section of a cutting after it has been completed in accordance with this Clause, the Superintendent shall order a Variation to the Contract for the resetting out, removal of additional material and retrimming of the batter. This Variation shall include all additional costs incurred by the Contractor who shall not have any ***Variation for Batter Slopes***

further claim upon the Principal as a result of the redetermination of the batter slope.

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. The cost of any increase in excavation quantities resulting from such change in batter slope shall be borne by the Contractor. 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*** ***Contractor's Cost***

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***

4. The cost of restoring batters shall be borne by the Contractor. ***Contractor's Cost***

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. The cost of such maintenance and cleaning of benches shall be borne by the Contractor. ***Bench Maintenance Contractor's Cost***

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 50 mm 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***

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 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. ***CBR Testing***

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 10 mm above or 40 mm 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. ***Inspection by Superintendent***

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***

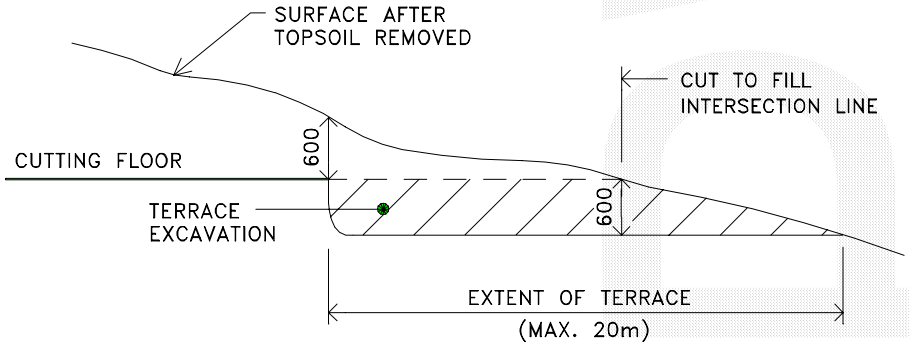

Figure C213.1 - Transition from Cut to Fill

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. The requirements of the Explosives Act,1952 and Regulations, 1955 and Amendments and Local Government laws if applicable shall be complied with.

Contractor to Obtain Licences

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)	25 mm/sec
Bridgeworks and structural retaining walls under construction	20 mm/sec
Residential premises, schools, hospitals and other buildings	5 mm/sec (with 10% not to exceed 10 mm/sec)
Buildings or monuments of historical significance	2 mm/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 Environmental Protection Noise Policy, 1997 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 exceeded. The Contractor shall not resume any blasting until such proposals have been submitted. ***Excessive Air Blast Over-Pressure***

C213.20 CONTROL OF GROUND VIBRATION

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. ***Monitoring Vibrations***

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. ***Blasting Site Relationship***

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: ***Maximum Instantaneous Charge***

$$MIC = 0.5\left[\frac{D}{\left[\frac{PPV}{1140}\right]^{-0.625}}\right]^2$$

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.

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. ***Adjustment of Blast Design***

UNSUITABLE MATERIAL

C213.21 GENERAL

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. ***Definition***

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 ***Preparation of Foundations***

other foundation damage.

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

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. The cost of any reworking shall be borne by the Contractor. ***Reworking Stony Patches Contractor's Cost***

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 Redetermination***

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 ***Mechanical***

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. ***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 10 mm above or 40 mm 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 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 ***Selection of Material*** ***Contractor's Cost***

provided. The cost of providing such extra material shall be borne by the Contractor.

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. ***Payment***

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***

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 drainage characteristics at no extra cost to the Principal. It shall be stored and ***Synthetic Membrane***

installed in accordance with Manufacturer's instructions. The use of a synthetic membrane shall be subject to the Superintendent's approval.

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 ***Use in Embankments***

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.

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. Spoil disposed of off site is to comply with Council's requirements for filling of land.

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 Environmental Planning Act, 1998, the Local Government Planning Scheme, local laws, local planning policies and land owners, 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 standard compactive effort, of not less than 95 per cent. ***95% Compaction Requirements***

- Each layer of material replacing unsuitable material as detailed in Clause C213.21.
- Each layer of material placed in embankments, up to 0.3 metres below the bottom 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 higher 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 100 per cent as determined by AS 1289.5.7.1 for standard compactive effort: ***100% Compaction Requirements***

- Foundations for shallow embankments.
- Foundations other than shallow embankments.
- Each layer of the embankment 0.3 metres below the bottom 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. The cost of transport to stockpile for drying out and later use shall be borne by the Contractor. 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. The cost of such wetting or drying the material to be compacted shall be borne by the Contractor. ***Moisture Content*** ***Contractor's Cost 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 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. The cost of the removal to stockpile, drying out and reincorporation of the wet material shall be borne by the Contractor.

Moisture Content above Optimum

Contractor's Cost

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 Repre-sentation

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. The cost of preparing the surface for deflection monitoring is deemed to be included in the rate for General Earthworks.

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

C213.40 RESERVED

C213.41 RESERVED

C213.42 RESERVED

C213.43 RESERVED

C213.44 RESERVED

LIMITS AND TOLERANCES

C213.45 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarized 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

MEASUREMENT AND PAYMENT

C213.46 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification on a schedule of rates basis in accordance with Pay Items (a) to (d) inclusive.

2. A lump sum price for any of these items shall not be accepted.

3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. Control measures for erosion and sedimentation are measured and paid in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION.

5. Clearing and grubbing of stockpile sites and borrow areas is measured and paid in accordance with the Specification for CLEARING AND GRUBBING.

6. Seeding and restoration of stockpile sites and borrow areas is measured and paid in accordance with the Specification for LANDSCAPING.

7. Traffic control for blasting operations is measured and paid in accordance with the Specification for CONTROL OF TRAFFIC.

8. Fill adjacent to culverts, other than box culverts, and drainage structures is measured and paid in accordance with the STORMWATER Specifications for PIPE DRAINAGE and DRAINAGE STRUCTURES as appropriate.

9. Selected backfilling to box culverts is measured and paid in accordance with the STORMWATER Specification for PRECAST BOX CULVERTS.

Pay Item C213(a) REMOVAL AND STOCKPILING OF TOPSOIL

1. The unit of measurement shall be cubic metre measured in stockpile.

2. The volume shall be determined by calculation using the End Area method.

3. The schedule rate under this Pay Item includes all activities associated with stripping topsoil, carting and placing into stockpile, then stabilising and trimming the stockpiles.

Pay Item C213(b) GENERAL EARTHWORKS

1. The unit of measurement shall be the cubic metre measured as bank volume of excavation.

2. The schedule rate for this Pay Item shall be an average rate to cover all types of material encountered during excavation and placed in embankments or spoil stockpiles, including both earth and rock/

3. Payment for General Earthworks shall include all activities associated with the excavation of material and the construction of embankments, stockpiling of spoil, the haulage of material and any pretreatment such as breaking down or blending material or drying out material containing excess moisture, except that:

- removal of unsuitable material to spoil shall be paid under Pay Item C213(c)
- extra costs in processing selected material shall be paid under Pay Item C213(d)

4. The base of the excavation shall be the designed floor level in accordance with Clause C213.14 and no account shall be taken of level tolerances.

5. The volume of earthworks in cuttings shall be determined by calculation using the End Area Method.

6. Where unsuitable material from the foundations of shallow cuttings or material from cut to fill transitions is excavated and placed into embankments the volume shall be calculated from joint surveys carried out immediately prior to, and after subsequent removal of the unsuitable material, or by other methods which may be approved by the Superintendent.

Pay Item C213(c) UNSUITABLE MATERIAL TO SPOIL

1. The unit of measurement shall be the cubic metre measured as bank volume of excavation.

2. This pay item refers only to unsuitable material as defined in Clause C213.21 which is removed to spoil stockpile.

3. If the material is such that the bank volume of excavation cannot be measured, the Superintendent shall determine the conversion factors to be applied to the loose volumes measured in haulage units or to the measured stockpile volumes.

4. The schedule rate(s) under this Pay Item shall include all operations involved in the excavation, haulage, drying out, compaction or other activity required under Clause C213.21 for its disposal as spoil in accordance with Clause C213.34.

5. When this Pay Item provides for ranges of provisional quantities, the rates shall be applied successively, but not cumulatively, as the volume of unsuitable material increases from one provisional quantity range to the next higher range.

6. Each rate shall be applied as the sole payment due for all unsuitable material removed within each quantity range, irrespective of the nature or quantity of the material removed.

Pay Item C213(d) SELECTED MATERIAL

1. The unit of measurement shall be the cubic metre measured as embankment volume in place in the selected material zone. The volume shall be determined by multiplying the theoretical plan area of the top of the selected material zone with its nominated thickness.

2. This pay item covers any extra costs involved in stockpiling, processing, placing, compaction and trimming of material, including surface preparation for deflection monitoring in the selected material zone over and above those costs allowed for under Pay Item C213(b).

3. The width and depth shall be taken as shown on the Drawings or as directed by

the Superintendent. No account shall be taken of level 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 b) Embankment areas	 _____mm _____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 and C213.30	Upper Zones of Formation 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	Nominated Soaking Period (Days)
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.

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C220

STORMWATER DRAINAGE

GENERAL

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C220
STORMWATER DRAINAGE - GENERAL

CLAUSE **CONTENTS** **PAGE**

SPECIFICATION C220 : STORMWATER DRAINAGE - GENERAL

GENERAL

C220.01 INTRODUCTION

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

2. This is the general Specification common and applicable to all types of drainage lines, open drains, kerb and gutter, 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 Gutter

   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.

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***

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 gutter*

   (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*

(h) *Erosion and sedimentation control.*

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
C212	-	Clearing and Grubbing
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)
AS 3798	-	Guidelines on Earthworks for Commercial and Residential Developments

(c) Other

Queensland Urban Design Manual
RESOURCE NSW - Specification for Supply of Recycled Materials for Pavements, Earthworks and Drainage, 2003

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 ***Set-out***

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.

2. The Superintendent and Councils authorised Officer may amend the inlet or outlet locations or designed levels or the culvert length to suit actual site conditions. Any activity resulting from such amendments by the Superintendent and Councils authorised Officer shall be deemed to be included as part of the work covered by the Schedule of Rates. ***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***

C220.07 EXCAVATION

1. Before undertaking stormwater drainage excavation, topsoil shall be removed in accordance with the Specification for EARTHWORKS. ***Topsoil***

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/corporation to the method of excavation before commencing excavation. ***Approval by Public Utility Authorities/ Corporation***

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.

Note to Compiler :- Due regard may be taken of the opportunity to use recycled materials for backfill of stormwater pipe trenches–(RESOURCE NSW - Specification for Supply of Recycled Materials for Pavements, Earthworks and Drainage, 2003.) Note- disclaimer in front cover of specification under "important" re liability.

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	97%
Bedding material (other than for pipe drainage)	97%
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 flexible 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

C220.12 RESERVED

C220.13 RESERVED

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% 97%	C220.09
	(e) Backfill material within the selected material zone	97%	C220.09
3.	**Backfill**		
	(a) Layers	≤ 150mm	C220.09
	(b) Moisture Content	>60%, <95%	C220.09

Table C220.1 - Summary of Limits and Tolerances

MEASUREMENT AND PAYMENT

C220.15 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification and the associated activity specific specifications on a schedule of rates basis.

2. The Pay Items applicable to particular activities are listed in the Specifications for these activities.

3. Common to culverts and drainage structures is Excavation and payment for this shall be made under this Specification.

4. Erosion and sedimentation control measures are measured and paid in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION.

5. Topsoil removal is measured and paid in accordance with the Specification for EARTHWORKS.

6. Concrete work is measured and paid in accordance with the Specification for the particular drainage activities and not in the Specification for MINOR CONCRETE WORKS.

7. Sprayed concrete work is measured and paid in accordance with the Specification for MINOR CONCRETE WORKS.

8. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.

Pay Item C220(a) EXCAVATION FOR STORMWATER DRAINAGE CULVERTS AND STRUCTURES

1. The unit of measurement shall be cubic metre measured as bank volume of excavation.

2. The schedule rate for this Pay Item shall be an average rate to cover all types of material encountered during excavation. Separate rates shall not be included for earth and rock.

3. The rate is deemed to include:
   - Setting out and associated survey
   - Excavation, including excavation and replacement of unsuitable material.
   - Replacement for over-excavation for any reason
   - Control of stormwater runoff, temporary drainage and erosion and sedimentation control.

4. The volumes of excavation for payment shall be computed as follows:

(i) **Reinforced Concrete and Fibre Reinforced Cement Pipes**

- Positive Projection (if excavation required)

  Width:
  - single cell: external pipe diameter + 1m.
  - multi cell: sum of external diameters + sum of spacings between pipes measured square to the line of the culvert + 1m.

Depth:
- in natural ground: average actual depth from topsoil stripped ground surface to underside of specified bedding.
- in embankment: average actual depth or 500mm above top of pipe to underside of specified bedding, whichever is lesser.

Length: actual excavation length, centre to centre of pits or centre of pit to face of headwall.

- Wide Trench

Width:
- single cell: external pipe diameter + 1m.
- multi cell: sum of external diameters + sum of spacings between pipes measured square to the line of the culvert + 1m.

Depth:
- in natural ground: average actual depth from topsoil stripped ground surface to underside of specified bedding.
- in embankment: maximum 500mm above top of pipe to underside of specified bedding.

Length: actual excavation length, centre to centre of pits or centre of pit to face of headwall.

- Normal Trench

Width: 1.4 times external pipe diameter or external pipe diameter +300mm on each side, whichever is the greater..

Depth:
- in natural ground: average actual depth from topsoil stripped ground surface to underside of specified bedding.
- in embankment: maximum 500mm above top of pipe to underside of specified bedding.

Length: actual excavation length, centre to centre of pits or centre of pit to face of headwall.

(ii) **Steel Pipes and Pipe Arches**

Width:
- wide trench: external pipe diameter or span + 2 x external pipe diameter or span.
- normal trench: external pipe diameter or span + 600mm on each side.

Depth: as for RC and FRC pipes.
Length: actual excavation length.

(iii) **Flexible Pipes**

Width: For pipes of:-:

Ext. dia at collar ≥75 ≤150	external diameter of pipe plus 200mm
Ext. dia at collar >150 ≤300	external diameter of pipe plus 300mm
Ext. dia at collar >300 ≤450	external diameter of pipe plus 400mm

Depth:	average actual depth excavated.
Length:	actual excavation length, centre to centre of pits or centre of pit to face of headwall.

(iv) **Box Culverts**

The plan area for payment shall be the area calculated from the outside dimensions of the base slab plus 300mm and wingwalls as shown on the Drawings. The depth for payment shall be the average actual depth below ground surface stripped of topsoil to the bottom of the specified bedding.

(v) **Other Drainage Structures**

The plan area for payment shall be the area calculated from the outside dimensions of the structure as shown on the Drawings. The depth shall be determined from the actual site measurement of the surface at the time of excavation to the underside of the bedding.

(vi) **Unsuitable Material under Culverts and Drainage Structures**

The volume for payment of material which the Superintendent deems unsuitable shall be calculated from the actual plan area of material removed and the average actual depth below the bottom of bedding. It shall be replaced with ordinary backfill material either from drainage excavations or from Earthworks.

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C221

PIPE DRAINAGE

Amendment Record for this Specification Part

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EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C221 - PIPE CULVERTS

CLAUSE CONTENTS PAGE

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, Part 1: Structural design
AS/NZS 2566.2	-	Buried flexible pipelines, Part 2: Installation
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 not be placed in position until the Contractor has produced documentary evidence to the Superintendent that the manufacture of the products to be used in the works has complied with the Manufacturer's Quality Plan in accordance with ISO 9002. ***Compliance with Quality Plan***

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 dispatch 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 council has a formal process in place for the assessment and approval of other products, only those products approved for the purpose are to be used ***Other Products***

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

PRECAST REINFORCED CONCRETE AND FIBRE REINFORCED CONCRETE PIPES

C221.04 PIPES

1. Precast reinforced concrete pipes shall comply with AS 4058 and shall be of the class and size as shown on the Drawings.

Precast 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 AS 3725.

Wide Trench Conditions

Design Check

C221.06 BEDDING

1. Bedding shall be in accordance with this Specification, AS 3725 and AS 3725 Supplement 1 for the pipe support types as shown on the Drawings. Where the pipe support type is not shown on the Drawings, the support type shall be H2 .

Pipe Support Type

2. Figure C221.1 and Table C221.1 indicate the dimensions of bedding and backfilling for pipes laid in trench conditions and embankment conditions for all AS 3725 pipe support types.

Bedding Dimensions

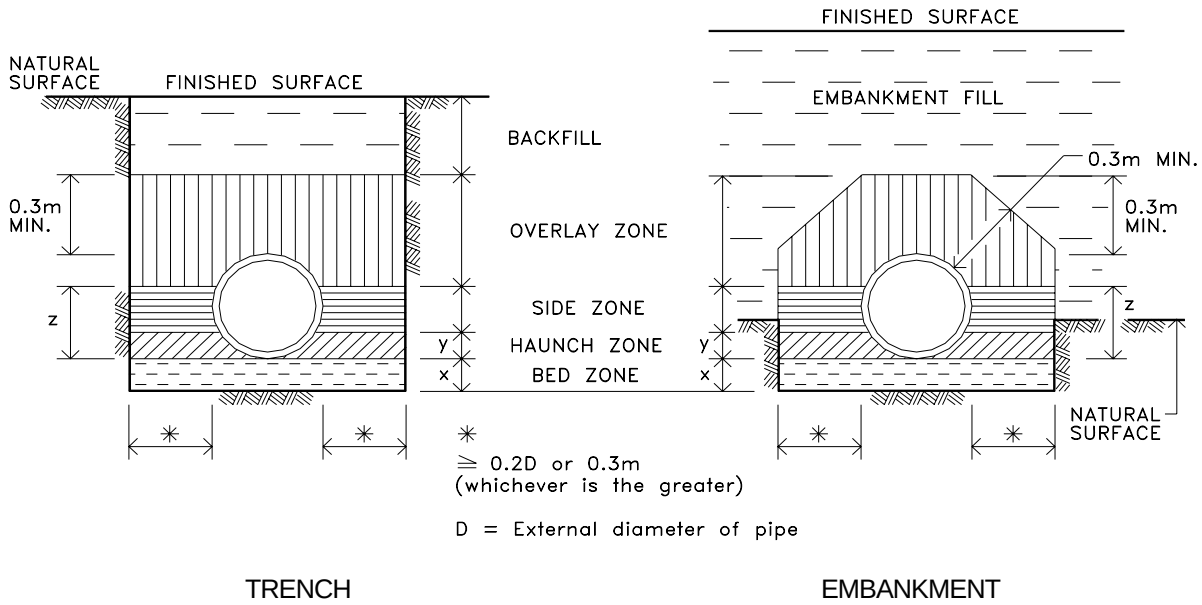

Figure C221.1 - Pipe Installation Conditions

		Pipe Support Type						
		U	**H1**	**H2**	**H3**	**HS1**	**HS2**	**HS3**
Dimension (minimum)	x	75 on rock Nil on soil	100 for D ≤ 1500 150 for D > 1500		0.25 D but >100	100 for D ≤ 1500 150 for D > 1500		
	y	—	0.1D	0.3D	0.3D	0.1D	0.3D	0.3D
	z	—	—	—	—	≥ 0.7D		

D = External diameter of pipe

Table C221.1 Pipe Installation Dimensions

3. Bedding material for the bed and haunch zones shall consist of a granular material having a grading, determined by AS 1141.11, complying with Table C221.2, and a Plasticity Index, determined by AS 1289.3.3.1 of less than 6. Select fill material in the side zones, for pipe support type HS, shall also comply with Table C221.2.

Material Requirements

Sieve size mm	Weight passing %	
	Bed and Haunch Zones	Side Zones
75.0	—	100
19.0	100	—
9.5	—	50 - 100
2.36	50 -100	30 - 100
0.60	20 - 90	15 - 50
0.30	10 - 60	—
0.15	0 - 25	—
0.075	0 - 10	0 - 25

Table C221.2 Bedding Material Grading Limits

4. The Contractor shall advise the Superintendent of the source of bedding material. ***Source***

5. All material shall be compacted in layers not exceeding 150mm compacted thickness except where explicitly approved by the Superintendent, for the first placed layer above the pipe crown in the overlay zone, in order to protect the pipe from construction damage. Each layer shall be compacted to the relative compaction specified before the next layer is commenced. ***Layers***

6. 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***

7. Compaction of select fill material in the bed and haunch zones shall be to the appropriate pipe support requirements shown in Table C221.3 when tested in accordance with AS 1289.5.4.1 for standard compactive effort. H3 Pipe Support includes concrete bedding. Concrete shall be grade N20 to AS 3600. Pipe shall be suitably reinforced in accordance with AS 3725 as standard elliptically reinforced pipe may not be adequate for H3 Pipe Support. Unless specifically selected pipes are nominated for use with H3 bedding, a design check shall be required to confirm the suitability of the proposed pipes. ***Compaction Requirements*** ***Design Check***

		Pipe Support Type						
		U	H1	H2	H3	HS1	HS2	HS3
Minimum Relative Compaction %	Bed and Haunch Zones	—	50	60	Conc-rete	50	60	70
AS 1289.5.4.1 (Standard Compaction)	Side Zones: Cohesionless	—	—	—	—	50	60	70
	Cohesive	—	—	—	—	85	90	95

Table C221.3 Bedding Material Compaction Requirements

8. The top 0.1Dmm of the bedding and haunch material directly under the pipe shall be placed and shaped accurately to house the pipe after compaction is achieved in the bedding and haunch zone external to the area of direct pipe support.

9. Where the impermeability of the natural ground and the slope of the drainage line is such that erosion of bedding material is considered by the Superintendent to be a likely problem, the Superintendent may specify cementitious stabilisation of the bedding material used in the bedding and haunch zones. ***Cementitious Stabilisation***

C221.07 INSTALLATION

(a) General

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

Positioning of 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 16% (1 in 6)

Bulkheads

The spacing of concrete bulkheads for the various pipe materials and diameter shall be in accordance with the following table:

Spacing

Pipe Diamenter	Grade	Spacing of Bulkheads		
		Flexible Pipe	RC Pipe	FRC Pipe
150-225	16% (1in 6)	6m	4.8m	4m
300-525	16% (1in 6)	6m	4.8m	4m
600 or greater	10% (1 in 10)	6m	4.8m	4m

.

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

Inspection by Superintendent

(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

Procedure for

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 Manufacturer and Superintendent.

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 approved by the local authority. 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 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.

Procedure

(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

Trench Backfill

Specification for EARTHWORKS.

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. Any damage caused shall be rectified, and all costs of such rectification shall be borne by the Contractor. Backfilling and compaction shall commence at the pipe or wall so as to confine remaining uncompacted material at commencement.

Precautions

Contractor's Cost

STEEL PIPES AND PIPE ARCHES

C221.09 NESTABLE STEEL PIPE AND DRAINAGE UNITS

1. Nestable steel pipes and drainage units shall be supplied in accordance with AS 2041 and shall be of the class and size as shown on the Drawings.

Specification

2. The galvanised steel sheets used in manufacture shall comply with AS 1397 for steel base grade G250 and a minimum coating Class of Z600.

Galvanised Steel Sheets

3. Where specified, the pipes and drainage units shall be given a protective coating over the steel, after assembly of a coal tar epoxy paint or equivalent as approved by the Superintendent, to a thickness of 400 microns.

Protective Treatment

4. Field cut ends shall be carefully wire brushed to remove any scale followed immediately by two coats of zinc-rich organic primer complying with AS/NZS 3750.9 or two coats of inorganic zinc silicate paint complying with AS/NZS 3750.15.

Field Cuts

C221.10 HELICAL LOCK-SEAM CORRUGATED STEEL PIPE

1. Helical lock-seam corrugated steel pipe shall be supplied in accordance with AS 1761 and AS 1762 and shall be of the class and size as shown on the Drawings.

Specification

2. The galvanised steel sheet used in manufacture shall comply with AS 1397 for steel based grade G250 and a minimum coating Class of Z600.

Galvanised Steel Sheets

3. Unless otherwise approved by the Superintendent, no part of the pipe shall incorporate steel strips which have been joined by welding. Field cut ends shall be carefully wire brushed to remove any scale followed immediately by two coats of organic zinc-rich primer complying with AS/NZS 3750.9 or two coats of inorganic zinc silicate paint complying with AS/NZS 3750.15. Pipes and coupling bands shall be given a protective hot-dip coating of bitumen on both sides to AASHTO standard M190 or equivalent as part of the process of manufacturing.

Protective Treatment

C221.11 BOLTED STEEL PIPES, PIPE ARCHES AND SPECIAL SHAPES

1. Bolted steel pipes, pipe arches and special shapes shall be supplied in accordance with AS 2041 and shall be of the class and size as shown on the Drawings. The corrugated pipe or plate shall be hot-dip galvanised on both sides after fabrication in accordance with the requirements for coating thickness and mass for articles in AS/NZS 4680.

Specification

2. Also, after assembly, all bolted steel pipes, pipe arches and special shapes shall be given a protective coating on the outside of the steel plate, of a coal tar epoxy paint complying with AS 3887 or equivalent paint approved by the Superintendent. Invert plates shall be coated on the outside before they are placed on the pipe bed. The plate surface shall be cleaned and degreased with a cleaning solution recommended by the protective coating manufacturer. The

Protective Treatment

protective coating shall be applied to give a uniform minimum dry thickness of 400 microns. Any coating damaged shall be recoated by first cleaning any grease, mud or other foreign matter from the affected area. The area shall then be recoated so that the minimum dry thickness of the coating is 400 microns.

C221.12 MATERIALS AND SURFACE TREATMENT OF STEEL PIPES AND PIPE ARCHES

Engineer's Certification

1. All steel pipes and pipe arches will require an Engineer's certification that the pipe materials and surface treatments are adequate to provide for installation and in-service loading as well as corrosion protection for a satisfactory design life of 100 years unless indicated otherwise on the Drawings. Such certification shall address the chemistry of the soil, groundwater, stream and backfill material as specified in Clause C221.13.

C221.13 MATERIAL AGAINST STEEL STRUCTURES

1. The severity of corrosive attack on steel structures will depend on the pH value and electrical resistivity of the soil surrounding the structure and the pH value of the water in the stream.

2. Besides meeting the normal requirements of the bedding, selected backfill materials and the materials used for embankment construction above the steel structures and within a horizontal distance from the structure equal to the height of the filling over the structure, the pH and resistivity limits as shown in Figure C221.2 will determine the level of corrosion protection required.

3. Notwithstanding the height of fill, embankment material within 6m of the structure shall conform to these requirements.

4. The pH and electrical resistivity of the material shall be determined in accordance with AS 1289.4.3.1 and AS 1289.4.4.1.

NATA Testing

5. The Contractor shall nominate the sources of the various materials and submit documentary evidence from a NATA registered laboratory that the representative samples conform to the requirements of this clause and the protective treatment provided. The samples shall be pretreated if necessary so as to represent the condition and grading when compacted and in service.

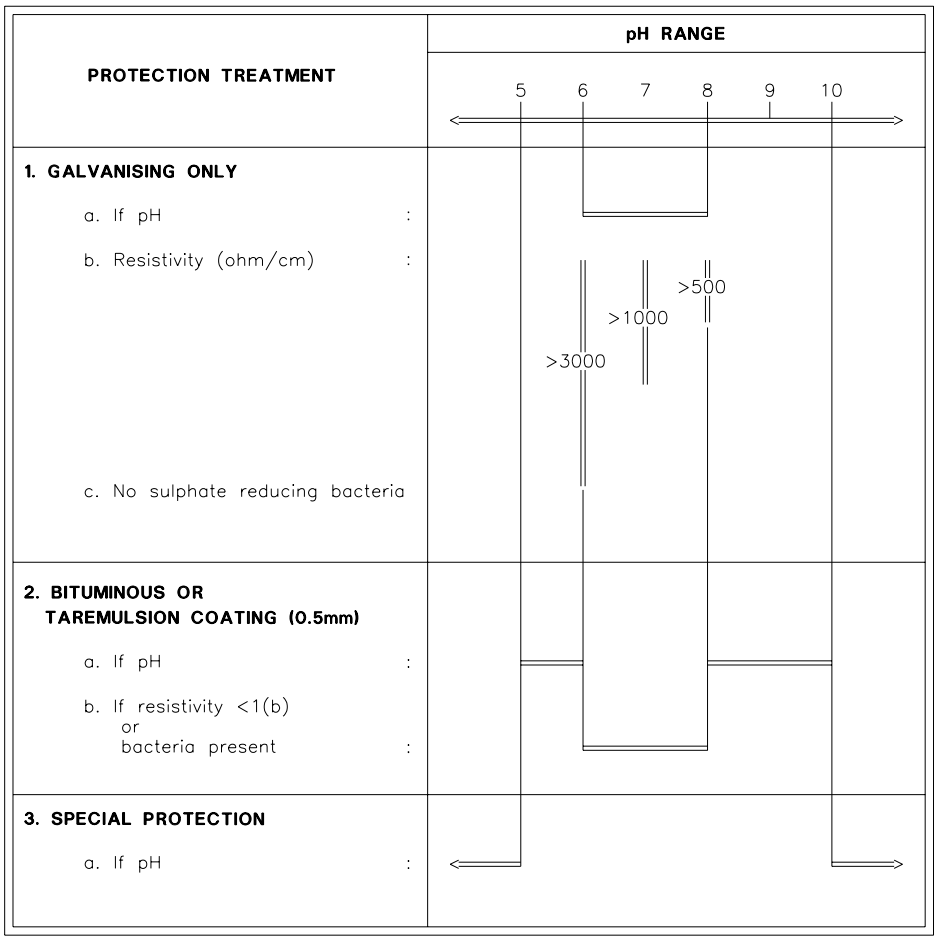

Figure C221.2 - Corrosion Protection Requirements For Steel Structures

C221.14 EXCAVATION AND FOUNDATION PREPARATION

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. The trench shall be excavated to a level 75mm below the design invert and for a minimum width of 600mm on each side of the structure. ***Trench Width Select Fill***

3. Where unsuitable material, as determined by the Superintendent, is encountered at the foundation level, it shall be removed to a depth approved by the Superintendent. The additional excavation shall be backfilled with material complying with, and compacted to, the requirements for HS3 pipe support as specified in Clause C221.06. ***Unsuitable Material***

4. Where rock is encountered at the foundation level, the foundation shall be excavated for an additional depth of 250mm, or 0.25 times the structure width, whichever is the lesser and for a width equal to the width of the structure. The additional excavation shall be backfilled with material complying with, and compacted to, the requirements for HS3 pipe support as specified in Clause C221.06. ***Rock Foundation***

C221.15 BEDDING

1. Bedding shall meet the requirements of Clause C221.06. The thickness of uncompacted bedding material between the foundation and the outer surface of corrugation shall not be less than 75mm. The uniform blanket of loose material which provides the minimum 75mm thick bedding, shall be placed on the shaped, compacted selected material foundation to allow the corrugations of the structure invert to bed in and become filled with the material. ***Depth***

C221.16 INSTALLATION

(a) General

1. The assembly of all corrugated steel pipes and pipe arches as well as helical lock-seam corrugated steel pipes shall be carried out in accordance with the manufacturer's recommendations. These recommendations shall be submitted to the Superintendent before assembly or laying of the culverts is commenced. ***Manufacturer's Recommen-dations***

2. If deemed necessary after consultation with the manufacturer, temporary bracing of corrugated steel pipes or pipe arches shall be carried out in accordance with the manufacturer's recommendations. ***Temporary Bracing***

(b) Joints

1. Corrugated steel pipes or pipe arches shall be joined in accordance with the manufacturer's recommendations and AS 2041. ***Method***

2. Where helical-lock seam corrugated steel pipes are to be joined, both ends of the join shall be rerolled with four annular corrugations of pitch 68mm. Coupling of the re-rolled ends shall be made in accordance with AS 1761 by using semi-corrugated bands. Rubber ring joint seals shall be used in conjunction with the coupling bands except where specifically indicated otherwise in the Drawings. ***Ends to be Rerolled***

3. All joints or lap joints in pipes or pipe arches (excluding rubber ring joint coupling bands) shall be covered with strips of non-woven geotextile material, of minimum 250mm width and of minimum mass 270 grams per square metre in accordance with the requirements for geotextile in the Specification for SUBSURFACE DRAINAGE – GENERAL, to prevent loss of sand backfill or bedding into the pipe. ***Geotextile Cover Material***

C221.17 BACKFILL

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). Backfill shall be placed around the steel pipe or structure, to a minimum dimension equal to the pipe width, on both sides. ***Selected Material***

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. 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 ***Trench Backfill***

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.

5. The Contractor shall check the shape of the culvert during backfilling to ensure that on completion of backfilling, the vertical and horizontal centreline dimensions of the pipe or structure shall not vary from the manufacturer's specified dimensions by more than plus or minus 2 per cent for pipes and pipe arches. ***Distortion of Structure Shape***

C221.18 INVERT PROTECTION OF CORRUGATED STEEL PIPES AND PIPE ARCHES

1. Where shown on the Drawings, the invert of corrugated steel pipes and pipe arches shall be protected using sprayed concrete. ***Sprayed Concrete***

2. The sprayed concrete shall be placed to a thickness of not less than 100mm over the crest of the corrugations and to a width such that the bottom third of the pipe circumference is covered symmetrically about the invert of the pipe. ***Depth and Width***

3. All foreign material shall be removed from the surface to be protected. Where corrosion has occurred all loose scale shall be removed. ***Scale Removal***

4. The production, application and curing of sprayed concrete shall be in accordance with the Specification for MINOR CONCRETE WORKS. ***Associated Specification***

5. The sprayed concrete shall be reinforced with a fabric of hard drawn steel wire 4mm diameter with 200mm square mesh. The fabric shall be securely supported at a central location within the sprayed concrete by non-metallic supports. ***Sprayed Concrete Reinforcement***

6. Laps in fabric shall be 300mm and a cover of 50mm of sprayed concrete shall be provided to the fabric at all edges. ***Laps in Fabric***

7. Immediately after placement of the sprayed concrete, all free water shall be removed and the surface coated with cement slurry. ***Cement Slurry Application***

8. No water shall be allowed to flow over the surface of the sprayed concrete for twenty-four hours after the placement of sprayed concrete. ***Water Flow***

FLEXIBLE PIPES

C221.19 MATERIALS

1. Flexible pipes shall be those covered by Australian Standard AS/NZS 2566.1 “Buried flexible pipelines Part 1: Structural design.” ***Specification***

   This Standard is applicable to buried flexible pipes manufactured from homogeneous or composite material; of plain or structured wall construction; and plastic (UPVC, OPVC, ABS, GRP, polyethylene) or metallic (aluminium, steel, ductile iron) materials of manufacture.

   Note: Clauses 221.09 to 221.18 apply to corrugated metal pipes.

2. The size/type/class of the flexible pipeline shall be as shown on the Drawings.

3. Embedment material in the bedding, side support and overlay zones shall be in accordance with this Specification, AS 2566.1 and AS 2566.2. ***Embedment material***

   Unless otherwise specified, embedment material in the bedding, side support and

overlay zones, as shown in Figure 1, shall be a cohesionless granular material having a grading, determined by AS 1141.11, no finer than Table 221.4 and a Plasticity Index, determined by AS 1289.3.3.1 of less than 6.

Sieve Size (mm)	Weight Passing (%)
19.0	100
2.36	50 – 100
0.6	20 – 90
0.3	10 – 60
0.15	0 – 25
0.075	0 – 10

Table 221.4 – Embedment Material Grading

(Table taken from AS 2566.2)

4. Other aggregates, gravels and sands suitable for embedment material are those complying with Tables G2 and G3 of AS 2566.2.

5. Trench backfill material shall satisfy the requirements for embankment material as defined in the Specification for EARTHWORKS. ***Backfill material***

C221.20 EXCAVATION AND BEDDING

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. Figure C221.3 and Table C221.4 indicate the dimensions of bedding and backfilling for pipes laid in trench conditions and embankment conditions, unless otherwise indicated on the Drawings. ***Bedding Dimensions***

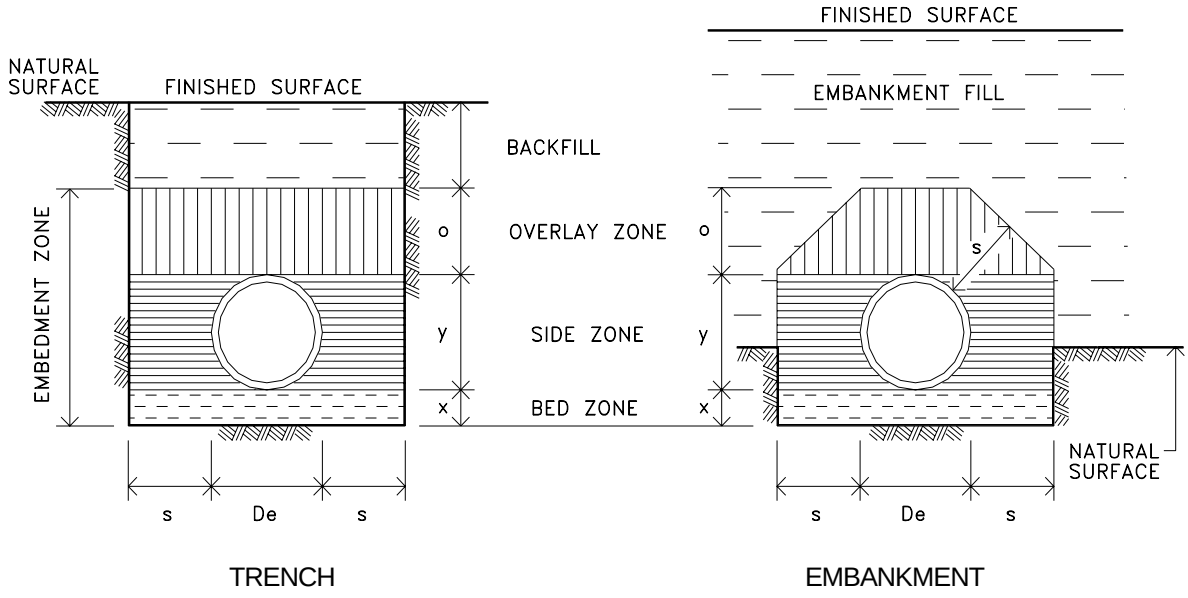

Figure C221.3 - Pipe Installation Conditions

(Figure taken from AS 2566.2)

Extreme External Dia (De)mm	Minimum Dimensions (mm)			
	x	s	o	y
≥75 ≤150	75	100	100	Pipe dia.
>150 ≤300	100	150	150	Pipe dia.
>300 ≤450	100	200	150	Pipe dia.
>450 ≤900	150	300	150	Pipe dia.
>900 ≤1500	150	350	200	Pipe dia.
>1500 ≤4000	150	0.25 De	300	Pipe dia.

NOTE: Where multiple pipes are laid side by side, the minimum distance between the pipes shall be dimension "s" for the larger of adjacent pipes.

Table C221.4 - Trench and Embedment Dimensions

3. Bedding zone material shall be placed and compacted in accordance with the requirements in Clause C221.06 except that the required relative compaction in the bedding zone shall be 95 per cent (AS 1289.5.4.1, Standard compaction). ***Compaction***

Embedment Material	Test Method	Compaction	
		Traffic Loading	No Traffic Loading
Cohesionless	Density Index (AS 1289)	70%	60%

Table 221.6 – Minimum Relative Compaction

(Taken from AS 2566.2)

C221.21 INSTALLATION

1. Embedment of the flexible pipes shall be in accordance with the requirements of the Drawings, Section 5 of AS/NZS 2566.2 and to the dimensions shown in Figure 221.3

2. Pipes shall be laid and joined in accordance with the manufacturer's Specifications, and to any Australian Standards relevant to installation of the type of pipe. Pipes with markings indicating the crown or invert of the pipe, or the required direction of flow in the pipe shall be laid strictly in accordance with the markings. All pipes shall be lowered into the trench without being dropped. ***Laying and Jointing***

3. Bulkheads or trenchstops shall be constructed where required in accordance with Table 5.7 of AS 2566.2. Bulkheads shall be constructed in accordance with the Specification for DRAINAGE STRUCTURES. ***Bulkheads***

4. Bedding zone material compaction and pipeline placement prior to backfill constitutes a **HOLD POINT**. Approval of the bedding, including positioned and jointed pipeline, is required by the Superintendent prior to the release of the hold point. ***Approval***

HP

C221.22 BACKFILL

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 in accordance with *Table 221.6* ***Embedment Compaction***

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. 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***

SPECIAL REQUIREMENTS

C221.23 CONSTRUCTION LOADS

1. Where the contractor proposes to use alternative backfill or compaction methods to those nominated in the Design Drawings, the design is to be rechecked by the Superintendent

C221.24 RESERVED

C221.25 RESERVED

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.	**Backfill - Steel Pipes**		
	(a) Side and Overlay Zone Compaction	Table C221.3, HS3	C221.17
	(b) Pipe/Structure		
	(i) Horizontal and Vertical Variation	< 2% of specified dimensions	C221.17
5.	**Sprayed Concrete**		
	(a) Over crest of corrugations over bottom third of pipe circumference	> 100mm	C221.18
6.	**Bedding Zone Compaction**	≥95%	C221.20
7.	**Backfill - UPVC Pipes**		
	(a) Side and Overlay Zone Compaction	≥95%	C221.21

Table C221.5 - Summary of Limits and Tolerances

MEASUREMENT AND PAYMENT

C221.27 PAY ITEMS (UNITS OF MEASURE)

1. Payment shall be made for all the activities associated with completing the work detailed in this Specification on a Schedule of Rates basis in accordance with Pay Item C221(a).

2. A lump sum price for this item shall not be accepted.

3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. Subsoil drains at pits and headwalls are measured and paid in accordance with this Specification and not in the Specification for SUBSURFACE DRAINAGE - GENERAL.

5. Selected material around pipes, trench backfill in embankment material to the underside of the selected material zone and selected material backfill within the selected material zone where approved, is measured and paid in accordance with this Specification and not in the Specification for EARTHWORKS.

6. Sprayed concrete invert protection is measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS.

7. Miscellaneous minor concrete work not included in the pay items in this specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.

8. Bulkheads are measured and paid in accordance with the Specification for DRAINAGE STRUCTURES.

Pay Item C221(a) PIPE CULVERTS

1. The unit of measurement shall be the linear metre measured along the centreline of each particular type, class and size of stormwater drainage pipe culvert and shall be the plan length between centres of gully pits or faces of headwalls.

2. The schedule rate shall include:

   - Supply
   - Survey and setting out
   - Bedding
   - Jointing (including connections)
   - Subsoil drains at pits and headwalls
   - Temporary bracing and strutting
   - Bituminous painting
   - Sprayed concrete lining and other protective measures
   - Selected material backfilling
   - Embankment material trench backfilling

QUEENSLAND

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C222

PRECAST BOX CULVERTS

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C222 - PRECAST BOX CULVERTS

CLAUSE **CONTENTS** **PAGE**

MEASUREMENT AND PAYMENT 7

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
   (i) erosion and sedimentation control.

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

C211 Control of Erosion and Sedimentation
C213 - Earthworks
C220 - Stormwater Drainage - General
C224 - Open Drains, including Kerb and Gutter

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
MRS11.05 Unbound Pavements

MATERIALS

C222.03 CULVERT UNITS, LINK AND BASE SLABS

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: ***Supply***

   (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

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

C222.05 SELECTED BACKFILL

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

C222.06 ORDINARY BACKFILL

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. ***Quality***

CONSTRUCTION

C222.07 COFFER DAMS

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. ***Contractor's Costs***

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 on rock subgrade 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 ***Line and Level***

this 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***

C222.10 BEDDING

(a) Cast-In-Situ Base Slabs

1. No bedding material shall be placed until the foundations have been inspected and approved by the Superintendent. ***Inspection***

2. Bedding shall be either mass concrete or lightly bound paving material which complies with the requirements of at least a Type 3, Subtype 3.4 material as defined in MRS 11.05 Unbound Pavements, whichever is shown on the Drawings. ***Type***

3. Mass concrete bedding shall be of the same compressive strength as for the base slab and shall not be less than 50mm thick over any point in the foundation. It shall be laid to the line and level of the underside of the base slab to a tolerance of ±10mm in level and ±5mm in line. The bedding shall be finished to a smooth surface. ***Mass Concrete***

(b) Precast Base Slabs

1. Precast base slabs, U-shaped culvert units and one piece culvert units shall be supported on a bed zone of selected backfill of minimum compacted depth 150mm in accordance with AS 1597.2. ***Selected Fill***

C222.11 CAST-IN-SITU BASE SLABS

1. Cast-in-situ base slabs shall be constructed to the dimensions shown on the Drawings and in accordance with the requirements of the Specification for MINOR CONCRETE WORKS. The invert levels shall be within -10mm to +10mm of the design level, grade 5mm in 2.5m (1 in 500) and plan position ±50mm. ***Construction***

2. Recesses / nibs to accommodate the walls of the precast crown units shall be formed in the base slab to the dimensions shown on the Drawings. ***Recesses for Walls***

C222.12 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 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 approved cement mortar or grout to the satisfaction of the Superintendent.. ***Mortar Bed in 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 40mm gap shall be provided between adjacent cells. This gap shall be filled with approved cement mortar or grout to the satisfaction of the Superintendent. ***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***

C222.13 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 horizontally to:1 vertically (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***

C222.14 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 GUTTER. ***Extent***

C222.15 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 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

C222.16 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

C222.17 RESERVED

C222.18 RESERVED

C222.19 RESERVED

MEASUREMENT AND PAYMENT

C222.20 DEDUCTIONS

1. Payment for in-situ concrete work shall be made at the scheduled rates provided the concrete meets the strength requirements specified in the Specification for MINOR CONCRETE WORKS.
2. Where any concrete does not reach the strength specified, the scheduled rate of payment shall be reduced by 2% for each 1%, or fraction thereof, by which the strength of the specimen fails to reach the specified strength, up to a maximum deficiency of 10%.
3. If the deficiency in strength exceeds 10%, the concrete represented by the specimens may be rejected, in which case no payment will be made.

C222.21 PAY ITEMS

1. Payment shall be made for the activities associated with completing the work detailed in this Specification in accordance with Pay Items C222(a) and C222(b).
2. A lump sum price shall not be accepted.
3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.
4. Excavation for box culverts is measured and paid in accordance with the Specification for STORMWATER DRAINAGE - GENERAL.
5. Excavation for inlet and outlet channels is measured and paid in accordance with the Specification for OPEN DRAINS INCLUDING KERB AND GUTTER.
6. Base slab bedding is measured and paid in accordance with this Specification and not in the Specification MRS 11.05 Unbound Pavements.
7. Cast-in-situ base slabs are measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS.
8. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.
9. Ordinary embankment backfill is measured and paid in accordance with the Specification for EARTHWORKS.
10. Cast-in-situ headwalls and wingwalls are measured and paid in accordance with the Specification for DRAINAGE STRUCTURES.

Pay Item C222(a) IN-SITU BASE SLAB

1. The unit of measurement shall be the cubic metre of reinforced concrete in place (excluding the mass concrete bedding layer).
2. The width, length and depth of the slab shall be as specified on the Drawings or as directed by the Superintendent.
3. The schedule rate shall include foundation preparation, bedding and all activities associated with the construction of the base slab.
4. The schedule rate does not include excavation.

Pay Item C222(b) PRECAST CONCRETE BOX CULVERTS

1. The unit of measurement shall be linear metre of the actual length installed.
2. The Schedule Rate shall include supply, installation and jointing of the precast units, selected backfilling and testing of the units.

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C223

DRAINAGE STRUCTURES

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C223 - DRAINAGE STRUCTURES

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SPECIFICATION C223 : DRAINAGE STRUCTURES

GENERAL

C223.01 SCOPE

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: ***Associated Specifications***

   C211 Control of Erosion and Sedimentation
   C221 - Pipe Drainage
   C222 - Precast Box Culverts
   C224 - Open Drains, including Kerb and Gutter

2. The work to be executed under this Specification consists of the construction of headwalls, wingwalls, pits, gully 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. ***Extent of Work***

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***

C223.02 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
C221 - Pipe Drainage
C222 - Precast Box Culverts
C224 -- Open Drains, including Kerb and Gutter
C271 Minor Concrete Works

(b) Australian Standards

AS 3996 - Metal access covers, road grates and frames

CONSTRUCTION

C223.03 GENERAL

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

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. ***Time for Completion***

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, where required,shall be constructed in accordance with the Drawings and with centreline on the axis of the culvert. ***Energy Dissipators***

C223.05 HEADWALLS, WINGWALLS, APRONS, CUT-OFF WALLS

1. The headwalls and 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***

3. Aprons and cut-off walls shall be constructed to limit the potential for scouring and undermining drainage structures. Where site conditions indicate that the intent of the construction of the apron and cut-off wall will not be achieved, the Superintendent shall be notified before the construction is commenced. The Superintendent will direct the contractor as to the action to be taken. ***Aprons and Cut-off Walls***

C223.06 PITS

1. All new pits, including access covers, gully grates 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 gully 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, where required,shall be installed in accordance with the Drawings ***Step Irons***

4. Step irons in cast insitu structures 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. Step irons in pre-cast structures shall be installed in the factory by the manufacturer ***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 and Councils authorised officer. ***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 gutter or other concrete structures, a 10mm wide joint shall be provided between the structure and paving, or kerb and gutter or other concrete structures. The joint shall consist of preformed jointing material of bituminous fibreboard or approved equivalent. ***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 20MPa 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 1m 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

C223.11 CONCRETE BULKHEADS

Bulkheads

1. Concrete bulkheads are to be provided in accordance with the drawings or the specification for PIPE DRAINAGE. This construction shall be used in conjunction with other pipeline bedding types and is designed to provide support to pipelines constructed at steeper grades

    16% (1 in 6) for 150mm to 225mm dia drainage pipelines

    16% (1 in 6) for 300mm to 525mm dia drainage pipelines

    10% (1 in 10) for 600mm dia drainage pipelines

    the construction consists of line bulkheads 150mm thick, constructed from class N20 concrete and embedded 150mm into the undisturbed sides and 75mm into the bottom of the trench. The bulkheads shall be placed immediately behind the collars of the pipes for FRC pipes, 4.8 meters for RC pipes and 6 meters for flexible pipes.

    The balance of pipeline construction shall be as for bedding type appropriate for a similar pipeline on normal grades.

C223.12 RESERVED

C223.13 RESERVED

LIMITS AND TOLERANCES

C223.14 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

MEASUREMENT AND PAYMENT

C223.15 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification, in accordance with the Pay Items C223(a) and C223(b).

2. If any item for which a quantity of work listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in other items for the cost of the activity which has not been priced.

3. Excavation is measured and paid in accordance with the Specification for STORMWATER DRAINAGE - GENERAL.

4. Backfill is measured and paid in accordance with this Specification and not with the Specification for EARTHWORKS.

5. Drainage structures are measured and paid in accordance with this Specification and not with the Specification for MINOR CONCRETE WORKS.

6. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.

Pay Item C223(a) CONCRETE HEADWALLS AND WINGWALLS

1. The unit of measurement shall be cubic metre of concrete as calculated from the dimensions on the Drawings.

2. The Schedule Rate shall include formwork, supply and fixing of steel reinforcement, supply, placing and curing of concrete, stripping, finishing and backfilling.

Pay Item C223(b) PITS, DISSIPATORS, CHANNEL BASINS AND OTHER SUPPLEMENTARY STRUCTURES

1. The unit of measurement shall be "each" for the completed structures as scheduled.

2. The rate shall include all activities and materials required to complete the structures as shown on the Drawings, including the supply and installation of all cast in metalwork, frames, grates, lintels and lids, finishing and backfilling.

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C224

OPEN DRAINS
INCLUDING KERB & GUTTER (CHANNEL)

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

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EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C224 - OPEN DRAINS, INCLUDING KERB AND GUTTER

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SPECIFICATION C224 : OPEN DRAINS, INCLUDING KERB AND GUTTER

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 banks / drains, contour drains, diversion drains, table drains, batter drains, swales, channels, gutters and kerbs and gutters. ***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 (gutters) - 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. Unlined open drains shall be graded to ensure free flow of water and, shall not have a grade of less than 1 per cent unless shown on the drawings. ***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***

4. Unlined 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. Unlined 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 banks and drains where approved by Council 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 catch drains 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 Banks and 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 gutter 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 as shown in the drawings ,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 or approved equivalent and shall be of sufficient depth to fill the joint. ***Jointing***

3. The level at any point on the surface of the concrete lining shall be within +/- 10mm of design levels. When a straight edge 3m long is laid on top of or along the surface of the concrete lining, the surface shall not vary more than 5mm from the edge of the straight edge. ***Tolerances***

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 and councils authorised officer. Where specified, they must be used strictly in accordance with the manufacturer's instructions. ***Manufacturer's Instructions***

C224.12 KERB AND GUTTER (CHANNEL)

1. Kerb and/or gutters (channel) 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 gutter shall be true to line and the top surface shall be of uniform width, free from humps, sags or other irregularities. Kerb and gutter shall have a steel float finish. ***Finish***

4. The level at any point on the surface of the gutters 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 gutters, 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 gully pits requiring gutter depression. In no instances shall kerb and channel pond water to a depth greater than 5mm. ***Tolerances***

5. Unless shown otherwise on the Drawings, contraction joints, shall be formed every 3m of gutter 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. Where shown on the Drawings, expansion joints, 15mm in width for the full depth of the kerb and gutter, shall be constructed at intervals not exceeding 15m and where the gutter abuts against gutter pits, retaining walls and overbridges. Expansion joints shall consist of a preformed jointing material of bituminous fibreboard or approved equivalent. ***Expansion Joints***

7. Where kerbs and/or gutters 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 gutter. ***Adjacent Concrete Pavement***

8. All house stormwater outlets shall be constructed using approved kerb adaptors , to match the existing type and size of kerb . 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 gutter has been constructed and not earlier than three days after placing, the spaces on both sides of the kerb and/or gutters shall be backfilled and reinstated in accordance with the Drawings, or as instructed by the Superintendent. ***Backfill Timing***

11. Backfill material (excluding footpath top dressing) 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 gutter 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
5.	**Kerb and Gutter**		
	(a) Compaction of foundation	To AS 2876	C224.12
	(b) Level of gutter surface	Level $\leq \pm$10mm of design level	C224.12
	(c) Surface uniformity	Deviation of kerb and gutter surface from 3m straight edge $\leq$5mm	C224.12
	(d) Contraction Joints		
	(i) Area	$\geq$50% of CS area	C224.12

Item	Activity	Limits/Tolerances	Spec Clause
	(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 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

C224.17 RESERVED

C224.18 RESERVED

C224.19 RESERVED

MEASUREMENT AND PAYMENT

C224.20 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification on a Schedule of Rates basis in accordance with Pay Items C224(a) to C224(h) inclusive.

2. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which as not been priced.

3. Erosion and sedimentation control measures are measured and paid in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION.

4. Sprayed concrete lining of open drains is measured and paid in accordance with the Specification for MINOR CONCRETE WORKS.

5. Cast-in-situ lining of open drains is measured and paid in accordance with this Specification and not with the Specification for MINOR CONCRETE WORKS.

6. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.

7. Topsoiling and turfing to sides of batter drains are measured and paid in accordance with the Specification for LANDSCAPING.

Pay Item C224(a) EXCAVATION - CATCH, CONTOUR AND MINOR DIVERSION DRAINS

1. The unit of measurement shall be the linear metre measured along the invert of the drain.

2. The placement and compaction of material excavated from the drains on the lower sides of the drains to form banks shall be included in the excavation rates.

3. The schedule rate for excavation shall allow for excavation of all types of material. Separate rates shall not be included for earth and rock.

4. Any temporary measures for the control of stormwater runoff shall be included in the rate for excavation.

Pay Item C224(b) EXCAVATION - INLET, OUTLET, AND DIVERSION CHANNELS

1. The unit of measurement shall be the cubic metre measured from cross sections on the drawings using the end area method, or as "each" where minor work is involved.

2. The disposal of surplus material shall be included in the excavation rates.

3. The schedule rate for excavation shall allow for excavation of all types of material. Separate rates shall not be included for earth and rock.

4. Any temporary measures for the control of stormwater runoff shall be included in the rate for excavation.

Pay Item C224(c) CONCRETE LINING OF OPEN DRAINS

1. The unit of measurement shall be the square metre of concrete in place.

2. The schedule rate under this Pay Item shall include all the operations involved in the surface preparation, supply and placing of concrete, jointing and curing.

Pay Item C224(d) STONE PITCHING OF OPEN DRAINS

1. The unit of measurement shall be the square metre of stone pitching in place.

2. The schedule rate under this Pay Item shall include all the operations in the surface preparation, supply of stone, placing, final trimming and mortar jointing.

Pay Item C224(e) BATTER DRAINS

1. The unit of measurement shall be linear metre along the length of the drain formed by batter drain units.

2. The schedule rate shall include supply of the units, excavation, installation, backfilling and compaction.

Pay Item C224(f) ROCK FILLED GABIONS

1. The unit of measurement shall be the cubic metre of rock filling.

2. The volume shall be taken from the Drawings with appropriate adjustments being made for any authorised changes.

3. The schedule rate shall include the supply and placement of geotextile material behind the gabions, the supply and assembly of the gabions, the supply and placing of the rock fill in the gabions.

Pay Item C224(g) ROCK FILLED WIRE MATTRESSES

1. The unit of measurement shall be the square metre of rock filled mattress complete.

2. The area shall be determined from the actual completed work and shall include the area folded into the trench.

3. The schedule rate shall include the supply and placement of geotextile material, star pickets and ties as specified, together with the supply and assembly of the wire mattresses and the supply and placing of the rock fill.

Pay Item C224(h) KERB AND/OR GUTTER (CHANNEL)

1. The unit of measurement shall be the linear metre measured along the length of the kerb and/or gutter.

2. The schedule rate shall include all operations involved in the forming, compaction of foundations, concreting, expansion and contraction joints, backfilling and compaction adjacent to the completed kerb.

3. Separate pay items shall be included for each type of kerb and/or gutter specified.

QUEENSLAND

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C230

SUBSURFACE DRAINAGE GENERAL

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C230 - SUBSURFACE DRAINAGE-GENERAL

CLAUSE **CONTENTS** **PAGE**

ANNEXURE

C230A SLOTTED PIPES FITTED WITH SEAMLESS TUBULAR FILTER FABRIC

SPECIFICATION C230 : SUBSURFACE DRAINAGE - GENERAL

GENERAL

C230.01 INTRODUCTION

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: ***Purpose***

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.

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***

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

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 Drawings, and shall present this set-out for inspection by the Superintendent.

Amendments to Planned Work

2. The Superintendent and Council's authorised officer may amend the locations or designed levels or the lengths to suit actual site conditions. Any activity resulting from such amendments by the Superintendent and Council's authorised officer shall be deemed to be included as part of the work covered by the Schedule of Rates. Should the Superintendent require a change to the conditions of

installation an appropriate variation shall be ordered.

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/corporation to the method of excavation before commencing excavation. ***Approval by Public Utility Authorities/ Corporations***

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. ***Detail***

C230.09 OUTLET STRUCTURES FOR SUBSURFACE DRAINAGE

1. Subsurface drainage pipes shall be connected to discharge into gully 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 gully 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 ***Erosion***

or shall be protected by the placement of selected stone or similar treatment together with a marker post to indicate location and assist maintenance. ***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 and fitted with seamless tubular filter fabric 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***

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

   (d) 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

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. ***Properties and Labelling***

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.

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. ***Ultra Violet Light Resistant***

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.

6. In addition to the above mentioned requirements, geotextiles for curtain drains shall consist of either 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 50 mm 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 300 mm length of the fabric. ***Water Transmission Rate***

(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.

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. ***Fitting***

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-executed plans to be returned to the Superintendent upon completion of the Contract. ***Work As Executed Plans***

2. In addition, the Contractor shall prepare a subsurface drainage information sheet or sheets at the completion of construction of each drain or drainage system and shall submit the subsurface drainage sheet or sheets to the Superintendent within five working days of the completion of the drain or drainage system. ***Information Sheet***

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 Cleanouts:

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

C230.15 RESERVED

C230.16 RESERVED

LIMITS AND TOLERANCES

C230.17 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

MEASUREMENT AND PAYMENT

C230.18 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification and the associated activity specific specification on a schedule of rates basis.

2. The Pay Items applicable to particular activities are listed in the Specifications for these activities.

3. Common to subsurface drainage works are Filter Material and Outlet Structures and payment for these items shall be made under this Specification.

4. A Lump Sum price for any of these items shall not be accepted.

5. If any item, for which a quantity of work is listed is not priced by the Contractor, it shall be understood that due allowance has been made in other items for the cost of the activity which has not been priced.

6. Erosion and sedimentation control measures are measured and paid in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION.

7. Excavation and Geotextile material is measured and paid in accordance with the Specification applicable to the particular activity.

8. Unsuitable material removal is measured and paid in accordance with the Specification for EARTHWORKS.

9. Concrete work for outlet structures is measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS.

10. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.

Pay Item C230(a) SUBSURFACE DRAINAGE

1. The unit of measurement shall be per linear meter measured along the centreline of each particular subsoil drain and shall be the plan length between centres of drainage structures or outlets

2. The schedule of rates shall include
   - supply
   - setting out and associated survey work
   - replacement for over excavation for any reason
   - control of stormwater run-off, temporary drainage and erosion and sedimentation control
   - connections, markers, fittings and seamless tubular filter fabric where specified
   - excavation and backfilling
   - laying
   - jointing (inc. connections)
   - selected filter material
   - embankment material trench backfilling
   - supply placing and securing of the geo-textile material
   - cleanout structure constructed in accordance with the drawings

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.

QUEENSLAND

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C231

SUBSOIL AND FOUNDATION DRAINS

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C231 - SUBSOIL AND FOUNDATION DRAINS

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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 . ***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 or pavement box 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

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 ***Bedding***

2. The type of filter material shall be as shown on the Drawings or as directed by the Superintendent and Councils authorised officer. ***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 not less than 97 per cent (standard compaction) as determined by AS 1289.5.4.1. ***Compaction of 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 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 targeted subsurface water catchment. An outlet structure in accordance with the Drawings shall be constructed at the discharge end.

(e) Cleanouts ***Location***

1. Cleanouts 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 cleanout construction are shown on the Drawings. The standard Cl 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 and Councils authorised officer. ***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, 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

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

C231.07 RESERVED

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.	**Cleanout 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

MEASUREMENT AND PAYMENT

C231.09 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed under this Specification in accordance with Pay Items C231(a).

2. A lump sum price for any of these items shall not be accepted.

3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the other items for the cost of the activity which has not been priced.

4. Filter material and outlet structures are measured and paid in accordance with the Specification for SUBSURFACE DRAINAGE - GENERAL.

Pay Item C231(a) SUBSURFACE DRAINAGE

1. The unit of measurement shall be per linear meter measured along the centreline of each particular subsoil drain and shall be the plan length between centres of drainage structures or outlets

2. The schedule of rates shall include

   - supply
   - setting out and associated survey work
   - replacement for over excavation for any reason
   - control of stormwater run-off, temporary drainage and erosion and sedimentation control
   - connections, markers, fittings and seamless tubular filter fabric where specified
   - excavation and backfilling
   - laying
   - jointing (inc. connections)
   - selected filter material
   - embankment material trench backfilling
   - supply placing and securing of the geo-textile material
   - cleanout structure constructed in accordance with the drawings

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C232

PAVEMENT DRAINS

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C232 - PAVEMENT DRAINS

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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 unless the subbase is open graded or pervious in nature in which case intra-pavement drains shall be provided. ***Sub-Pavement Drains***

2. Intra-Pavement Drains are intended for the drainage of the pavement layers of a flexible pavement where the subbase comprises an open graded or pervious pavement material or open graded asphaltic concrete. ***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	-	Asphaltic Concrete

(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 pervious pavement material 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, unless approved by the local authority 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. 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.

Filter Material

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) Cleanouts

1. Cleanouts 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 cleanout 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 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

Location

end.

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 permeable 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- ***Pipe Anchorage***

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.

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 subbase, in accordance with the Specification MRS 11.05 Unbound Pavements.

   (b) For open graded asphalt subbase, in accordance with the Specification MRS 11.34 Open Graded Asphaltic surfacing.

2. Tipping, spreading and compaction of the subbase shall be undertaken in such a 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. ***Damage to Pipes***

3. The cost of the removal and replacement of such damaged pipes shall be borne by the Contractor. ***Contractor's Costs***

4. 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 ***Width and***

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. ***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. The Filter material shall be compacted for its full depth to a relative compaction of not less than 100% (standard compaction) as determined by AS 1289.5.4.1 ***Compaction***

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) Cleanouts

1. Cleanouts 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 cleanout 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 gully pits and other stormwater drainage ***Location***

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.

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

C232.08 RESERVED

LIMITS AND TOLERANCES

C232.09 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.	Cleanout 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

MEASUREMENT AND PAYMENT

C232.10 PAY ITEMS

1. Pay Items shall be made for ALL activities associated with completing the work detailed under this Specification in accordance with Pay Items C232(a).

2. A Lump Sum price for any of these items will not be accepted.

3. If any item, for which a quantity of work is listed is not priced by the Contractor, it is then understood that due allowance has been made in other items for the cost of the activity which has not been priced.

4. Filter material and outlet structures are measured and paid in accordance with the Specification for SUBSURFACE DRAINAGE - GENERAL.

5. Subbase material, including spreading, compacting and trimming, is measured and paid in accordance with the Specification MRS11.05 Unbound Pavements or MRS11.30 Dense Graded Asphalt Pavements as appropriate.

6. Selected material backfill to edge drains is measured and paid in accordance with the Specification for EARTHWORKS.

Pay Item C232(a) SUBSURFACE DRAINAGE

1. The unit of measurement shall be per linear meter measured along the centreline of each particular subsoil drain and shall be the plan length between centres of drainage structures or outlets

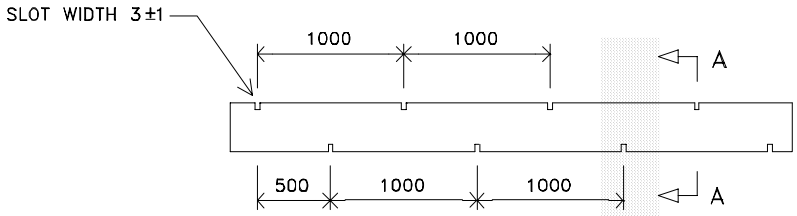
2. The schedule of rates shall include

    - supply
    - setting out and associated survey work
    - replacement for over excavation for any reason
    - control of stormwater run-off, temporary drainage and erosion and sedimentation control
    - connections, markers, fittings and seamless tubular filter fabric where specified
    - excavation and backfilling
    - laying
    - jointing (inc. connections)
    - selected filter material
    - embankment material trench backfilling
    - supply placing and securing of the geo-textile material

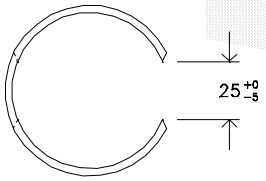
cleanout structure constructed in accordance with the drawings.

ANNEXURE C232A

SLOTTING DETAILS FOR THICK WALLED UNPLASTICISED PVC PLASTIC PIPE



PLAN



SECTION A–A

Diagram not to scale
Dimensions are in millimetres

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C233

DRAINAGE MATS

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

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. The cost of repairing or replacing such damaged geotextile shall be borne by the Contractor. ***Damaged Geotextile*** ***Contractor's Cost***

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 the Specification 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. The cost of repairing or replacing such damaged geotextile shall be borne by the Contractor.

Damaged Geotextile

Contractor's Cost

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

C233.07 RESERVED

LIMITS AND TOLERANCES

C233.08 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

MEASUREMENT AND PAYMENT

C233.09 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification in accordance with Pay Items C233(a) and C233(b).

2. A lump sum price for any of these activities shall not be accepted.

3. If any item, for which a quantity of work is listed in the Schedule of Rates, has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. Filter material and outlet structures are measured and paid in accordance with the Specification for SUBSURFACE DRAINAGE - GENERAL.

5. Slotted thick walled unplasticised PVC pressure pipe is measured and paid in accordance with this Specification and not in the Specification for PAVEMENT DRAINS.

Pay Item C233(a) SUPPLY AND PLACEMENT OF GEOTEXTILE

1. The unit of measurement shall be the square metre of area covered by geotextile as measured on site.

2. No additional payment shall be made for additional geotextile used in lap joints.

3. For Type A drainage mats, the additional layer of geotextile placed under rock facing shall be measured and included as an additional quantity for payment under this item.

4. The schedule rate shall cover the supply, placing and securing of the geotextile material.

5. The schedule quantity is a provisional quantity.

Pay Item C233(b) DRAINAGE MAT OUTLET PIPE

1. The unit of measurement shall be the linear metre of pipe laid.

2. The distance shall be measured along the centreline of the pipe and shall be the actual length laid including pipe leading to outlet structures.

3. The schedule rate shall cover the supply and laying of the pipe.

4. The schedule quantity is a provisional quantity.

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C241

STABILISATION

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C241
STABILISATION

CLAUSE **CONTENTS** **PAGE**

SPECIFICATION C241
STABILISATION

GENERAL

C241.01 SCOPE

1. Where specifically permitted by Council, this Specification defines the materials for stabilised materials provided by stationary plant production as well as materials and process requirements for in-situ stabilisation.

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. ***Scope***

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

4. The pavement course or subgrade zone or layer to be stabilised shall be as specified in the Specifications MRS 11.05 Unbound Pavements, or as indicated on the Drawings. ***Associated Specifications***

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***

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 TrafficC211 – Control of Erosion and Sedimentation
C213	-	Earthworks
C220	-	Stormwater Drainage - General
C242	-	Flexible Pavements

MRS11.05 – Unbound 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. Cement shall be from a source approved under the Queensland Government's State Purchasing Policy at time of production.

3. The Contractor shall nominate the brand and source of all cementitious materials. ***Nominated Brand and Source***

4. 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***

5. 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^{o}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.

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: ***Properties***

(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.

2. The properties which characterise the particular flyash to be used in the stabilising agent submitted as part of the mix design are: ***Properties***

(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

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. ***Requirements***

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.

3. When a blended stabilising agent is produced from a combined grinding of components the following properties will characterise the particular stabilising agent blend: ***Properties***

   (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 Work Place 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 500m^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 and at full cost to the Contractor. ***Uniform Mixture Contractor's Cost***

(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 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. ***Equipment***

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 and/or Council's authorised officer 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. Such additional work shall be carried out at no cost to the Principal. ***Additional Mixing Contractor's Cost***

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 ***Based on Laboratory Tests***

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.

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 MRS11.05 – Unbound 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. 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.

Straight Edge Test

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 MRS11.05 – Unbound 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 (standard 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 (standard 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***

4. Under this Specification provision for curing up to the period indicated in Annexure C241A shall be the responsibility of the Contractor at cost to the Contractor. ***Curing Period***

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^{o}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

C241.21 RESERVED

C241.22 RESERVED

C241.23 RESERVED

MEASUREMENT AND PAYMENT

C241.24 PAY ITEMS

1. Payment shall be made for the activities associated with completing the work detailed in this Specification for on-site stabilisation in accordance with Pay Items C241(a) to C241(b) inclusive. Except that where stabilisation is provided by use of stationary plant the supply of the material including the stabilisation service and stabilising agent is measured and paid in accordance with Specification MRS11.05 – Unbound Pavements or EARTHWORKS as appropriate for supply of the material as a pre-mix product. Supply in these circumstances includes all testing.

2. A lump sum price for any of these items shall not be accepted.

3. Supply, spread and compact subbase, or base material is measured and paid in accordance with the Specification MRS11.05 – Unbound Pavements.

4. Supply, spread and compact select material is measured and paid in accordance with the Specification for EARTHWORKS.

5. Control of traffic is measured and paid in accordance with the Specification for CONTROL OF TRAFFIC.

6. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

Pay Item C241(a) SUPPLY AND SPREAD STABILISING AGENT (IN-SITU MIXING ONLY)

1. The unit of measurement shall be the square metre.

2. The area shall be determined by the length and width of work as specified on the Drawings or as directed by the Superintendent.

3. No account shall be taken of allowable tolerances.

4. The schedule rate under this Pay Item shall include all the activities associated with the supply, delivery and spreading of the stabilising agent including testing in accordance with this Specification.

Pay Item C241(b) MIXING OF STABILISING AGENT

1. The unit of measurement shall be the square metre.

2. The area shall be determined by the length and width of work as specified on the Drawings or as directed by the Superintendent.

3. No account shall be taken of the allowable tolerances.

4. The schedule rate under this Pay Item shall include all the activities associated with the mixing of the stabilising agent with the designated materials in-situ and to the nominated depth in accordance with this Specification.

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

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C242

FLEXIBLE PAVEMENTS

NOTICE FOR

AUS-SPEC #1 FLEXIBLE PAVEMENT CONSTRUCTION

as released in Queensland, September 1998

At time of publication Local Government industry practice in Queensland relies on the Queensland Transport Specification MRS 11.05, Unbound Pavements.

AUS-SPEC #1 provides an alternative to this practice in providing a national approach for Local Government recommended by the authors as more generic in terms of materials specification and materials performance targets appropriate for local roads.

Councils who wish to require the Queensland Transport Specification MRS 11.05 should cite this Specification in a simple instruction provided behind the coversheet for Section C242, Flexible Pavements (effectively replacing this notice).

The 20 pages that constitute the AUS-SPEC alternative should then be deleted to avoid confusion and Council should ensure an up-to-date reference copy of the Specification and Queensland Transport Pavement Design Manual (which is cross referenced in the specification) is available at Council's offices.

Councils adopting the national AUS-SPEC approach should simply delete this notice.

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

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 1289.5.1.1	-	Determination of the dry density/moisture content relation of

a soil using standard 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) QLD DMR Test Methods

Q110C - Dry Density - Moisture Relationship of Cement Treated Material (standard compaction).

Q115 - Unconfined Compressive Strength.

Q701 - Benkelman Beam Deflection.

(d) NSW RTA Test Methods

T114 - Maximum Dry Compressive Strength of Road Materials

T171 - Modified Texas Triaxial Compression Test

(e) Other

Austroads APRG Report 21- A Guide to the Design of New Pavements for Light Traffic

RESOURCE NSW - Specification for Supply of Recycled Materials for Pavements, Earthworks and Drainage, 2003

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 ***Details of Proposed***

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. ***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 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. ***Variations by 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***

Note to Compiler: - Due regard may be taken of the opportunity to use recycled materials for pavements – (RESOURCE NSW - Specification for Supply of Recycled Materials for Pavements, Earthworks and Drainage, 2003.). Note - disclaimer in front cover of specification under "important" re liability.

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 4×10^6 ESAs but less than 10^7 ESAs.
2b	Roads with design traffic exceeding 10^6 ESAs but less than or equal to 4×10^6 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	100	100	100	100
	% passing 19.0mm sieve	95-100	95-100	93-100	93-100
	% passing 13.2mm sieve	-	-	-	-
	% passing 9.5mm sieve	-	-	71-87	71-87
	% passing 6.7mm sieve	50-70	30-55	-	-
	% passing 4.75mm sieve	-	-	47-70	47-70
	% passing 2.36mm sieve	35-55	20-30	35-56	35-56
	% passing 0.425mm sieve	-	-	14-32	14-32
	% passing 0.075mm sieve	-	-	6-20	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 %	35-55	30-50	-	-
	B. Pass 75μm sieve % / Pass 425μm sieve	35-55	30-50	-	-
	C. Pass 13.5μm sieve % / Pass 75μm sieve	35-60	-	-	-
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	-	-
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 (100% Standard 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)					
	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 (100% Standard 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.

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 100 per cent of Maximum Dry Density as determined by AS 1289.5.1.1). ***Modified TexasTriaxial Classification***

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 ***Proportion***

cent by mass. The material prior to lime treatment shall not contain any added pozzolanic material.

8. The lime treated material shall yield an unconfined compressive strength not exceeding 1.0 MPa, when tested in accordance with Test Method Q115 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 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. ***Traffic 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 Test Method Q115 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 ***Stockpile Sites***

Superintendent.

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 such as to allow incorporation into the works including trimming and compaction within the nominated field working period. ***Time Limit***

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 1289.5.1.1 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, the cost of correcting the underlying layer to comply shall be borne by the Contractor. ***Contractor's Costs***

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 1289.5.1.1.

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 plant, the pavement material shall be compacted by alternative hand-operated plant approved by the Superintendent. ***Hand Operated 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. This operation will be at cost to the Contractor. ***Unstable Areas Contractor's Cost***

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 ***Caution***

significant run off or flooding on sections of the area. Slurrying of the surface or leaching of the stabilising agent shall be avoided.

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. The cost of all testing for compaction assessment of any layer in an area of pavement shall be borne by the Contractor. ***Contractor's Costs***

4. Alternatively, when agreed by the Principal and Council, acceptance of lots may be determined according to the elastic rebound deflection. The elastic rebound deflection shall be taken as the maximum deflection in accordance with Test Method Q701 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. ***Benkelman Beam Testing***

C242.19 RELATIVE COMPACTION

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: ***Calculation***

$$\text{Relative Compaction (per cent)} = \frac{\text{In-situ dry density}}{\text{Comparative dry density}} \times 100$$

NOTE: The comparative dry density shall be the maximum dry density determined in the laboratory.

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. ***In-Situ Dry Density Testing***

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. ***Daily Samples***

4. For unbound layers, the sample shall be tested in accordance with ***Maximum Dry***

AS 1289.5.1.1 to determine the maximum dry density (standard compactive effort) for the material. ***Density***

5. For bound layers the sample shall be tested within two hours after the addition of stabilising agent to the mix in accordance with Test Method Q110C to determine the maximum dry density (standard compactive effort) for the material. This test method shall also be used to determine the standard optimum moisture content. ***Time for Testing***

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. ***Comparative Dry Density***

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 standard compactive effort is not less than 100 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 100 per cent (standard compactive effort) but equal to or greater than 98 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 95 per cent.

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. ***Rejection of Lots***

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 guttering, and for pavement layers extending under the kerb and/or guttering, 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 300 mm 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 gutter exists or is being constructed, the level of the top of the base course adjacent to the kerb and gutter shall not vary by more than ± 5mm from the lip level of the gutter 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

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. ***Rejection Criteria***

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. ***Corrective Action***

3. The cost of surface correction or replacement work ordered in accordance with this Clause including removal of material, disposal and supply and transport of replacement material, shall be borne by the Contractor. ***Contractor's Costs***

(b) Bound Materials

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. ***Rejection Criteria***

2. The cost of removal and disposal of rejected material and its replacement with fresh material shall be borne by the Contractor. ***Contractor's Costs***

3. Notwithstanding the above, the Superintendent may allow the Contractor to rectify the area in the following cases: ***Corrective Action Circumstances***

(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 3 mm 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.

The cost associated with surface level corrections required in this Clause shall be borne by the Contractor. ***Contractor's Costs***

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 ***Length to be Removed***

Superintendent.

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 cost of re-preparing areas of the deteriorated pavement shall be borne by the Contractor. ***Contractor's Cost***

4. 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. In any case only vehicles registered for legal road usage and loaded within legal limits will be allowed to use the pavement. ***Restrictions on Movement of Construction 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	≥100 per cent (standard compactive effort). For bound pavements may accept between 98% and 100% 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 Gutter	<±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

C242.28 RESERVED

C242.29 RESERVED

C242.30 RESERVED

C242.31 RESERVED

MEASUREMENT AND PAYMENT

C242.32 PAY ITEMS

1. Payment shall be made for the activities associated with completing the work detailed in this Specification in accordance with Pay Items C242(a) to C242(b) inclusive.

2. A lump sum price for any of these items shall not be accepted.

3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. Base course primerseal is measured and paid in accordance with the Specification for SPRAYED BITUMINOUS SURFACING.

Pay Item C242(a) SUPPLY, SPREAD AND COMPACT SUBBASE COURSE

1. The unit of measurement shall be the square metre.

2. The area shall be determined by the length and width of work as specified on the Drawings or as directed by the Superintendent.

3. No account shall be taken of allowable tolerances.

4. The schedule rate under this Pay Item shall include all the activities associated with the supply, spread, compaction, trimming, jointing, and testing of the subbase course, and curing of bound material.

Pay Item C242(b) SUPPLY, SPREAD AND COMPACT BASE COURSE

1. The unit of measurement shall be the square metre.

2. The area shall be determined by the length and width of work as specified on the Drawings or as directed by the Superintendent.

3. No account shall be taken of the allowable tolerances.

4. The schedule rate under this Pay Item shall include all the activities associated with the supply, spread, compaction, trimming, jointing, and testing of the base course, and curing of bound material.

QUEENSLAND

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C244

SPRAYED BITUMINOUS SURFACING

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification as special requirement clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C244 - SPRAYED BITUMINOUS SURFACING

CLAUSE CONTENTS PAGE

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 10 mm) 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.

(d) High Stress Seal or Reseal

The application of a polymer modified binder into which aggregate is incorporated to provide a durable wearing surface.

(e) Strain Alleviating Membrane

The application of polymer modified binder into which aggregate is incorporated to provide a durable wearing surface with strain alleviating or other desirable properties.

(f) Strain Alleviating Membrane Interlayer

(g) Geotextile Reinforced Seal

The application of C170 tack coat, geotextile and polymer modified binder into which aggregate is incorporated to provide a durable wearing surface with strain alleviating or other desirable properties.

NOTE: This Specification does not include bituminous emulsion 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 1141 - Methods for sampling and testing aggregates - List of methods

AS 2008 - Residual bitumen for pavements.

AS 2150 - Hot mix asphalt
AS 2341 - Methods of Testing Bitumen and Related Roadmaking Products
AS 2758.2 - Aggregate for sprayed bituminous surfacing.
AS 3568 - Oils for reducing the viscosity of bitumen for pavements.

(c) QDMR Forms and Specifications

MRS 11.11 - Sprayed Bituminous Surfacing Tables 8,10 and 11
MRS 11.18 - Polymer Modified Binder
QDMR - Sprayer Certificate

(d) QLD State Legislation

Queensland Fire and Rescue Act, 1996

(e) Other

AUSTROADS - Design of Sprayed Seals
AUSTROADS - Bitumen Sealing Safety Guide
AUSTROADS – MBT11 Handling Viscosity of Polymer Modified Binders (Thermosel)
AUSTROADS - MBT 22 Torsional Recovery of Polymer Modified Binders
AUSTROADS - MBT 23 Force Ductility
AUSTROADS - MBT 27 Brittle Point by Fast Fraass
AUSTROADS - MBT 31 Softening Point of Polymer Modified Binders

C244.03 CONTROL OF TRAFFIC

1. The Contractor shall provide for the 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. ***Contractor's Responsibility***

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 ***Speed Control***

displacement of aggregate occurs. Where necessary, the Contractor shall use patrol vehicles to ensure that traffic travels at an acceptable speed.

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. ***Minimise Traffic Delays***

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. ***Part Width Spraying***

MATERIALS

C244.04 SAMPLING AND TESTING OF MATERIALS

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. ***NATA Registration***

C244.05 BINDER MATERIALS.

(a) Binder 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. Tack coat under geotextiles must be Class 170.

2. Polymer Modified Binder must be the grade/class as specified in Annexure C244.A and must conform to MRS 11.18.

(b) Refinery Cutback Bitumen

1. Refinery cutback bitumen shall conform to AS2150. ***Cutback Bitumen***

C244.06 AGGREGATE PRECOATING AGENT AND BITUMEN ADHESION AGENT

1. Aggregate precoating agents shall be approved by the Superintendent based on previous local experience with aggregate from the same source. ***Previous Experience***

2. Bitumen adhesion agents shall be approved by the Superintendent based on previous local experience with aggregate from the same source.

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 AND GEOTEXTILE FABRIC

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 AS 2758.2 from a laboratory with appropriate NATA accreditation, before aggregate from the lot is incorporated in the Works. ***Test Requirements***

3. The geotextile must be a nonwoven needle punched fabric with a minimum melting point of 165^{o}C, minimum mass of 130 g/m^{2} and a minimum bitumen saturation of 0.9 L/m^{2}. ***Geotextile***

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 2150

(f) Bitumen for geotextile tack coat – refinery source (if applicable).

(g) Geotextile – source, type and properties.

(h) Polymer Modified Binder – type, grade, supplier and manufacturer's recommendations.

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 and the spraying and storing temperatures recommended by the manufacturer of the polymer modified binder 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 Sprayer Certificate issued by the Queensland Department of Main Roads. ***Sprayer Certificate***

2. The spray nozzles shall be of the make and type endorsed on the Sprayer 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. ***Spray Nozzles***

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 ***Faulty Equipment***

carrying out work in accordance with this Specification.

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 300 mm 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 5 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 (^{o}C)
170	160 - 190
320	170 - 200

Table C244.1 - Bitumen Temperatures

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 (^{o}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 binder material is below the applicable lower limit from Table C244.1 or Table C244.2, or the minimum temperature recommended by the manufacturer of the polymer modified binder, the binder 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 Queensland Fire and Rescue Act, 1996. 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 binder material shall not exceed the applicable upper limit from Table C244.1 and Table C244.2. or the temperature ranges recommended by the manufacturer of the polymer modified binder 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. Binder materials shall not be held at temperatures within the ranges shown in Tables C244.1 or C244.2 or the temperature ranges recommended by the manufacturer of the polymer modified binder for periods in excess of ten hours. ***Temperature Retention***

8. Any Binder material which has been overheated or stored in temperatures in Tables C244.1 or C244.2 or the temperature ranges recommended by the manufacturer of the polymer modified binder 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 or MRS 11.18 and to the Superintendent's satisfaction. Non-conforming binder material shall be disposed of legally and responsibly. ***Overheated Binder***

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 (excluding Polymer Modified Binder) 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***

5. Spraying of polymer modified binders containing scrap rubber, must be undertaken only if the pavement temperature has been at or above 20°C for at least one hour before commencement of spraying and does not fall below the specified minimum pavement temperature for spraying during the period of spraying. An additional defect liability period of 12 months must apply to spray sealing work using polymer modified binders containing other than scrap rubber when the spraying is conducted at pavement temperatures below 25°C ***PMB***

C244.17 INCORPORATION OF CUTTER OIL, FLUX OIL AND ADHESION AGENT

1. The Contractor shall determine and record the proportion of cutter oil added to each sprayer load, using MRS 11.11 and based on the measured pavement temperatures. ***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***

4. 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***

5. Where binder 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***

6. Polymer Modified Binder must be cut back with a compatible cutter oil in accordance with the manufacturer's recommendations. ***PMB Cutter Oil***

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 the binder. ***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 surface. ***Curing Time for Primer***

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 binder or grade of cutback bitumen shall be as specified in Annexure C244A. ***Type of Binder***

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 MRS 11.11. ***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 120 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 ***Terminating Paper Strip***

paper at the commencement and/or termination of each run shall not be less than that endorsed on the Sprayer Certificate.

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 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. ***Hand Spraying***

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***

10. Areas sprayed with polymer modified binder containing scrap rubber which are not within 10 percent of the target application rate must constitute a 'Nonconformance' under the Contract. For areas sprayed with other polymer modified binders, a tolerance of 5 percent must apply***.*** ***PMB Nonconformance Rate***

11. Geotextile must be applied where nominated on Annexure C244.A or as directed. The fabric must be fixed to the pavement smoothly and without wrinkles, using a tack coat of up to 0.6 L/m^2 (cold) of Class 170 bitumen. ***Geotextile Seal***

12. Joins in geotextile fabric must have 200 mm minimum overlaps. Joining fabric in the longitudinal direction under wheel paths must be minimised. The difference in binder content between the rate used in the tack coat and the bitumen saturation of the fabric, must be added to the seal design application rate for inclusion in the target application rate. Where applicable, an additional binder allowance must be made for the existing surface texture ***Geotextile Seal Joins***

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 binder 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 ***Deficient or Excess Aggregate***

efficiently removed by hand brooming.

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 remaining loose particles of aggregate shall be removed from the pavement and disposed of responsibly by the Contractor. ***Removal of Loose Particles***

C244.20 WORK RECORDS

1. Particulars of the work performed shall be recorded by the Contractor on a Council proforma or Contractor's spray record sheet. 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 ***Conditions***

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.

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 obtained. ***Replace or Correct***

3. 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***

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 Clause C244.30. All nonconformances not listed within the deductions clause shall be rectified to comply with this Specification as a cost to the Contractor. ***Superintendent'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 and ±10 per cent for polymer modified binder containing scrap rubber shall be deemed as conforming being within Tolerance Threshold, T1.

- Variations greater than Tolerance Threshold T1 and less than the Tolerance Threshold, T2 indicated in Annexure C244.B shall result in payment with deductions applied in accordance with Clause C244.30. Application rates outside Tolerance Threshold T2 shall be rejected.

SPECIAL REQUIREMENTS

C244.24 RESERVED

C244.25 RESERVED

C244.26 RESERVED

C244.27 RESERVED

C244.28 RESERVED

LIMITS AND TOLERANCES

C244.29 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 working 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**		
		Bitumen temperature when incorporated with cutter oil, bitumen shall be in temperature ranges as per Table C244.1.	C244.15
		Refinery Cutback Bitumen temperature at the time of spraying shall be in temperature range as per Table C244.2.	C244.15
		Binder materials shall not be held at temperatures within the ranges of Tables C244.1 or C244.2 for the temperature ranges recommended by the manufacturer of the polymer modified binder for periods in excess of 10 hours.	C244.15
5.	**Spraying Temperature**		
		Bituminous surfacing (excluding Polymer Modified Binder) shall not be undertaken if the pavement temperature has not been at or above 10^{o}C for at least one hour before commencement of spraying or if the pavement temperature falls below 10^{o}C during the period of spraying.	C244.16
		Bituminous surfacing using Polymer Modified Binder which does not contain scrap rubber shall not be undertaken if the pavement temperature has not been at or above 25^{o}C for at least one hour before commencement of	C244.16

Item	Activity	Limits/Tolerances	Spec Clause
		spraying or if the pavement temperature falls below 25°C during the period of spraying.	
		Bituminous surfacing using Polymer Modified Binder containing scrap rubber shall not be undertaken if the pavement temperature has not been at or above 20°C for at least one hour before commencement of spraying or if the pavement temperature falls below 20°C during the period of spraying	C244.16
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**		
		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
		Application rates and quantities shall apply to a temperature of 15°C and have T1 tolerances as set out in Clause C244.23 and T2 tolerances as set out in Annexure C244.B.	C244.18
		At least a 48 hour period shall elapse after spraying of primer before binder for a seal is applied.	C244.18
		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	C244.19

Item	Activity	Limits/Tolerances	Spec Clause
		minimum of one hour per 1000 square metres sprayed.	
		(ii) For traffic volume >500 vehicles per lane per day, backrolling for minimum of one hour per 1500 square metres sprayed.	C244.19
11.	**Nonconformance**		
		Bitumen with viscosity at 60^{o}C within the specified limits, but with other properties outside the limits specified in AS 2008, shall incur deductions.	C244.30
		For Class 170 bitumen or Class 320 bitumen having a viscosity at 60^{o}C outside the limits specified in AS 2008, deductions shall apply.	C244.30
		Cutback bitumen with viscosity at 60^{o}C within the specified range according to Table 1 of AS 2157, but having any property outside the range specified by AS210, shall incur deductions.	C244.30
		For cutback bitumen having a viscosity at 60^{o}C outside the range specified in Table 1 of AS 210, deductions shall apply.	C244.30
		Polymer Modified Binder having viscosity at 60^{o}C within the specified limits but having any property outside the range specified by MRS11.18, a deduction for the supply and spraying of polymer modified binder must apply.	C244.30
		Polymer Modified Binder having Torsional Recovery outside the range specified by MRS11.18, a deduction for the supply and spraying of polymer modified binder must apply	C244.30

Table C244.3 - Summary of Limits and Tolerances

MEASUREMENT AND PAYMENT

C244.30 DEDUCTIONS

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.

Superintendent's Authority

2. In the case of bitumen having a viscosity at 60°C within the specified limits, but having any other property outside the limits specified in AS 2008, a deduction of 2 per cent of the schedule rate for the relevant pay items

Deductions other than Viscosity

3. In the case of Class 170 bitumen or Class 320 bitumen having a viscosity at 60°C outside the limits specified in AS 2008, the deductions shown in Table C244.4 shall apply to the relevant pay items).

Viscosity Variation Deductions

Class 170	Class 320	Deduction (Per cent of Scheduled Rate)
Under 120	Under 220	50
120 - 124	220 - 229	25
125 - 129	230 - 239	10
130 - 134	240 - 249	5
135 - 139	250 - 259	2
140 - 200	260 - 380	Nil
201 - 210	381 - 400	2
211 - 220	401 - 420	5
221 - 230	421 - 440	10
231 - 240	441 - 460	25
Over 240	Over 460	50
Viscosity shall be calculated to the nearest whole number.		

Table C244.4 - Deduction for Actual Viscosity at 60°C (Pa.s)

4. In the case of a cutback bitumen having a dynamic viscosity at 60°C within the specified range according to AS 2150 but having any property (other than viscosity at 60°C) outside the range specified by AS 2150, 2 2 percent of the schedule rate for Pay Items C244(a), C244(b) and/or C244(c) shall apply.

Deductions other than Viscosity

5. AS 2150, the deductions shown below shall apply to Pay Items C244(a), C244(b) and/or C244(c): ***Viscosity Variation Deductions***

Viscosity in range of next adjoining grade	-	deduction 10% of scheduled rate
Viscosity in range of next but one adjoining	-	deduction 25% of scheduled rate
Viscosity beyond next but one adjoining grade	-	deduction 50% of scheduled rate

The dynamic viscosity as determined by any method allowed by AS 210 shall be rounded to two significant figures in the direction favouring the Contractor. The range allowed in Table 1 includes an allowance for the repeatability of the test. No attempt shall be made to include another allowance for repeatability. ***Viscosity Determination***

6. In the case of polymer modified binder having a viscosity at 60^{o}C within the specified limits but having any property outside the range specified by MRS11.18, a deduction of 5 percent of the schedule rate for the supply and spraying of polymer modified binder must apply.

In the case of polymer modified binder having a Torsional Recovery outside the range specified by MRS11.18, a deduction in the schedule rate for the supply and spraying of polymer modified binder must apply as follows:

For Torsional Recovery:	lower than specified by up to 3% points	2%	deduction
	4 to 6% points lower than specified	10%	deduction
	over 6% points lower than specified	20% deduction	

Where the Torsional Recovery is nonconforming, the appropriate higher deduction must apply. If any other property is nonconforming, the Superintendent may accept the work subject to a deduction of 5% of the schedule rate for the supply and spraying of polymer modified binder.

The above deductions are all cumulative If the total of the calculated deductions exceeds 25 percent, the work must be removed and replaced.

7. In the case of nonconforming application rates for prime, primerbinder or binder, the deductions for variations outside the T1 Tolerance Threshold but within the T2 Tolerance Thresholds indicated in Annexure C244.B shall be applied to Pay Item C244(a), (b), (c), and/or (g) as appropriate at 20 per cent of schedule rate.

C244.31 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification in accordance with Pay Items C244(a) to C244(f) inclusive.

2. A lump sum price for any of these items will not be accepted.

3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. The quantities shown in the Schedule of Rates are based on estimated quantities and are not to be taken as actual or correct quantities of work to be carried out.

5. Deductions to Scheduled Rates shall be applied in accordance with Clause

C244.30.

6. Control of traffic is measured and paid in accordance with the Specification for CONTROL OF TRAFFIC.

Pay Item C244(a) Supply and Spray Primer, Primerbinder (Including Preparation of Surface)

1. The unit of measurement shall be the litre measured at 15°C.

2. The quantities (in litres) shall be determined by multiplying the target application rate of the above materials (less field incorporated cutter and flux) at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres).

3. Payment shall be made on the target application rate exclusive of tolerances.

4. A separate scheduled rate is to be given for each type of primer and primerbinder, as nominated in the project specific Annexure C244.A:

C244(a).1	AMCOO
C244(a).2	AMCO
C244(a).3	AMC1
C244(a).4	AMC2
C244(a).5	AMC3
C244(a).6	AMC4
C244(a).7	AMC5
C244(a).8	AMC6
C244(a).9	AMC7
C244(a).10	Field Cutback Bitumen (Nett Bitumen)

Pay Item C244(b) Supply and Spray Binder - Class 170 Bitumen (Including Adhesion Agent where required and Preparation of Surface)

1. The unit of measurement shall be the litre of Class 170 bitumen at 15°C.

2. The quantities (in litres) shall be determined by multiplying the target application rate of Class 170 bitumen at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres).

Pay Item C244(c) Supply and Spray Binder - Class 320 Bitumen (Including Adhesion Agent where required and Preparation of Surface)

1. The unit of measurement shall be the litre of Class 320 bitumen at 15°C.

2. The quantities (in litres) shall be determined by multiplying the target application rate of Class 320 bitumen at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres).

Pay Item C244(d) Supply, Incorporate and Spray Cutter Oil in Primer, Primerbinder Or Binder

1. The unit of measurement shall be litres of cutter oil at 15°C.

2. The quantity (in cold litres) shall be determined from the actual percentage of cutter oil to be added in the field to produce the primer, primerbinder or binder for each sprayer run and applied to the road.

Pay Item C244(e) Supply, Incorporate and Spray Flux Oil

1. The unit of measurement shall be litres of flux oil at 15°C.

2. The quantity (in cold litres) shall be determined from the nominated percentage of flux oil to be added in the field to the primer, primerbinder or binder and applied to the surface.

Pay Item C244(f) Supply, Precoat, Apply and Incorporate Aggregate

C244(f).1	5mm Aggregate
C244(f).2	7mm Aggregate (precoated)
C244(f).3	10mm Aggregate (precoated)
C244(f).4	14mm Aggregate (precoated)
C244(f).5	20mm Aggregate (precoated)

1. The unit of measurement shall be the cubic metre.

2. The quantity (in cubic metres) shall be determined by dividing the target application rate (in square metres per cubic metre [m^2/m^3]) by the area of road surface covered for each sprayer run (in square metres).

3. A separate unit rate shall be given for each nominal size of aggregate precoated as specified.

Pay Item C244(g) Supply and Spray Polymer Modified Binder (Including Adhesion Agent where required and Preparation of Surface)

1. The unit of measurement shall be the litre of polymer modified binder at 15°C.

2. The quantities (in litres) shall be determined by multiplying the target application rate of polymer modified binder at 15°C (in litres per square metre) by the area of road surface sprayed for each sprayer run (in square metres).

3. A separate scheduled rate is to be given for each grade of polymer modified binder, as nominated in the project specific Annexure C244.A.

Pay Item C244(h) Supply and Incorporate Geotextile

1. The unit of measurement shall be the square metre. Measurement must exclude laps. Payment must exclude supply and incorporation of aggregate.

ANNEXURE C244.A - DETAILS OF WORK

Section		Prime	Primer Seal		Seal or Reseal	
Road Name		Binder Type	Binder Type	Aggregate Nom. Size	Binder Type	Aggregate Nom. Size
From	To					

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% 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	

QUEENSLAND

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C245

ASPHALTIC CONCRETE

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C245
ASPHALTIC CONCRETE

ANNEXURES

SPECIFICATION C245: ASPHALTIC CONCRETE

GENERAL

C245.01 SCOPE

1. The work to be executed under this Specification consists of the design, production and placing of asphalt including the supply of materials, sampling, testing and any other operations necessary to provide asphalt in accordance with the provisions of the Contract. Asphalt produced to the requirements of this Specification is not routinely considered appropriate for heavy duty traffic application which is considered to comprise more than 300 commercial vehicles per lane per day. The extent of the Contractor's work shall include: ***Extent of Work***

   (a) Sampling and testing of materials and the design of asphalt mixes required by the Contract.

   (b) Manufacture of the production mix.

   (c) Provision of a testing laboratory.

   (d) Preparation of the surface on which asphalt is to be placed.

   (e) Transport of asphalt.

   (f) Laying and compaction of asphalt.

   (g) Sampling and testing.

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***

C245.02 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

201 - Control of Traffic

(b) Australian Standards

AS 1141.11 - Particle size distribution by dry sieving.
AS 1141.14 - Particle shape, by proportional calliper.
AS 1141.18 - Crushed particles in coarse aggregate derived from gravel.
AS 1141.22 - Wet/dry strength variation.
AS 1141.42 - Pendulum friction test (PAFV)
AS 1160 - Bitumen emulsions for the construction and maintenance of pavements.
AS 2008 - Residual bitumen for pavements.
AS 2150 - Hot mix asphalt.
AS 2357 - Mineral fillers for asphalt.
AS 2734 - Asphalt (hot-mixed) paving - Guide to good practice.

AS 2758.5	-	Asphalt aggregates.
AS 2891.1	-	Sampling of Asphalt.
AS 2891.3.1	-	Bitumen content and aggregate grading - Reflux method.
AS 2891.5	-	Determination of stability and flow - Marshall procedure.
AS 2891.6	-	Determination of stability by the modified Hubbard-Field procedure.
AS 2891.8	-	Voids and density relationships for compacted asphalt mixes.
AS 2891.9.3	-	Determination of bulk density of compacted asphalt - Mensuration method.
AS 2891.10	-	Water and volatile oils content.

(c) NSW RTA Test Methods

T640	-	Resistance to Stripping Test

(d) AUSTROADS

Test Methods

MBT 11	-	Handling Viscosity of Polymer Modified Binders (Thermosel).
MBT 21	-	Elastic Recovery, Consistency and Stiffness of Polymer Modified Binders (ARRB TR Elastometer).
MBT 22	-	Torsional Recovery of Polymer Modified Binders.
MBT 31	-	Softening Point Test for Polymer Modified Binders

Other

AP-T04	-	Austroads Specification Framework for Polymer Modified Binders (June 2000)

C245.03 PLANT

1. The Contractor shall provide all the plant, equipment and labour necessary for carrying out the work in accordance with this Specification. ***Contractor's Responsibility***

2. All plant and equipment used on the work shall be in accordance with the Contractor's submitted quality documentation and kept in good operating condition. The Contractor shall not use in the work any plant or equipment demonstrated to be faulty in operation so as to effect the product quality or unsafe in operation as assessed by the Superintendent. ***Plant to be Suitable***

3. All plant shall be registered and insured as appropriate to its use on a public road and shall comply with statutory environmental regulations.

C245.04 PROTECTION OF SERVICES AND ROAD FIXTURES

1. The Contractor shall take all necessary precautions to prevent asphalt 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. Immediately after the asphalt has been spread the Contractor shall clean off or remove any such material as directed by the Superintendent and leave the services and road fixtures in a condition satisfactory to the Superintendent. ***Contractor's Responsibility***

C245.05 CONTROL OF TRAFFIC

1. The Contractor shall provide for traffic in accordance with the requirements of the ***Provision for***

Specification for CONTROL OF TRAFFIC while undertaking the work. ***Traffic***

2. Any costs incurred as a result of the supply of labour and materials complying with the Specification for CONTROL OF TRAFFIC shall be borne by the Contractor. ***Contractor's Cost***

3. The Contractor shall take all necessary steps to avoid or minimise delays and inconvenience to road users during the course of the work but without compromise to the safety of the road users or employees. ***Delays***

C245.06 WORK RECORDS

1. Particulars of the work performed shall be recorded by the Contractor on the Asphalt Work Record attached as Annexure C245A or as per the Contractor's own procedures where equivalent. The Contractor shall complete the Asphalt Work Record, which shall be countersigned by the Superintendent each day as a true record of the work performed. A copy shall be supplied to the Superintendent. ***Asphalt Work Record***

2. Delivery dockets stating the mass of each truck load of asphalt shall be attached to the Asphalt Work Record. ***Delivery Dockets***

MATERIALS

C245.07 GENERAL

1. Unless otherwise directed by this Specification, materials or mix ingredients shall be sampled in accordance with AS 2891.1. ***Sampling***

2. The types of asphalt and binder required in the contract are as stated in Annexure C245C.

C245.08 AGGREGATES

1. Aggregates shall be of uniform quality and grading. Aggregates complying with the requirements of this Clause when combined with the mineral filler shall be capable of achieving the asphalt properties required by this Specification. ***Uniformity***

(a) Coarse Aggregate

1. Coarse aggregate shall comply with AS 2758.5 and comprise all mineral matter retained on a AS 4.75 mm sieve. Coarse aggregate shall consist of clean, dry, hard, tough and sound crushed rock, metallurgical slag or gravel, be of uniform quality and be free from dust, clay, dirt or other matter deleterious to asphalt. ***Quality***

2. The grading of the coarse aggregate used in the work shall be determined in accordance with AS 1141.11. ***Grading***

3. If the Contractor proposes to blend two or more coarse aggregates from different sources to provide the Nominated Mix then Test Reports for each constituent material shall be submitted separately. The coarse aggregate from each source shall comply with the following requirements: ***Test Requirements***

(a) Wet Strength - AS 1141.22.

Shall be not less than 100 kN for any fraction except the wet strength required for any fraction of open graded asphalt shall not be less than 150 kN.

(b) Wet/Dry Strength Variation - AS 1141.22

Shall not exceed 35 per cent for any fraction or constituent.

(c) Particle Shape - AS 1141.14

The proportion of misshapen particles in the source retained on the 9.50mm AS sieve shall not exceed 35 per cent using a calliper ratio of 2:1 and shall not exceed 10 per cent using a calliper ratio of 3:1.

(d) Fractured (Crushed) Faces of Coarse Aggregate - AS 1141.18

Aggregate which is from a gravel or river deposit and which is retained on a 6.70 mm AS sieve shall consist of at least 75 per cent by mass of particles with at least two fractured faces and when used in the wearing course shall have at least 90 per cent by mass of particles with at least one fractured face. The area of each fractured face shall be a significant proportion of the total surface area of the particle.

4. When tested in accordance with AS 1141.42 aggregate shall be rejected if the Polishing Aggregate Friction Value (PAFV) for the aggregate is less than 44. ***Polishing Value***

(b) Fine Aggregate

1. Fine aggregate comprises all mineral matter (other than filler) passing the 4.75 mm AS sieve. It shall consist of clean, hard, tough and sound grains, free of coatings or loose particles of clay, silt or other matter deleterious to asphalt. The fine aggregate shall consist of natural sand or a mixture of natural sand and material derived from the crushing of sound stone or gravel conforming to the requirement in this clause. ***Soundness***

2 If the Contractor proposes to blend two or more fine aggregates from different sources to provide the Nominated Mix then Test Reports for each constituent material shall be submitted separately. ***Test Requirements***

C245.09 MINERAL FILLER

1. Mineral filler may consist of hydrated lime, fly ash, portland cement, flue dust from the manufacture of portland cement or plant baghouse dust. The nature and proportion of filler shall conform to the requirement of the Nominated Mix design. ***Constituents***

2. The mineral filler shall comply in all other respects with the requirements of AS 2357. ***Quality***

C245.10 BINDER

1. The binder supplied and used in the works shall be bitumen complying with AS 2008 except where other binders are required in accordance with the requirements of Clause C245.10(b) or C245.10(c). ***Bitumen Quality***

(a) Bitumen

1. The bitumen/binder used in the works shall be as specified in Annexure C245C. ***Binder Class***

(b) Other Binders

1. Where included in the mix design these binders shall be incorporated in the works in accordance with the requirements of this Specification. ***Approval***

2. Where other binders are produced by the inclusion of an additive at the time of manufacture of the asphalt, the mixing time shall be adjusted to assure full ***Mixing Time***

digestion of the additive and uniform coating of all aggregate particles.

(c) Modified Bitumens

1. Polymer modified bitumens (PMBs) shall be nominated by the pavement designer in accordance with AUSTROADS Specification AP-T04 to indicate type and grade and entered into Annexure C245C on a site specific basis. Typical PMBs and key performance parameters are indicated in Table C245.1. The use of PMBs in a nominated asphalt mix is considered as an extension of the nomination of a compliant mix as set out in Clause C245.14 of this Specification. ***Polymer Modified Binder***

2. The binder shall be pumped and stored at the manufacturer's recommended temperatures. ***Storage Temperature***

3. For polymer modified bitumens all blending of materials (with the exception of bitumen adhesion agent) shall be carried out in the manufacturer's premises before dispatch. Materials shall not be blended in a road tanker or sprayer. The polymer modifiers shall be compatible in mixing with bitumen complying with AS 2008. ***Blending***

4. Polymer modifier shall be incorporated within bitumen in such a way so as to comply with manufacturer's guidelines regarding concentration, mixing temperatures or other restrictions relating to work place safety. ***Contractor's Responsibility***

Test	A30P	A15E	Test Method
Consistency on ER at 60^{o}C (Pa.s)	1500 min	8000 min	MBT 21
Torsional Recovery at 25^{o}C (%)	12 min	58 min	MBT 22
Viscosity at 165 ^{o}C (Pa.s)	0.75 max	0.9 max	MBT 11
Softening Point ^{o}C	60 min	82 min	MBT 31

NOTE: For the purpose of assessing compliance with this Table samples shall be heated to 135°C without high shear mixing and immediately cast into test moulds, unless otherwise specifically required by the test method.

Table C245.1 - Typical Specified Properties for Polymer Modified Bitumens for Roads with less than 300 commercial vehicles per lane per day

5. Hubbard-Field and Marshall stability requirements shown in Table C245.2 shall not apply when a polymer modified bitumen binder is nominated in the mix design.

C245.11 BITUMEN ADHESION AGENT

1. A bitumen adhesion agent, if required, shall be added to the binder. Details of the proposed bitumen adhesion agent shall be submitted for the Superintendent's approval. The bitumen adhesion agent shall be used in a manner compatible with the manufacturer's recommendations. The bitumen adhesion agent shall be added at a concentration within the range 0.5 per cent to 1.0 per cent by mass of the binder. ***Approval***

C245.12 BITUMEN EMULSION

1. The bitumen emulsion shall be cationic rapid setting CRS170 bitumen emulsion complying with the requirements of AS 1160. ***Type***

2. Plant and/or containers used for the transport or storage of anionic emulsion or emulsified bitumen shall not be used for the subsequent transport or storage of a cationic emulsion. ***Containers***

C245.13 RECLAIMED ASPHALT PAVEMENT (RAP)

1. Dense graded asphalt that does not include modified bitumen may include a proportion of RAP up to but not exceeding 20 per cent by mass. The resultant asphalt shall meet all requirements for the Nominated Mix. ***RAP Percentage***

2. The RAP to be utilised shall be nominated by source and/or stockpile. Testing of the Nominated Mix shall include RAP sampled from the stockpile and of similar physical properties as that to be utilised for the contract. Any change in RAP supply shall be brought to the attention of the Superintendent 5 days prior to proposed usage in asphalt under this contract. ***RAP Source***

ASPHALT MIX DESIGN

C245. 14 NOMINATED MIX

1. The Contractor shall design each asphalt mix, henceforth called the `Nominated Mix', within the limits shown in Table C245.2 and Table C245.3. ***Design***

2. The Contractor shall provide a Certificate from a laboratory with appropriate NATA registration stating that each Nominated Mix and its constituents meet the requirements of this Specification. All relevant test results shall accompany the Certificate. All phases of any particular test must be performed at one laboratory. The Certificate shall confirm that the required testing has been carried out in the twelve month period before the date of submission to the Superintendent. ***NATA Laboratory Tests***

3. Details of the Nominated Mix shall be submitted to the Superintendent at least twenty one days before the placing of asphalt. The Nominated Mix information shall include combined aggregate grading and binder content, proportions of constituent materials used (including adhesion agent), gradings of aggregate and filler, and type and sources of aggregates, rap, filler, and binder. Submission of such details constitutes a **HOLD POINT**. Superintendent's approval is required prior to release of the hold point. ***HP***

4. The Contractor shall nominate the mix design test regime for Stability/Flow and Voids as either Marshall or Modified Hubbard-Field testing. Thereafter the appropriate test parameters set out in Table C245.2 will be assigned as requirements. ***Test Method***

5. If any revision is necessary, then the costs associated with revision of the Nominated Mix and testing of the revised Nominated Mix in accordance with this clause shall be borne by the Contractor. ***Revised Mix Contractor's Cost***

Property	Requirements						
	Moderately High Traffic Roads (Collector, Arterial & Industrial)				Local Residential Roads**		
Aggregate passing AS Sieve (% by mass)	Nominal Size of Asphalt						
	5mm (AC5)	10mm (AC10)	14mm (AC14)	20mm (AC20)	Type A	Type B	Type R
53.0mm							
37.5mm							
26.5mm				100			
19.0mm			100	90-100			
13.2mm		100	85-100	70-90	100	100	
9.50mm		90-100			95-100	90-100	
6.70mm	100	70-90	55-75	40-70	80-95	65-85	100
4.75mm	80-100				65-80	60-80	85-100
2.36mm	45-70	40-60	35--52	25-50	45-60	55-75	55-80
1.18mm					35-50	45-65	38-60
0.600mm	20-43	20-38	15-30	10-27	25-40	30-50	25-43
0.300mm					15-25	20-30	15-30
0.150mm					7-15	10-18	8-20
0.075mm	4.5-11	4.5-10	3-7	3-7	3-10	5-11	5-12
Binder content (% by mass of total asphalt mix)*	5.6-6.8	5.1-6.4	4.8-6.2	4.6-6.1	6.0-7.0	5.8-6.8	6.5-7.5
Ratio filler/binder content	0.6-1.2[o]	0.6-1.2[o]	0.6-1.2[o]	0.6-1.2[o]	0.6-1.2[o]	0.6-1.2[o]	0.6-1.2[o]
Stability of the compacted asphalt mix (kN)							
As per Modified Hubbard Field Procedure (AS 2891.6)	18-34	18-34	18-34	18-34	NA	NA	NA
Min as per Marshall Method (at 35 blows) (AS 2891.5)	5.5	5.5	6.5	6.5	4.0	4.0	3.5
Voids in compacted asphalt mix (% of voids in volume of mix) (AS 2891.8)							
As per modified Hubbard Field Procedures	4-7	4-7	4-7	4-7	3-6	3-6	3-6
As per Marshall Method	4-6 (50 blows)	4-6 (50 blows)	4-6 (50 blows)	4-6 (50 blows)	3-5 (35 blows)	3-5 (35 blows)	3-5 (35 blows)
Voids filled by binder (% voids in the total mineral aggregate to be filled by binder) Test Method AS 2891.8	65-80	65-80	65-80	65-80	60-85	60-85	60-85
Flow (mm) of compacted mix # (35 blow Marshall)	1.5-4.0	1.5-4.0	1.5-4.0	1.5-4.0	2-5	2-5	2-5

NOTE:
* Some increase beyond these ranges of binder content may be permitted for aggregates having unusually high absorption characteristics. Superintendent's apprroval is required for such adjustments.
\# This requirement only where Marshall Method of Testing is used.
** Type A and B are suitable for residential streets, car parks and commercial driveways carrying light traffic. Type R is suitable for footpaths, cycleways and recreation areas.
[o] Higher filler/binder ratios may be approved by the Superintendent when evidence of local usage and satisfactory performance is submitted with the mix design.

Table C245.2 - Limits for Design of Nominated Mix - Dense Graded Asphalt (AC)

Property	Limits for nominal size asphalt	
	10mm (OG10)	**14mm (OG14)**
Test Method AS 2891.3.3: Combined Particle size distribution passing AS Sieve (% by mass)		
53.0mm		
37.5mm		
26.5mm		
19.0mm		100
13.2mm	100	85-100
9.50mm	85-100	65-95
6.70mm	50-80	35-75
4.75mm	25-55	15-45
2.36mm	10-35	3-25
1.18mm	0-19	0-20
0.600mm	#	#
0.300	#	#
0.150mm	#	#
0.075	#	#
Test Method AS 2891.3.1: Binder Content (% by mass of total asphalt mix)	3.8-5.7	3.4-5.2
Test Methods AS 2891.5, AS 2891.6, AS 2891.9.3: Voids in laboratory compacted asphalt mix (% voids of the volume of the asphalt mix)	18-23	18-23

NOTE: Some increase beyond these ranges of bitumen content may be permitted for aggregates having unusually high absorption characteristics. Superintendent's approval is required for such adjustments.

\# For each sieve given on the left hand side of the table, even when no particle size distribution shall be given in the submission of the Nominated Mix and in the reporting of trial and production mixes.

Table C245.3
Quality Requirements for Open Graded Asphalt

C245.15 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 an asphalt mix has been approved by the Superintendent upon inspection of all relevant NATA documentation as required by this Specification. ***HP***

2. The Contractor shall not make any changes to the Approved Mix, or constituent materials without the prior written approval of the Superintendent. If any such change is proposed, then the Contractor shall provide details of the Nominated Mix and materials, in accordance with Clause C245.14. ***Changes to Approved Mix***

3. Notwithstanding any approval given by the Superintendent to a proposed asphalt mix, the Contractor shall be responsible for producing asphalt which satisfies all requirements of this Specification. ***Contractor's Responsibility***

C245.16 REQUIREMENTS OF PRODUCTION MIX

1. Asphalt produced in the plant and delivered to the site shall be known as the 'production mix'. ***Production Mix***

2. Asphalt, as produced during the course of the contract, shall comply with the requirements shown in Table C245.4 and Table C245.5 unless otherwise approved by the Superintendent.

3. Asphalt produced in the plant shall comply with "voids" requirements set out in Table C245.2.

Production Mix Properties	Allowable Variations from Approved Mix *	
Nominated Mix Type (see Table C245.2)	AC5, AC10, AC14, AC20, AC28, AC40	A, B, R
Grading - AS 2891.3.3		
Passing 4.75mm AS sieve and larger	±7%	±7%
Passing 2.36mm and 1.18mm	±5%	±5%
Passing 0.600mm and 0.300mm	±4%	±4%
Passing 0.150mm	±2.5%	±2.5%
Passing 0.075mm	±1.5%	±1.5%
Binder Content - AS 2891.3.1	±0.3%	±0.3%

* Notwithstanding, these allowable variations shall not fall outside the limits for design of nominal mix as shown in Table C245.2

Table C245.4
Dense Graded Asphalt - Variation of Production Mix

Production Mix Properties	Allowable Variations from Approved Mix *	
Nominated Mix Type (See Table C245.3)	**OG10 & OG14**	**OG28 & OG40**
Grading - AS 2891.3.3		
Passing 13.2mm AS sieve and larger	± 7%	± 10%
Passing 4.75mm and larger to 13.2mm	± 7%	± 7%
Passing 1.18mm and 2.36mm	± 5%	± 5%
Passing 0.075mm	± 1.5%	± 1.5%
Binder Content - AS 2891.3.1	± 0.5%	±0.5%

* Notwithstanding, these allowable variations shall not fall outside the limits for design of nominal mix as shown in Table C245. 2

Table C245.5
Open Graded Asphalt - Variation of Production Mix

PRODUCTION

C245.17 MIXING PROCEDURE

(a) Plant

1. Mixing shall be undertaken in an approved batch pugmill, continuous pugmill or drum mixing plant, as specified in the Contractor's Quality Documentation and nominated at tender and capable of uniformly mixing coarse and fine aggregate, filler, and binder to meet the requirements specified in this Specification and AS 2150.

Characteristics

(b) Inspection of Mixing Plant

1. The Superintendent, upon provision of notice to the asphalt supplier or the supplier's representative, shall have access to the mixing plant for purposes of inspection to verify production procedures and the supplier's compliance with the Contractor's Quality Management Manual and Project Quality Plan. The Superintendent shall have the right to declare any nonconformance and shall be entitled to request correction of either the Contractor's Quality Management Manual or the Project Quality Plan or both. ***Access***

(c) Temperature

1. Plant temperatures shall be maintained in a range sufficient to ensure a homogeneous asphalt without causing deleterious effects to the binder through overheating. Temperatures shall be in the ranges shown in Table C245.6. For asphalt made with other binders complying with Clause C245.10, the temperatures shall be in accordance with manufacturer's recommendation. ***Temperatures***

2. In special cases, the Superintendent may permit a lower temperature for manufacture, but in no circumstances shall the temperature of the asphalt at the time of laying be less than the minimum value specified in Clause C245.24(c) for the appropriate road surface temperature and layer thickness. ***Limits***

3. The asphalt temperature shall be measured as soon as practical after the asphalt leaves the pugmill, drum and/or the hot storage bin(s). ***Measurement***

4. The asphalt produced in a drum mixing plant shall have a moisture content not greater than 0.5 per cent by mass when tested in accordance with AS 2891.10. ***Moisture Content***

TYPE OF ASPHALT	**DENSE GRADED ASPHALT**			**OPEN GRADED ASPHALT**	
Type of Binder	**Class 170**	**Class 320**	**Polymer Modified**	**Class 170**	**Class 320**
Min. Binder Temp. (^{o}C)	140	140	180	115	115
Max. Binder Temp. (^{o}C)	165	170	190	165	170
Min. Asphalt Temp. (^{o}C)	140	140	150	125	125
Max. Asphalt Temp. (^{o}C)	165	170	165	140	140

Table C245.6
Temperatures for Manufacture of the Asphalt

* Minimum values may need to be adjusted to conform to minimum laying temperature as stated within Table C245.8

(d) Mixing Time

1. Mixing time shall be such that all particles of aggregate are uniformly coated with binder. ***Uniform Coating***

(e) Storage of Asphalt

1. Asphalt may be stored in an insulated storage bin prior to delivery. Asphalt which has been stored for more than twenty four hours or is below the minimum temperature specified in Table C245.6 shall not be used. Binder manufacturer's instructions must be followed when polymer modified asphalt is stored. ***Limitations***

(f) Contractor's Laboratory

1. The Contractor shall maintain and operate an appropriately registered NATA testing laboratory at or near the mixing plant to control the quality of the asphalt produced. ***Quality Control***

2. The Contractor will make the laboratory available for inspection by the Superintendent at any time during the course of the Works. ***Inspection***

3. All documented test results shall be submitted to the Superintendent for inspection and approval in a format and to a timetable suitable to the Superintendent. ***Submission of Test Results***

4. The cost of testing required by this Specification shall be borne by the Contractor. ***Contractor's Cost***

C245.18 SAMPLING AND TESTING OF PRODUCTION MIX

(a) Responsibility for Sampling

1. The Contractor shall be responsible for taking samples and shall supply all facilities, equipment and labour for that purpose. The samples shall be taken by the Contractor. The costs associated with taking samples of production mix shall be borne by the Contractor. ***Contractor's Responsibility and Costs***

(b) Frequency of Sampling

1. For the purpose of testing production mix the Contractor shall sample production lots at the minimum frequencies set out in Table C245.7. This testing frequency requirement shall apply to each asphalt mix type and individual mix design. The test results shall be related to production intervals with samples representing the full lot of production of the relevant mix for the production interval. This interval shall extend from the midpoint of production in terms of tonnage between samples to the subsequent midpoint. The production lot represented by the samplings shall consist of material manufactured under essentially uniform conditions being essentially homogeneous with respect to manufacturing equipment and raw materials.

2. Test results from this production control sampling are acceptable as representative of deliveries made under this contract subject to the traceability of production from specific production intervals to the location at the paving site. Such traceability shall include registration of lot number and time of production on the delivery docket system. The size of any production lot shall be limited to production from a 12 hour "shift".

3. Where the Principal has special requirements for sampling and testing of particular mixes the required frequency of testing and the taking of referee samples shall be set out in Annexure C245C. Referee samples are to be taken, secured and labelled for identification in sealed containers by the asphalt supplier and made available under Principal's instruction for confirmation testing if required.

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

4. Additionally the Resistance to Stripping Test, RTA Test T640, shall be carried out on all production mixes at a frequency of one test per mix per 5000 tonnes production or once per calendar month whichever is the most frequent. The Tensile Strength Ratio shall be greater than 70 per cent for all mixes. Where Tensile Strength Ratio is between 70 and 80 per cent corrective action shall be proposed by the Contractor including corrections to the mix design. Such advice shall be provided by the Contractor within a period of 48 hours from a result in the range 70-80 per cent which is deemed marginal. ***Stripping***

(c) Sampling

1. Sampling shall be performed in accordance with AS 2891.1. Samples shall be identified so as to allow traceability of the mix to the paving site. Each sample or sample portion as appropriate sampled as a referee sample shall be stored in an airtight container labelled so as to be traceable to the job and paving site location.

(d) Testing

1. Testing required by this Clause shall be arranged by the Contractor at an appropriately registered NATA laboratory. Test reports will be made available to the Superintendent as soon as they are available and always within 7 days of delivery of material. ***Registered Laboratory***

2. The cost of such testing shall be borne by the Contractor. ***Contractor's Costs***

TRANSPORT

C245.19 GENERAL

1. The bodies of haulage trucks shall be kept clean and coated with a thin film of an approved release agent to prevent asphalt sticking to the body of the truck. Any surplus release agent shall be removed before loading. ***Release Agent***

2. During transport asphalt shall be covered with a canvas or other suitable cover which is held down securely. ***Cover of Load***

3. When the mix whose transportation time exceeds 30 minutes, is to be transported over long distances (in excess of 20 kilometres), or is transported in cold conditions (air temperature below 15^{o}C), the mix shall be covered with a heavy duty canvas or similar waterproof cover which shall overlap the sides of the truck body by at least 250mm and shall be tied down securely. The bodies of all trucks shall be suitably insulated. ***Long Distance***

4. Delivery of the asphalt shall be at a uniform rate within the capacity of the spreading and compacting equipment. ***Delivery Rate***

5. The mass of all truck-loads of asphalt shall be measured on a registered weighbridge. ***Weighbridge***

PLACING

C245.20 GENERAL

1. The type and size of asphalt and the surface levels and thickness for each layer of asphalt shall be as shown in the Drawings. ***Layers***

2. Placing of asphalt shall not be permitted when the surface of the road is wet or while rain appears imminent, or when cold winds chill the asphalt to such an extent that, in the opinion of the Superintendent, spreading and compaction will be adversely affected. ***Weather Conditions***

3. The Superintendent may order work to cease temporarily on account of adverse weather, unsatisfactory pavement surface condition, or other circumstance which the Superintendent feels may adversely affect the subsequent operations. ***Temporary Suspension of Work***

C245.21 PREPARATION OF PAVEMENT

(a) Cleaning of Surface

1. The existing surface shall be dry, clean and free from any loose stones, dirt and foreign matter. The surface shall be swept beyond the edge of the proposed asphalt layer 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. ***Requirement***

2. Surface preparation shall be in accordance with AS 2734. Thermoplastic linemarking or other linemarking, where indicated necessary by the Superintendent in Annexure C245C, will be removed prior to paving. Raised pavement markers shall be removed prior to paving. ***Surface Preparation***

3. The Contractor, when paving over existing road pavement, shall be responsible for the recording of lane marking positions including the extent of barrier line. After paving the Contractor will mark up the pavement to re-establish such positions using conventions agreed with the Superintendent and to a standard adequate to allow accurate re-establishment of line marking. ***Linemarking***

(b) Rectification of Pavement Surface

1. The Contractor shall repair any damage to the existing pavement surface caused by the Contractor's activities. Affected areas designated by the Superintendent shall be removed and reinstated to the Superintendent's satisfaction. The cost of repairing such damage shall be borne by the Contractor. ***Contractor's Responsibility, Contractor's Cost***

2. Surface depressions of greater depth than twice the permissible tolerance (specified in Clause C245.31) of the layer are to be tack coated and squared where necessary, filled with fresh asphalt of appropriate nominal size in accordance with Table C245.9 and compacted before the subsequent course is placed. The asphalt in these patches shall be compacted to comply with the general level of the existing surface to the Superintendent's satisfaction. ***Correction Courses***

3. When the optional "Preparation of Surface Hold Point" is required as indicated in Annexure C245C, placing of asphalt shall not be undertaken until the pavement has been prepared to the satisfaction of the Superintendent. Preparation of the affected area to the satisfaction of the Superintendent shall constitute a **HOLD POINT**. Subsequent inspection and Superintendent's approval of surface condition shall be required prior to the release of the hold point. ***Optional HP***

C245.22 TACK COAT

1. The whole of the area to be sheeted with asphalt shall be tack coated with a light and even coat of bitumen emulsion. Where multiple courses are to be applied a tack coat shall be used between each course unless directed otherwise by the Superintendent. ***Placement***

2. The bitumen emulsion shall be applied at a rate of between 0.10 litres per square metre and 0.20 litres per square metre of undiluted bitumen. ***Application Rate***

3. The bitumen emulsion shall be applied by a mechanical sprayer with spray bar. Where the areas to be sprayed are small, irregular or inaccessible to mechanical sprayers, such areas shall be tack coated by hand spraying or brushing. ***Mechanical Sprayer***

4. The bitumen emulsion may be warmed or diluted with water to facilitate spraying. Adequate time shall be allowed for the emulsion to break before asphalt is laid. Over application of tack coat, due to surface depressions, shall be removed or dispersed by brushing. ***Application***

5. All contact surfaces of kerbs and other structures and all cold joints shall be coated with a thin uniform application of tack coat. ***Contact Surfaces***

6. Care shall be taken to ensure that bitumen emulsion is not sprayed on, or allowed to coat any services or exposed fixtures including concrete kerbs, guardfence or bridge handrails. Appurtenances susceptible to overspray shall be protected with suitable paper. ***Surface Protection***

7. When trucks or other vehicles are likely to move from tack coated areas onto adjacent finished surfaces, the Superintendent may require that the finished surfaces be suitably protected from carryover of bituminous material. ***Truck Movements***

8. In locations of heavy pedestrian traffic, such as shopping areas, the Contractor shall take appropriate precautions in accordance with the Specification for CONTROL OF TRAFFIC to keep pedestrians off tack coated areas. ***Pedestrian Control***

C245.23 LAYING

(a) Paver

1. The paver(s) shall be expected to have a minimum spreading capacity of 50 tonnes of asphalt per hour and be capable of spreading a width of at least 3.7m to the requirements of this Specification. It shall be expected to have automatic screed control operated from joint matching shoe, fixed line, travelling straight edge or levelling beam. The Contractor shall provide the Superintendent with notice of proposed pavers without these capabilities and obtain Superintendent's agreement to their use. ***Capacity of Configuration***

(b) Laying Operations

1. The work shall be so arranged as to keep the number of joints, both longitudinal and transverse to a minimum. ***Joint Layouts***

2. The paver shall operate at a uniform speed and the delivery of asphalt shall ***Continuous***

match the output of the paver such that continuous laying of asphalt is achieved. ***Laying***

3. In the event of faulty operation of the paver causing irregularities in the spread asphalt, work shall cease until the fault is rectified. ***Irregularities in Laying***

4. Unless otherwise approved by the Superintendent, asphalt shall not be spread by hand behind the paver. Workers shall not stand or walk on the hot surface until compaction has been completed except where necessary for correction of the surface. ***Worker Control***

5. The Superintendent may approve spreading asphalt by hand for minor correction of the existing surface and in areas inaccessible to mechanical pavers. ***Hand Spreading***

6. Asphalt shall not be placed when the surface of the pavement is wet or while rain appears imminent. ***Adverse Conditions***

7. AS 2734 shall constitute a valid reference of good practice for asphalt laying practice.

(c) Laying Temperature

1. For asphalts made with Class 170 or 320 bitumen the minimum asphalt temperatures at the time of discharge into the paver shall be as shown in Table C245.8. Measurement may be made by calibrated infra-red thermometers when accepted by both Contractor and Superintendent. ***Limits***

2. For asphalt made with other binders complying with Clause C245.10(b) or C245.10(c), the minimum asphalt temperature for laying shall be as directed by Table C245.6 or based upon manufacturer's instruction. ***Other Binders***

3. The Superintendent may not allow asphalt to be laid outside the specified limits for wind velocities as specified in Clause C245.25. ***Outside Specified Wind Velocities***

4. The Superintendent may reject that part of any truck load which contains lumps of cooled asphalt which are liable to affect the quality of the finished surface. ***Cooled Asphalt in Truck***

5. The laying temperature of open graded asphalt shall not exceed 140^{o}C unless a polymer modified binder is used in which case the Superintendent shall adopt the temperature based on manufacturer's instruction. Any asphalt exceeding this temperature shall be rejected. ***Excessive Heating***

6. The laying temperature shall be measured in the paver hopper. A suitable stem type thermometer readable and accurate to within plus or minus 2^{o}C with a range from at least 0^{o}C to 200^{o}C shall be used. The stem shall be inserted into the asphalt to a depth of approximately 200mm at a location at least 300mm from the side of the paver. The average of two readings shall be adopted as the temperature of the mix. Measurements of asphalt and road surface temperatures and wind velocity to comply with this Clause shall be recorded on Asphalt Work Record Sheet. ***Temperature Determination***

Binder Type	Road Surface Temperature in Shade (°C)	Minimum Asphalt Temperatures (°C) for Laying		
		Layer Thickness Less than 30mm	Layer Thickness 30mm to 45mm	Layer Thickness 45mm to 100mm
Class 170	5-10	*	*	145
&	10-15	150#	145##	140
Class 320	15-25	145#	140##	135
Bitumen	over 25	140	135	130
SBS polymer	15-25	NA	160	155
modified bitumen **	over 25	NA	150	150

NOTE: * Layers thinner than 45mm shall not be placed when the pavement temperature is below 10°C for dense graded and polymer modified asphalt mixes and 15°C for all open graded asphalt.

** For other polymers the minimum temperatures as directed by the Superintendent.

Laying not permitted if wind velocity across the pavement exceeds 5 km/hr.

Laying not permitted if wind velocity across the pavement exceeds 15 km/h.

Table C245.8
Minimum Asphalt Temperatures for Laying

(d) Level Control

1. Where Annexure C245B - Schedule of Details calls for level control the following minimum requirements shall be observed. The procedure shall be reported to the Superintendent at least 1 working day in advance of operations at any site. Additional controls may be necessary to obtain the required finished pavement properties. ***Minimum***

2. Target levels will be established on site by way of pegs, stringline, wire or previously constructed kerb and gutter (channel) or similar physical longitudinal control. Such target levels will be made available for Superintendent's inspection. ***Level Control***

3. Corrective course shall be automatically controlled by programmed computer control of the paver, joint matching shoe or stringline sensor. Where the correction is only minor, the Superintendent may allow the use of levelling beams. ***Corrective Course***

4. Intermediate courses shall be automatically controlled by programmed computer control of the paver or a joint matching shoe. ***Intermediate Course***

5. The wearing course shall be controlled by levelling beams or a joint matching shoe. When identified in the Project Quality Plan and/or approved by the Superintendent, small areas (as defined) may be paved as wearing course to target levels indicated by pegs or pavement markings. ***Wearing Course***

6. The Contractor is at all times responsible for selection of the procedure for paving subject to the minimal requirements set out in this Clause. The Contractor's procedure shall ensure the accuracy of the resultant pavement levels and their compliance with the Drawings or documented requirements. ***Level Accuracy***

(e) Layer Thickness

1. The compacted thickness of each course shall be as shown on the Drawings. A course may comprise one or more layers. The nominal compacted layer thickness adopted in designs or instructions shall be in accordance with Table C245.9. ***Nominated Layer Thickness***

Nominal Size of Asphalt (mm)	Compacted Layer Thickness (mm)	Type of Work
5	15 to 25	Wearing course
10	25 to 40	Wearing course
14	35 to 50	Wearing course
10	25 to 40	Intermediate course
14	35 to 50	Intermediate course
20	50 to 80	Intermediate course
5	10 to 25	Corrective course
10	20 to 35	Corrective course
14	30 to 45	Corrective course
20	40 to 70	Corrective course

Table C245.9 - Course and Layer Thickness

2. Minimum compacted thickness and maximum compacted thickness for each asphalt layer as constructed shall be in accordance with the requirements set out in Annexure C245C for each site.

C245.24 JOINTS

(a) General

1. The location of longitudinal and transverse joints shall be as approved by the Superintendent and at the spacing nominated in the Drawings. All joints shall be compacted and finished with a smooth, planar surface coinciding with, and being of similar appearance to the remainder of the layer. ***Density at Joints***

(b) Longitudinal Joints

1. An automatically controlled joint matching device shall be used to control the levels of adjacent runs. Care shall be taken to provide positive bond between adjoining runs. Longitudinal joints shall be: ***Joint Matching Device***

(a) continuous and parallel.
(b) coincident within 150mm of line of change in crossfall.
(c) offset by at least 150mm from joints in underlying layers.
(d) located away from traffic wheel paths.
(e) located beneath proposed traffic linemarkings in the case of a wearing course.

2. Work shall be arranged to avoid longitudinal joint faces being left exposed overnight. ***Overnight Exposure***

3. When pavers are laying asphalt so as to produce a "hot joint", this joint shall be constructed by leaving an uncompacted strip approximately 150mm wide along the edge of the first run, and after the adjoining run has been spread, both sides of the joint shall be rolled simultaneously. ***Hot Joint***

4. A joint shall be considered 'cold' when the temperature of the asphalt has dropped below 60^{o}C for dense graded mix and below 50^{o}C for open graded mix. Cold joints will require tack coating. ***Cold Joint***

(c) Transverse Joints

1. When the end of the asphalt layer has cooled due to disruption of the work, or when resuming work on the next day, a transverse joint shall be formed. ***Location***

2. Transverse joints shall be at right angles to the direction of laying. They shall be staggered by at least 1m between successive layers and between adjacent runs. ***Staggered Layers***

3. Runs shall end either against a timber bulkhead to ensure a straight vertical, well compacted edge or by feathering out and compacting. In the latter case, before continuing the run the feathered material shall be cut back to a line where the full layer thickness exists. The surface shape of the end of the run shall be checked by a straight edge to locate the line of cut. The end of the previous run shall be lightly tack coated before the laying of the next run proceeds. ***Feathered Edge***

4. When the asphalt layer is required to join and match the level of an existing pavement surface, bridge deck or other fixture, sufficient of the existing material shall be cut out to achieve the minimum layer thicknesses as set out in Table C245.9. ***Matching Existing Surface***

COMPACTION

C245.25 PLANT AND EQUIPMENT

1. The proposed compaction fleet and rolling pattern shall be adequate to achieve the specified compaction and finish. ***Compaction Fleet***

2. For compaction of confined areas or patching works a small vibrating roller, or hand operated vibrating compactor acceptable to the Superintendent shall be used. ***Confined Areas***

3. As a minimum practical compaction fleet the Contractor shall provide 1 vibrating steel roller and 1 pneumatic tyred roller. Additional rollers and roller size shall be determined by the Contractor so as to meet the criteria for compaction and nominated in the project quality plan.

C245.26 DENSE GRADED ASPHALT

(a) Initial Rolling

1. Initial rolling shall be carried out using steel rollers. Vibratory steel rollers may be used, but they shall be operated in the static mode for the first pass. On deep lift asphalt, pneumatic tyred rollers may be used. ***Roller Type***

2. Initial rolling shall commence as soon as possible after laying has commenced. Rollers shall be operated as close as possible to the paver. ***Commencing Time***

3. The transverse and longitudinal joints and edges shall be compacted first. ***Priority***

4. Initial rolling shall be completed before the asphalt temperature falls below 105°C, or 120°C for polymer modified asphalt. ***Temperature Level***

(b) Secondary Rolling

1. Secondary rolling shall immediately follow initial rolling. In secondary rolling, static steel rollers or pneumatic tyred rollers shall be used. The tyre pressures of pneumatic tyred rollers should equal or exceed 550 kilopascals. Rolling shall commence at the longitudinal joint side of the run. ***Roller Types and Tyre Pressures***

2. Secondary rolling shall be completed before the mix temperature falls below 80°C. ***Temperature Level***

(c) Final Rolling

1. Final rolling shall be carried out by a pneumatic tyred roller to eliminate all roller marks and to produce a uniform finish. If secondary rolling has been carried out with a pneumatic tyred roller, a steel roller may be used for final rolling instead of the pneumatic tyred roller specified. ***Tyre Pressures***

2. Final rolling shall be completed before the asphalt temperature falls below 60°C. ***Final Rolling***

C245.27 OPEN GRADED ASPHALT

1. All rolling of open graded asphalt shall be with static steel rollers. The minimum number of rollers shall be in accordance with Table C245.10. Only initial and final rolling shall be required. ***Roller Type***

2. Compaction methods shall be in accordance with AS 2734, Section 8. ***Number of Passes***

3. All rolling shall be completed while the asphalt temperature is neither less than 90°C nor more than 110°C. ***Rolling Temperature***

C245.28 ACCEPTANCE CRITERIA FOR COMPACTION

1. The acceptance for compaction shall be on a lot by lot basis where each day's work is generally one lot. Any defective areas which show cracking, bony material or exhibiting excessive binder shall be excluded from the lot and shall be rectified by the Contractor before being tested. ***Statistical Basis***

2. When directed by the Superintendent the Contractor shall arrange for the determination of the relative compaction of the lot by either of the following methods: ***Relative Compaction***

(a) Cores

(i) The cores shall be taken on a random basis acceptable to the Superintendent and have density tests performed on the cores in accordance with Test Method AS 2891.9.3. The layer thickness shall be deemed to be the mean thickness of the cores. The testing shall be undertaken at a laboratory with appropriate NATA accreditation.

(b) Nuclear Density Meter Determination

(i) The type of nuclear density meter shall be appropriate to the depth of the

layer being measured and shall be calibrated for each type of asphalt.

(ii) The Contractor shall arrange for a nuclear density meter (backscatter mode) to measure density in situ and shall determine the acceptable compaction level, in terms of the nuclear density meter, from compaction trials or by correlation with cores taken from a compacted layer. Records of nuclear density meter readings shall clearly locate the test position to allow calibration by core testing subsequently if required. The layer thickness shall be deemed to be the nominal layer thickness. The proposed correlation shall be submitted to the Superintendent for approval.

3. Relative compaction of the core is the ratio of the field bulk density of the core and the mean laboratory density of the lot, determined by AS 2891.9.3, and reported as a percentage of the mean laboratory density. ***Relative Compaction***

4. No cores or nuclear density measurements shall be taken within 150mm of a joint or free edge unless directed by the Superintendent, layers less than 30mm in thickness are not tested for compaction as the test results are not reliable for such samples. ***Limitations on Compaction Testing***

5. The minimum Relative Compaction of all values within a lot of dense graded asphalt shall be 95 per cent for a layer of thickness less than 50mm or 96 per cent for a layer of thickness of 50mm or greater. ***Minimum Relative Compaction***

C245.29 FINISHED PAVEMENT PROPERTIES

1. Each course of asphalt shall be finished parallel to the finished surface of the wearing course.

C245.30 THICKNESS

1. The thickness of asphalt shall be specified and/or measured in one of the following ways: ***Measurement***

(a) No Finished Surface Levels Specified

1. When asphalt is placed over an existing pavement in one or more courses, the calculated average compacted thickness of each course, except any approved corrective course, shall be in accordance with the course thickness specified in the Drawings and tolerances indicated in Table C245.10. ***Calculated Average Compacted Thickness***

Nominal Size of Asphalt (mm)	Tolerance (mm)
5	+5 -0
10	+5 -5
14	+5 -5
20	+10 -10
28	+10 -10
40	+10 -10

Table C245.10
Tolerance for Course Thickness

(b) Finished Surface Levels Specified

1. When asphalt is placed in more than one course to specified levels over a pavement built by others, each course (excluding a corrective course) shall be

placed in accordance with this clause provided that the thickness of the wearing course shall be not less than 90 per cent of that specified and the level of the wearing course shall comply with the limits shown in Table C245.11.

2. When the Contractor also constructs the underlying pavement, the level and thickness of the asphalt shall comply with the requirements of Table C245.10.

C245.31 LEVEL

1. The top surface of any course after final compaction shall be parallel with the final wearing surface and the levels of the surface of the nominated course shall not vary from the levels determined from the Drawings or as determined by the Superintendent by more than the limits shown in Table C245.11.

Nominated Course	Below Nominated Course Level (mm)	Above Nominated Course Level (mm)
Wearing Course	0	10
Top of Intermediate Course	5	10
Other Intermediate Course	10	10
Corrective Course	15	10

Table C245.11 - Tolerance for Course Levels

2. Surface irregularities exceeding the tolerances given in this Clause shall be corrected to the satisfaction of the Superintendent at the Contractor's cost before a subsequent course is placed. ***Surface Irregularities***

C245.32 SHAPE

1. The surface shall not deviate from the bottom of a 3m long straightedge laid in any direction by more than the tolerances shown in Table C245.12. ***Tolerances***

Course	Deviation from 3m straight edge (mm)
Corrective Course	15
Intermediate Course	10
Wearing Course	10

Table C245.12- Deviation from 3m Straightedge

2. Surface irregularities exceeding the tolerances given in Table C245.12 for a particular course shall be corrected to comply with Table C245.13 before a subsequent course is placed. When the Contractor is required to provide a new wearing course in a single layer operation over a pavement built by others, the tolerance for the wearing course shown in Table C245.11 shall apply provided the deviations of the existing surface from a 3m straightedge do not exceed the tolerance specified in Table C245.12 for an intermediate course. Compliance with Table C245.12 shall be confirmed by the Superintendent where the existing surface has been provided by others. ***Surface Irregularities***

C245.33 VOIDS

1. For dense graded asphalt mixes having voids outside the limits specified in Table C245.2, the deductions shown in Clause C245.40 may apply when approved by the Superintendent. ***Limits on Voids***

C245.34 REMOVAL AND REPLACEMENT OF REJECTED MATERIAL

1. The sections of work that have been rejected under the preceding clauses of this Specification or as otherwise determined by the Superintendent shall be removed within 15 days from the work and replaced with fresh asphalt mix material corresponding in grade and quality to that material specified in the Nominated Mix unless otherwise approved by the Superintendent. ***Time Limit***

2. If removal of the single nonconforming pavement strata is impossible, the effected area as determined by the Superintendent shall be removed to subbase or subgrade depth as appropriate to provide a smooth level surface on which to found the reinstated base and/or subbase course. ***Removal Depth***

3. The perimeter of the nonconforming area shall be prepared in accordance with the practice pertaining to longitudinal and transverse cold joints (AS 2734). ***Perimeter***

4. In rejected sections the material is to be removed over the full length of the affected area except that a minimum length of 5m and a minimum width equal to the paver width shall be removed. ***Length to be Removed***

5. Any damage to abutting layers, structures or utilities shall be rectified by the Contractor. All rectification costs shall be borne by the Contractor. ***Contractor's Cost***

6. The Superintendent shall have the right to alter the constitution, quality, grading, or other parameters of the 'Reinstatement Pavement' if it is felt that reconstruction of the effected area with the Approved Mix would produce nonconforming pavement as a result of non-continuous pavement structure. ***Altered Design***

7. After removal of the rejected base or subbase course the area shall be made available to the Superintendent for inspection and approval to proceed with the works. This action constitutes a **HOLD POINT**. Superintendent inspection and approval is required prior to release of hold point. ***HP***

8. All materials used in the reinstatement of the nonconforming area shall comply with the requirements of this Specification unless otherwise directed by the Superintendent. ***Replacement Material***

9. All costs associated with removals, testing and corrections of base and subbase course and extra costs incurred by the Contractor in respect of delays caused by such removals, replacements and corrections shall be borne by the Contractor. All costs associated with the removal testing and correction of non-conforming pavement shall be borne by the Contractor. ***Contractor's Costs***

SPECIAL REQUIREMENTS

C245.35 RESERVED

C245.36 RESERVED

C245.37 RESERVED

C245.38 RESERVED

LIMITS AND TOLERANCES

C245.39 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses of this Specification are summarised in Table C245.13 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Coarse Aggregate**		
	(a) Wet Strength	>100kN for any fraction other than the open graded asphalt where wet strength is to be >150kN	C245.08(a)
	(b) Wet/Dry Strength Variation	<35%	C245.08(a)
	(c) Particle Shape	Proportion retained on 9.50mm AS sieve: <35% for calliper ratio 2:1 <10% for calliper ratio 3:1	C245.08(a)
	(d) Fractured Faces	Proportion retained on 6.70mm AS sieve: >75% of mass with at least two fractured faces. When used as a wearing course shall have at least 90% by mass with at least one fractured face.	C245.08(a)
	(e) Polished Aggregate Friction Value (PAFV)	> minimum value of 44	C245.08(a)
2.	**Fine Aggregate**	Shall meet the requirements as specified for Coarse Aggregate (Item 1) above.	C245.08(b)
3.	**Polymer Modified Bitumens**		
	(a) Specified Properties	As per Table C245.1	C245.10(c)
4.	**Reclaimed Asphalt Pavement**		
	(a) Proportion of RAP	<20% by mass	C245.13
5.	**Design of Nominated Mix**		
	(a) Dense Graded Limits	As per Table C245.2	C245.14
	(b) Open Graded Limits	As per Table C245.3	C245.14
6.	**Production Mix Variation**		
	(a) Dense Graded Asphalt	As per Table C245.4	C245.16
	(b) Open Graded Asphalt	As per Table C245.5	C245.16
7.	**Asphalt**		
	(a) Moisture Content	< 0.5% by mass	C245.17
8.	**Temperatures for**		

Item	Activity	Limits/Tolerances	Spec Clause
	Manufacture of Asphalt		
	(a) Binder Temperature	As per Table C245.6	C245.17
	(b) Asphalt Temperature	As per Table C245.6	C245.17
9.	**Preparation of Pavement**		
	(a) Cleaning of Surface	>300mm beyond the edge of proposed layer	C245.21
10.	**Tack Coat**		
	(a) Bitumen Emulsion	Application Rate > 0.10 and < 0.20 litres per square metre	C245.22
11.	**Laying**		
	(a) Paver Capacity	>50 tonnes asphalt per hour	C245.23(a)
	(b) Spread Width	>3.7m	C245.23(a)
	(c) Laying Temperature		
	(i) Open Grade AC	<140^{o}C	C245.23(c)
	(ii) Dense Grade AC	As per Table C245.8	C245.23(c)
	(d) Course and Layer Thickness	Nominal size mix and compacted layer thickness as per Table C245.9.	C245.23(e)
12.	**Longitudinal Jointing**		
	(a) Change in Crossfall	Within 150mm of line of change.	C245.24(b)
	(b) Where Underlying Layers	Offset at least 150mm from joints in underlying layers.	C245.24(b)
13.	**Transverse Jointing**		
	(a) Where Underlying Layers	Stagger to be >1m between successive layers and adjacent runs.	C245.24(c)
14.	**Compaction**		
	(a) Dense Graded Asphalt	Initial Rolling: To be completed before asphalt temperature falls below 105^{o}C or 120^{o}C for polymer modified asphalt.	C245.26(a)
		Secondary Rolling: Tyre pressures on pneumatic rollers to be ≥550kPa. Rolling to be completed before the asphalt temperature falls below 80^{o}C.	C245.26(b)
		Final Rolling: Rolling to be completed before asphalt temperature falls below 60^{o}C.	C245.26(c)
	(b) Open Graded Asphalt	Rolling to be completed while asphalt temperature is >90^{o}C and <110^{o}C.	C245.27
	(c) Acceptance Criteria for Compaction	Minimum Relative Compaction of all values within a lot >95% for layer of thickness <50mm and >96% for layer thickness >50mm.	C245.28

Item	Activity	Limits/Tolerances	Spec Clause
15.	**Finished Pavement**		
	(a) Thickness	Max. compacted thickness tolerance as for Table C245.11. Where finished surface levels are specified, thickness shall be >90% of specified and level shall comply with requirements of Table C245.12.	C245.30
	(b) Shape	Shall not deviate from bottom of 3m straight edge by more than tolerance in Table C245.13.	C245.32

Table C245.13 - Summary of Limits & Tolerances

MEASUREMENT AND PAYMENT

C245.40 DEDUCTIONS

1. A section of work on which either the asphalt and/or placing work fails to meet this Specification may be accepted at the absolute discretion of the Principal subject to the provisions listed hereunder.

(a) Voids

(i) For dense graded asphalt mixes having voids outside the limits specified in Table C245.7, the asphalt may be accepted at the absolute discretion of the Superintendent if all other requirements of this Specification are met and provided the void contents fall within the range 3-8% for Collector Arterial and Industrial Road mixes and 2-6% for the Local and Residential Road mixes. Deductions shown in Table C245.14 may be applied by the Superintendent to Schedule Pay Items C245(b), (c) or (d) as appropriate.

(b) Aggregate Grading and Binder Content

(i) For asphalt having aggregate grading or binder content outside the limits specified in Table C245.2 and C245.3, the asphalt shall be rejected and removed from the site.

Mix Type by Road Type (refer Table C245.2)	Calculated Mean Laboratory Voids Result (%) for a lot reported to 0.1% before rounding		Deduction (%)
	Modified Hubbard-Field Method	Marshall Method	
Collector Arterial and Industrial Mix	4 3.0 - 3.9 <3.0	4 3.0 - 3.9 <3.0	NIL 20% REJECT
Collector Arterial and Industrial Mix	7 7.1 - 7.5 7.6 - 8.0 >8.0	6 6.1 - 6.5 6.6 - 7.0 >7.0	NIL 10% 20% REJECT
Local and Residential Mix	3 2.0 - 2.9 <2.0	3 2.0 - 2.9 <2.0	NIL 20% REJECT
Local and Residential Mix	6 6.1 - 6.5 6.6 - 7.0 >7.0	5 5.1 - 5.5 5.6 - 6.0 >6.0	NIL 10% 20% REJECT

Table C245.14 - Deductions for Voids (% of Schedule Rate)

C245.41 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed under this Specification in accordance with Pay Items C245(a) to C245(g) inclusive.

2. A lump sum price for any of these items shall not be accepted.

3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. Where "provisional" items are shown in the schedule, these may not be required during the course of the work as the requirement may be governed by site or external constraints.

5. Provision for traffic shall be measured and paid in accordance with the Specification for CONTROL OF TRAFFIC.

Pay Item C245(a) SUPPLY AND APPLICATION OF TACK COAT (INCLUDING PREPARATION OF SURFACE)

1. The unit of measurement shall be the litre.

2. The quantity shall be determined by multiplying the nominated application rate of bitumen emulsion (in litres per square metre) by the authorised area of road surface tack coated or other method approved by the Superintendent.

3. No account shall be taken of area of tack coat applied to faces of joints, kerbs and other structures.

4. The schedule rate under this item shall include all operations involved in the supply and application of the tack coat, including surface preparation and provision of a blinded surface where determined by the Superintendent.

Pay Item C245(b) DENSE GRADED ASPHALT IN INTERMEDIATE COURSES

C245(b)(1)	5mm Nominal Size
C245(b)(2)	10mm Nominal Size
C245(b)(3)	14mm Nominal Size
C245(b)(4)	20mm Nominal Size

1. The unit of measurement shall be tonnes confirmed by weighbridge dockets.

2. The schedule rate under this item shall include all operations involved in the supply, spreading and compaction of the asphalt.

3. A separate unit rate shall be included in the Schedule of Rates for each nominal size of asphalt specified.

Pay Item C245(c) DENSE GRADED ASPHALT IN WEARING COURSE

C245(c)(1)	10mm Nominal Size
C245(c)(2)	14mm Nominal Size
C245(c)(3)	20mm Nominal Size
C245(c)(4)	Residential Type A
C245(c)(5)	Residential Type B
C245(c)(6)	Residential Type R

1. The unit of measurement shall be tonnes confirmed by weighbridge dockets.

2. The schedule rate under this item shall include all operations involved in the supply, spreading and compaction of the asphalt.

3. A separate unit rate shall be included in the Schedule of Rates for each nominal size of asphalt specified.

Pay Item C245(d) DENSE GRADED ASPHALT OVER AN EXISTING PAVEMENT

C245(d)(1) 5mm Nominal Size
C245(d)(2) 10mm Nominal Size
C245(d)(3) 14mm Nominal Size

1. The unit of measurement shall be tonnes confirmed by weighbridge dockets.

2. The schedule rate under this item shall include all operations involved in the supply, spreading and compaction of the asphalt.

3. A separate unit rate shall be included in the Schedule of Rates for each nominal size of asphalt specified.

Pay Item C245(e) OPEN GRADED ASPHALT IN WEARING COURSE

C245(e)(1) 10mm Nominal Size
C245(e)(2) 14mm Nominal Size

1. The unit of measurement shall be tonnes confirmed by weighbridge dockets.

2. The schedule rate under this item shall include all operations involved in the supply, spreading and compaction of the asphalt.

3. A separate unit rate shall be included in the Schedule of Rates for each nominal size of asphalt specified.

COUNCIL ***ANNEXURE C245A***

ASPHALT WORK RECORD

Date: _____ Contract No: _____ Work Location: _____km to: _____km

Road Name: _____ Supplier: _____ From: _____ *(Crossroad or landmark)* towards _____

Road No: _____ Job No: _____ PMS/MMS Segment Numbers: _____

Plan No: _____ Mix Type: _____ New Surfacing ☐ Resurfacing ☐ Existing Surface Type: _____

Delivery								**Paving**										**Remarks**
Load No.	Time			Truck Reg'd No.	Docket No.	Nett Mass (t)	Mix Temperature Ex paver	Chainage		Paved Width (m)	Direction with or against chainage	Dist. from left edge to centre of run (m)	Thickness (mm)	Layer			Sample No. & Lot Size (tonnes) if sampled	Weather Work Stoppages, Start & Finish etc.
	Depot Plant	Arrive Job	Depart Job					From	To					1st	2nd	3rd		

Remarks:

Penciller: _____ Sampling by: _____ Superintendent's Representative: _____ Contractor's Representative: _____

Affiliation: _____ Affiliation: _____ *(Signature)* *(Signature)*

ANNEXURE C245B

SCHEDULE OF DETAILS
Pavement Type _____ Sheet No.

Location _____ Road No._____ PMS/MMS Segment Nos._____ of ____ Sheets

Course	Type and Nom Size of Asphalt	Type and Grade of Binder	Compacted thickness of course (mm)	Minimum Delivery Rate (per hr)	Delivery Trucks to be Insulated* (Yes/No)	Specific Control Method (when required)				
Wearing										
Intermediate 1										
Intermediate 2										
Intermediate 3										
Intermediate 4										
Correction 1										
Correction 2										
Drainage Layer										

(TO BE ISSUED BY SUPERINTENDENT FOR EACH SEPARABLE PART)

ANNEXURE C245C

ASPHALT AND BINDER TYPES

1. Nominal sizes of asphalt required for this contract (tick box) and enter binder type:

AC TYPE		BINDER
AC 5	☐	
AC 10	☐	
AC 14	☐	

AC TYPE		BINDER
AC 20	☐	
AC 28	☐	
AC 40	☐	

AC TYPE		BINDER
Type A	☐	
Type B	☐	
Type R	☐	

OG ASPHALT TYPE		BINDER
OG 10	☐	
OG 14	☐	

OG ASPHALT TYPE		BINDER
OG 28	☐	
OG 40	☐	

Binder Types: Class 170 A30P
Class 320 A15E

2. Specific Sampling and Testing Requirements differing from those shown in Table C245.7 shall apply to the mixes annotated by an asterisk (*) in the above tabulation.
Testing Frequency:_____ Referee Sampling Frequency_____ (eg 10% of tested samples)

3. Nomination of aggregate pretreatment procedure if required by Superintendent:

_____

_____

4. Special aggregate mixes required for this contract: (Nominate Source)

_____

_____

5. Requirements for removal of thermoplastic or other line marking:

_____

6. Requirement for Preparation of Surface Hold Point

Refer Clause C245.21 PREPARATION OF PAVEMENT ☐ *Yes* ☐ *No*

QUEENSLAND

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C247

MASS CONCRETE SUBBASE

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C247
MASS CONCRETE SUBBASE

CLAUSE **CONTENTS** **PAGE**

SPECIFICATION C247
MASS CONCRETE SUBBASE

GENERAL

C247.01 SCOPE

1. The work to be executed under this Specification consists of the construction, by mechanical or hand placement of mass concrete subbase including trial sections and subgrade beams to the dimensions and levels shown on the Drawings and in accordance with the provisions of the Contract.

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***

C247.02 THICKNESS AND LEVELS OF SUBBASE

1. The subbase thickness and levels shall be as shown on the Drawings. ***Levels***

C247.03 PROVISION FOR BASE SLAB ANCHORS

1. During construction of the subbase, in advance of concrete base construction the Contractor shall make provision to permit construction of base slab anchors at the locations and to the dimensions shown on the Drawings. Excavation of material, trimming of trenches, compacting of the bottom of the trench, disposal of surplus material and construction of the concrete anchors shall be carried out in accordance with the Specification for PLAIN OR REINFORCED CONCRETE BASE as part of the concrete base construction. ***Base Slab Anchors***

C247.04 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

C248	-	Plain or Reinforced Concrete Base
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1012.1	-	Sampling of fresh concrete.
AS 1012.3.1	-	Determination of properties related to the consistence of concrete - Slump test.
AS 1012.4.2	-	Determination of air content of freshly mixed concrete - Measuring reduction in air pressure in chamber above concrete.
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 1012.13	-	Determination of the drying shrinkage of concrete for samples prepared in the field or in the laboratory.
AS 1012.14	-	Securing and testing cores from hardened concrete for

compressive strength.

AS 1141.11	-	Particle size distribution by sieving.
AS 1141.14	-	Particle shape, by proportional calliper.
AS 1141.22	-	Wet/dry strength variation.
AS 1160	-	Bitumen emulsion for construction and maintenance of pavements.
AS 1379	-	The specification and manufacture of concrete.
AS 1478.1	-	Chemical admixtures for concrete, mortar and grout – Part 1: Admixtures for concrete.
AS 2758.1	-	Concrete aggregates.
AS 3582.1	-	Supplementary cementitious materials for use with portland cement - Flyash.
AS 3799	-	Liquid membrane - forming curing compounds for concrete.
AS 3972	-	Portland and blended cements.

MATERIALS FOR CONCRETE

C247.05 CEMENT

1. Cement shall be Type GP Portland cement or Type GB blended cement complying with AS 3972. Cement shall be from a source approved under the Queensland Government's State Purchasing Policy.

2. When submitting details of the nominated mix in accordance with Clause C247.15 the Contractor shall nominate the brand and source of the cement. On approval of a nominated mix by the Superintendent, the Contractor shall use only the nominated cement in the work. ***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 stage of the work. ***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 Superintendent may require a retest to ensure the cement complies with AS 3972, before the cement is used in the work. The cost of retesting cement shall be borne by the Contractor. ***Storage Time*** ***Contractor's Cost***

5. 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***

C247.06 FLYASH

1. Flyash shall be from a source approved under the Queensland Government's State Purchasing Policy. The use and the quality of flyash shall comply with AS 3582.1.

2. When submitting details of the nominated mix in accordance with Clause C247.15, the Contractor shall nominate the powerhouse source of the flyash. On approval of a nominated mix by the Superintendent, the Contractor shall use only flyash from the nominated powerhouse. ***Source***

3. Documentary evidence of the quality and source of the flyash shall be furnished by the Contractor to the Superintendent upon request at any stage of the work. ***Documentary Evidence***

C247.07 WATER

1. Water used in the production of concrete shall be potable, free from materials harmful to concrete or reinforcement, and be neither salty nor brackish. ***Quality***

C247.08 ADMIXTURES

1. Chemical admixtures and their uses 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. An air-entraining agent may be included in the mix. If an air-entrainer is used, the air content of the fresh concrete shall comply with Clause C247.14. ***Quality***

2. Fresh concrete with an air content not complying with Clause C247.14 shall be rejected. ***Excess Air Content***

3. 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 C247.13. 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 C247.15. ***Retarder for Warm Season***

4. 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 or, alternatively, omitted altogether. If the Contractor proposes to vary the admixture between the warm and cool seasons such variation shall constitute a proposed change to an approved mix for the purposes of Clause C247.16. ***Retarder for Cool Season***

5. When submitting details of the nominated mix in accordance with Clause C247.15, the Contractor shall nominate the proprietary source, type and name of each admixture to be used. Documentary evidence of the quality shall be furnished by the Contractor to the Superintendent upon request at any stage of the work. ***Source and Type***

C247.09 AGGREGATES

(a) General

1. When submitting details of the nominated mix in accordance with Clause C247.15, the Contractor shall nominate the sources of aggregate to be used and shall submit details of the geological type of each aggregate. ***Source and Type***

2. Aggregates shall all pass the 37.5mm AS sieve and shall comply with AS 2758.1 in respect of bulk density, water absorption (maximum 5 per cent), material finer than 75 micrometres, impurities and reactive materials. The proportion of misshapen particles (2:1 ratio) determined by AS 1141.14 shall not exceed 35 per cent. ***Quality***

3. When submitting details of the nominated mix, the Contractor shall submit to the Superintendent a NATA Certified Laboratory Test Report on the quality and grading of the aggregate proposed to be used. The grading shall be known as the "Proposed Grading". ***Proposed Grading***

4. If the Contractor proposes to blend two or more aggregates to provide the Proposed Grading the Test Reports for each constituent material shall be submitted separately and the Superintendent advised of the proportions in which the various sizes and constituents are to be combined. The aggregate from each source and the combined aggregate shall comply with the requirements of this clause. ***Blending of Aggregates***

5. All aggregate used in the production of concrete shall be clean, hard, durable rock fragments free from the inclusion of mineral salts, oils, organic matter or other materials deleterious to the performance of concrete.

(b) Grading

1. The grading of the combined aggregate used in the work, determined by AS 1141.11, shall not deviate from that of the Proposed Grading by more than the amounts shown in Table C247.1.

Australian Standard Sieve	Maximum Deviation Per Cent Passing by Mass of Total Sample
37.5 mm	-5
19.0 mm	+ or -10
4.75 mm	+ or -10
1.18 mm	+ or -5
600 μm	+ or -5
150 μm	+ or -2

Table C247.1 - Aggregate Grading Deviation Limits

(c) Durability

1. Any fraction of any constituent and any fraction of combined aggregate shall conform to the following requirements:- ***Tolerances***

   (a) Wet Strength - AS 1141.22 - Shall not be less than 50 kN.

   (b) 10 per cent Fines Wet/Dry Variation - AS 1141.22 - Shall not exceed 35 per cent.

(d) Storage

1. Storage and handling facilities shall be such as to prevent the aggregates becoming intermixed or mixed with foreign materials, and to prevent segregation occurring. ***Facilities Required***

2. The area surrounding the storage facilities and mixing plant shall be so constructed that delivery vehicles, loaders and trucks shall not be capable of introducing foreign matter to the aggregates at any time. If foreign matter is introduced or the area reaches a condition where, in the opinion of the Superintendent, foreign matter may be introduced to the aggregates, production of concrete and delivery of materials shall cease until the condition is corrected to the satisfaction of the Superintendent. ***Introduction of Foreign Matter***

QUALITY REQUIREMENTS OF CONCRETE

C247.10 CEMENT AND FLYASH CONTENT

1. When a cement and flyash blend is nominated the minimum Portland cement content shall be 90 kilograms per yielded cubic metre of concrete and the minimum flyash content shall be 100 kilograms per yielded cubic metre of concrete. ***Minimum Content***

C247.11 COMPRESSIVE STRENGTH

1. The compressive strength of concrete shall be determined in accordance with AS 1012.9. The minimum compressive strength at 7 days shall be 4MPa and at 28 days shall not be less than 5MPa for flyash blended cement. The maximum compressive strength at 28 days shall be less than 15MPa, with the exception that where the nominated mix demonstrates a 28 day shrinkage less than 400 microstrains, then the concrete achieving a strength less than 20MPa shall be accepted.

Compressive Strength

C247.12 SHRINKAGE

1. The drying shrinkage of the nominated mix, determined by AS 1012.13 shall not exceed 450 microstrain after three weeks air drying. The drying shrinkage at the nominated slump plus 10mm shall be taken as the average of the reading or readings within 5 per cent of the median of the three readings obtained in accordance with AS 1012.13.

Shrinkage Limit

C247.13 CONSISTENCY

1. The Contractor's nominated slump, determined in accordance with AS 1012.3.1, shall be neither less than 25mm nor more than 40mm for mechanically placed concrete and shall be neither less than 50mm nor more than 65mm for hand placed concrete.

Slump Tolerances

C247.14 AIR CONTENT

1. If an air entraining agent is used, the air content of the fresh concrete, determined in accordance with AS 1012.4.2, shall be neither less than 3 per cent nor more than 7 per cent when discharged from the transport vehicle ready for placement.

Air Content Tolerances

DESIGN AND CONTROL OF CONCRETE MIXES

C247.15 GENERAL

1. The Contractor shall submit, for approval by the Superintendent, details of the concrete mix or mixes and the materials, including source, to be used for each of mechanically placed and hand placed subbase, including nominated slump and moisture condition of the aggregates (oven dry, saturated surface dry, or other specified moisture content) on which the mix is based. Each such mix shall be known as a 'nominated mix'.

Nominated Mix

2. The Contractor shall provide a Certificate from a laboratory with appropriate NATA registration stating that each nominated mix and its constituents meet the requirements of this Specification. All relevant test results shall accompany the Certificate. All phases of any particular test must be performed at one laboratory. The certificate shall confirm that the required testing has been carried out in the twelve month period before the date of submission to the Superintendent.

Certificate of Compliance with Specification

3. In the tests supporting the above certification, the compressive strength gain curve shall be submitted showing the compressive strengths at ages 3, 7, 10 and 28 days determined in accordance with AS 1012.9. Each of the results shall be based on three specimens of concrete produced from a batch of the nominated mix. The compressive strength shall be the average of individual results within 1.0MPa of the median.

Compressive Strength Determination

4. These details shall be submitted at least 21 days before using the nominated mix in the work. ***Submission of Details***

C247.16 VARIATIONS TO APPROVED MIXES

1. The Contractor shall not make any changes to the approved mix, its method of production or source of supply of constituents without the prior written approval of the Superintendent. ***Approval required to vary mix***

2. Where changes to an approved mix are proposed, the Contractor shall provide details of the nominated mix and materials, in accordance with Clause C247.15. If the variations to the quantities of the constituents in the approved mix are less than 10 kilograms for Portland cement, 20 kilograms for other cementitious material and 5 per cent by mass for each other constituent, except admixtures, per yielded cubic metre of concrete, the Superintendent may approve the changes without new trials being carried out. ***Contractor's Responsibility***

3. Notwithstanding these tolerances, the minimum cement content shall be 90 kilograms per yielded cubic metre of concrete, the minimum flyash content shall be 100 kilograms per yielded cubic metre of concrete. ***Minimum Constituent Quantities***

CONFORMANCE FOR CONCRETE STRENGTH AND THICKNESS

C247.17 CONCRETE CYLINDERS

(a) Test Specimens

1. Test specimens for determining the compressive strength of concrete shall be standard cylinders complying with AS 1012.8. The Contractor shall supply a sufficient number of moulds to meet the requirements for the frequency of testing specified in this Clause and shall also arrange for a laboratory with appropriate NATA registration to conduct the sampling of fresh concrete and the making, curing, delivery and testing of specimens. Copies of test results shall be forwarded to the Superintendent. ***Contractor's Responsibility***

2. Samples of concrete for testing shall be taken in accordance with AS 1012.1. The selection of the batches to be sampled shall be taken randomly. The specimens shall be moulded from each sample so that they are as identical as practicable. ***Sampling***

3. The method of making and curing specimens shall be in accordance with AS 1012.8 with compaction by internal vibration.

4. The Contractor shall mark the specimens for identification purposes. ***Marking***

5. Specimens shall be inspected, capped and crushed in accordance with AS 1012.8 and AS 1012.9.

6. The cost of all work and material required in the making, curing, delivery and testing of specimens shall be borne by the Contractor. ***Contractor's Costs***

(b) Frequency of Moulding of Test Specimens

1. Test specimens shall be moulded as follows:- ***Moulding of Cylinders***

(i) For the determination of the compressive strength at twenty-eight days.

For each lot of up to 50 cubic metres of concrete placed at the one time: One pair of specimens

(ii) For the determination of the compressive strength at seven days.

For each lot of up to 50 cubic metres of concrete placed at the one time: One pair of specimens

(iii) For the determination of compressive strength for any early testing as deemed necessary by the Contractor.

For each lot of up to 50 cubic metres of concrete placed at the one time: One pair of specimens

2. A lot is defined as a continuous pour of up to 50 cubic metres of concrete placed in the subbase. ***Lot Size***

C247.18 COMPRESSIVE STRENGTH OF CONCRETE

(a) General

1. The compressive strength of the concrete represented by a pair of specimens moulded from one sample shall be the average compressive strength of the two specimens. ***Determination of Strength***

2. At the time of approving the mix design, the Superintendent shall nominate whether 7 day or 28 day compressive strength or both shall be the acceptance criteria for strength.

(b) Adjustment of Test Compressive Strength for Age of Specimen

1. Should any specimen be tested more than 28 days after moulding the equivalent 28 day compressive strength shall be the test compressive strength divided by the factor applying to the age of the specimen at the time of the test shown in Table C247.2. For intermediate ages the factor shall be determined on a pro-rata basis. ***Strength Age Factor***

Age of Specimen at time of test (days)	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 or greater	1.25

Table C247.2 - Concrete Age Conversion Factors

(c) Conformance for Compressive Strength

1. If the compressive strength of test cylinders for any lot is less than the criteria specified in Clause C247.11, the lot represented by the test cylinders shall be removed and replaced. ***Limits***

2. The cost of removal of rejected concrete, including its disposal from the site, shall be borne by the Contractor. ***Contractor's Cost***

3. In case of non-conformance the Contractor may request permission of the Superintendent to core the in situ subbase for testing of the actual compressive strength to represent the particular lot. The locations for testing shall be nominated by the Superintendent and Councils authorised officer. Such locations may be determined by the use of a nuclear density meter, or any alternative method. Testing shall be carried out at the request of the Contractor. Subbase concrete failing to reach the required in situ compressive strength shall not be retested for at least 72 hours after the determination of the value of the in situ compressive strength. ***Non-conformance and Coring***

C247.19 SPECIMENS CUT FROM THE WORK

1. Specimens cut from the work shall be tested in a NATA registered laboratory nominated by the Contractor. Specimens shall be in the form of cylindrical cores of hardened concrete. ***Test Specimens***

2. Cores shall be secured, accepted, cured, capped and tested in accordance with AS 1012. 14 with the following amendments:- ***Specimen Characteristics***

   (a) The requirement that the concrete shall be at least 28 days old before the core is removed shall not apply. However, concrete must have hardened enough to permit removal without disturbing the bond between the mortar and the coarse aggregate.

   (b) The preferred dimension for cores shall be 100mm diameter but in no case shall the diameter be less than 75mm or two and one half times the nominal size of the coarse aggregate, whichever is the greater.

   (c) When inspected in the uncapped state, cores shall be rejected if any diameter departs by more than 5mm from the mean diameter.

   (d) Cores shall be rejected where the length of the core when ready for capping is less than the diameter. The test strength determined shall be adjusted for form by a factor in accordance with Table C247.3.

   (e) Wet Conditioning only shall be used.

Length/Diameter Ratio	Correction Factor
2.00	1.00
1.75	0.98
1.50	0.96
1.25	0.93
1.00	0.89

NOTE: For intermediate form ratios, the factor shall be determined by interpolation.

Table C247.3 - Core Strength Factor

3. Core cutting shall be carried out by the Contractor in the presence of and at the locations nominated by the Superintendent. The frequency of coring shall be such that a core is taken to represent each lot or the area of subbase placed between any two consecutive construction joints whichever is the lesser. The lot represented by each core shall be nominated by the Contractor at the time of sampling and duly recorded prior to testing. ***Frequency of Coring***

4. Cores shall be despatched to arrive at the testing laboratory within 24 hours of the core being cut from the subbase. Wet curing shall commence within 24 hours of the receipt of the cores. ***Curing of Cores***

5. The cost of cutting and transporting the cores to the testing laboratory and restoring all holes in the subbase shall be borne by the Contractor. The method of restoration shall be approved by the Superintendent. ***Cutting Cores Contractor's Cost***

6. The cost of core preparation for testing, curing and testing shall be borne by the Contractor. ***Testing Contractor's Cost***

C247.20 ACCEPTANCE OF CORED CONCRETE FOR COMPRESSIVE STRENGTH

1. Concrete shall achieve an in situ compressive strength of 5MPa within 28 days of placement. ***Strength Requirement***

2. If the specimen cut from the subbase reaches 4MPa for in situ compressive strength, base paving may proceed. ***Core Strength***

3. No payment shall be made for the rejected concrete nor any bond breaker placed. ***Rejected Concrete***

4. The cost of removal of rejected concrete, including its legal and responsible disposal from the site, shall be borne by the Contractor. ***Contractor's Cost***

C247.21 CONFORMANCE FOR THICKNESS

(a) General

1. No thickness measurements will be carried out if the surface of the subbase is within the level tolerances as specified in Clause C247.32(b). ***Conforming Tolerances***

2. If scabbling is required to achieve the level tolerance limits, the Superintendent may order thickness checks to be carried out. Where the survey ground model of the subgrade is available, subbase thickness shall be calculated from levels taken on a 5m grid on the plan area. Alternatively, the Superintendent may authorise coring and measurement at the edges of the layer. ***Thickness Measurement***

3. Thickness measurements shall be rounded off to the nearest 5mm.

(b) Thickness Below Specification

1. After making due allowance for the tolerances, subbase which is more than 20mm below the theoretical thickness shall be rejected and removed from the site. The cost of removal and disposal from the site shall be borne by the Contractor. ***Remove and Replace***

2. Subbase which is 20mm or less below the theoretical thickness may be accepted by the Superintendent providing that it represents isolated sections within a lot and such sections comprise less than 10 per cent of the area of the lot. ***Acceptance***

PRODUCTION, TRANSPORT AND CONSISTENCY OF CONCRETE

C247.22 PRODUCTION AND TRANSPORT OF CONCRETE

1. At least four weeks before commencing work under this Specification, the Contractor shall submit, for the information of the Superintendent, details of the proposed methods of handling, storing and batching materials for concrete, details of proposed mixers and methods of agitation, mixing and transport. ***Contractor's Responsibility***

C247.23 HANDLING, STORAGE AND BATCHING MATERIALS

1. The methods of handling, storing and batching materials for concrete shall be in accordance with AS 1379, with the following additional requirements:- ***Methods***

   (a) Certificates of Calibration issued by a recognised authority shall be made available for inspection by the Superintendent, as evidence of the accuracy of the scales.

   (b) Cementatious material shall be weighed in an individual hopper, with the cement weighed first.

   (c) The moisture content of the aggregates shall be determined at least daily immediately prior to batching. Corresponding corrections shall be made to the quantities of aggregates and water.

   (d) Where a continuous type mixer is employed, the components shall be measured by a method of continuous weighing approved by the Superintendent, except for liquids which may be measured by volume or flow rate meter.

C247.24 MIXERS AND AGITATION EQUIPMENT

1. Details of proposed mixers and agitation methods shall be in accordance with the plant and equipment sections of AS 1379, with the following additional requirement that in Appendix A of AS 1379 the maximum permissible difference in slump shall be 10mm. ***Requirements***

C247.25 MIXING AND TRANSPORT

1. Mixing and transport methods shall be in accordance with the production and delivery sections of AS 1379, with the following additional requirements:- ***Methods***

   (a) The mixer shall be charged in accordance with the manufacturer's instructions.

   (b) For the purpose of conducting mixer uniformity tests in accordance with Appendix A of AS 1379 on a split drum mixer producing centrally mixed concrete, the whole of the batch shall be discharged into the tray of a moving vehicle. The concrete shall then be sampled from the tray of the vehicle at points approximately 15 per cent and 85 per cent along the length of the tray.

(c) For truck-mixed concrete, addition of water in accordance with the batch production section of AS 1379 shall be permitted only within ten minutes of completion of batching and within 200m of the batching facilities. The delivery docket must clearly indicate the amount of water added, but in no circumstance shall the water : cement ratio be exceeded. Mixing of the concrete shall be completed at that location.

(d) After addition of the cement to the aggregate, concrete shall be incorporated into the work within:-

(i) One and a half hours, where transported by truck mixer or agitator

(ii) One hour, where transported by non-agitating trucks

Means of verification, satisfactory to the Superintendent, of the times of addition of cement to the aggregate shall be provided.

The times within which the concrete shall be incorporated into the work may be reduced if the Superintendent considers the prevailing weather, mix type, or materials being used warrant such a change.

(e) The size of the batch in an agitator vehicle shall not exceed the manufacturer's rated capacity nor shall it exceed 80 per cent of the gross volume of the drum of the mixer

C247.26 MAXIMUM MIXING TIME

1. Where by reason of delay, it is necessary to hold a batch in the mixer, mixing may be continued for a maximum of ten minutes except for split drum mixers where the maximum shall be five minutes. ***Batch in Mixer***

2. For longer periods, the batch may be held in the mixer and turned over at regular intervals, subject to the time limits specified for incorporation of the concrete into the work not being exceeded. ***Long Delays***

C247.27 CONSISTENCY

1. The consistency of the concrete shall be such as to allow the production of a dense, non-segregated mass with bleeding limited so as to prevent bleed water flowing over the slab edge under the conditions of placement. If bleed water does so flow, the Contractor shall cease paving until the consistency of the mix is adjusted to prevent flow or the mix is redesigned and approved by the Superintendent. The edge produced shall maintain its shape and shall not sag or tear. ***Requirements***

2. The Contractor shall provide all equipment, materials and labour for consistency testing and shall carry out tests in the presence of the Superintendent. The cost of consistency testing shall be borne by the Contractor. ***Contractor's Cost***

3. The consistency of the concrete shall be checked by use of a slump cone in accordance with AS 1012.3.1. The test shall be made on concrete samples obtained in accordance with AS 1012.1. ***Test Method***

4. Check tests shall be done on each truckload of concrete. ***Check Tests***

PLACING AND FINISHING CONCRETE SUBBASE

C247.28 GENERAL

1. At least four weeks before commencing work under this Specification, the Contractor shall submit as part of the Quality Plan, for the information of the Superintendent, full details of the equipment and methods proposed for placing and finishing the concrete subbase together with a paving plan showing proposed paving widths, sequence and estimated daily outputs. ***Contractor's Responsibility***

2. The Contractor shall give the Superintendent seven days written notice of the intention to commence construction of the subbase on any section of work (including the placement of the trial subbase in accordance with Clause C247.49). ***Written Notice***

3. The surface on which concrete subbase is to be placed shall be clean and free of loose or foreign matter and in damp condition. ***Surface Conditions***

4. Concrete shall not be placed either during rain or when the air temperature in the shade is below 5°C or above 38°C. ***Air Temperature Limits***

5. The temperature of the concrete placed in the work shall be neither less than 10°C nor more than 32°C. ***Concrete Temperature Limits***

C247.29 RATE OF EVAPORATION

1. When the value of Rate of Evaporation, determined from the graph in Figure C247.1, exceeds 0.50 kilograms per square metre per hour the Contractor shall take precautionary measures, satisfactory to the Superintendent, for the prevention of excessive moisture loss. If, in the opinion of the Superintendent, such precautionary measures prove to be unsatisfactory, the Contractor shall cease work while the evaporation rate is in excess of 0.50 kilograms per square metre per hour. ***Evaporation Limit***

2. The cost of such precautionary measures shall be borne by the Contractor. ***Contractor's Cost***

3. Should the Contractor elect to use an evaporation retarder to prevent excessive moisture loss, application shall be by fine spray after all finishing operations, except minor manual bull-floating, are complete. ***Evaporation Retarder***

4. The Contractor shall be responsible for measuring and recording concrete temperature and wind velocity at the point of concrete placement, and for continuously measuring and recording air temperature and relative humidity daily, at the site throughout the course of the work. The Contractor shall provide and maintain all equipment and shall provide suitable personnel necessary for all such measuring and recording. ***Contractor's Responsibility***

5. The cost of providing and maintaining such equipment and providing such personnel shall be borne by the Contractor. ***Contractor's Costs***

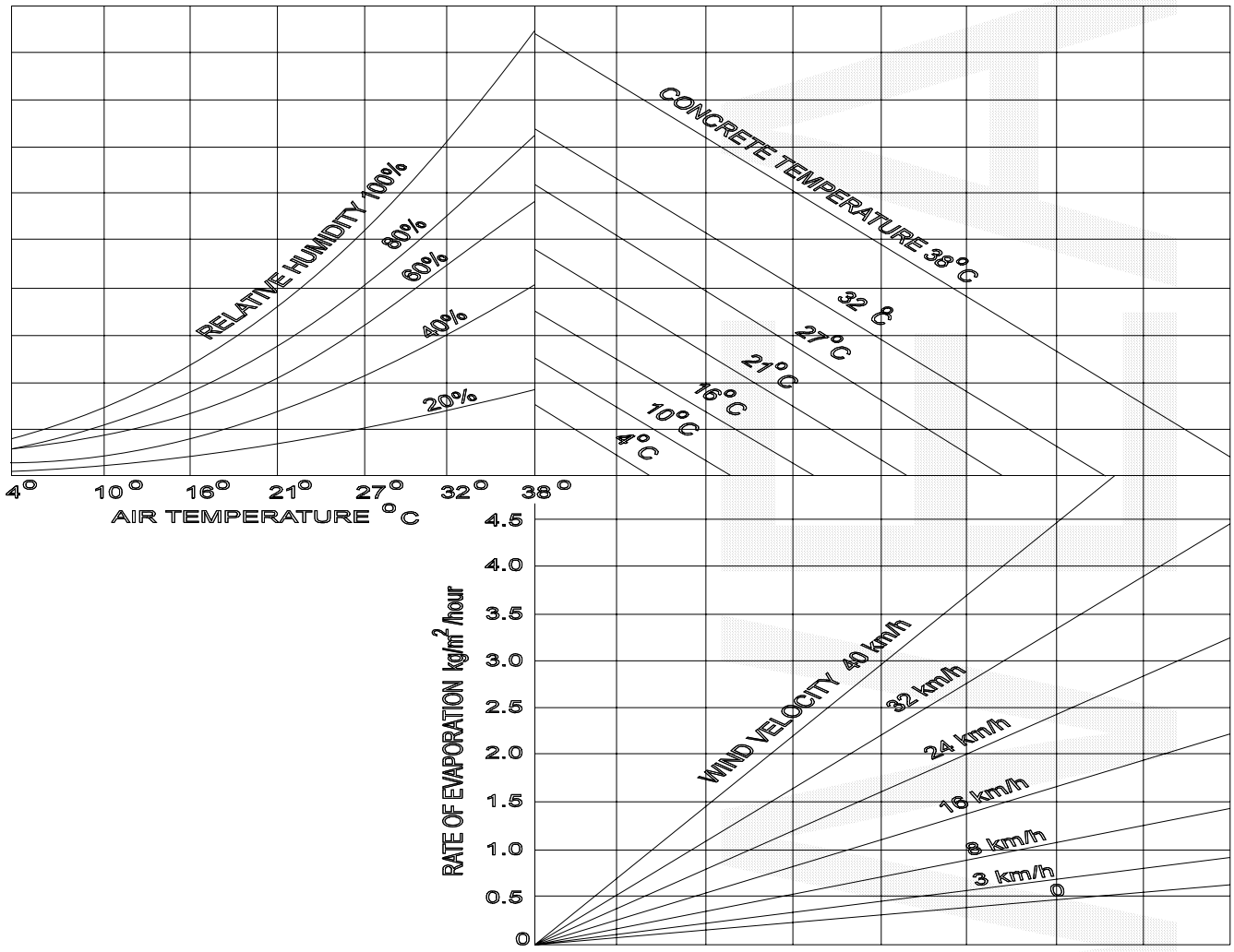


Figure C247.1 - Rate of Evaporation

The graph shows the effects of air temperature, humidity, concrete temperature and wind velocity together on the rate of evaporation of water from freshly placed and unprotected concrete.

Example:

- with air temperature at 27°C
- with relative humidity at 40%
- with concrete temperature at 27°C
- with a wind velocity of 26km/h the rate of evaporation would be 1.6 kg/m^2/hour.

To determine the evaporation rate from the graph, enter the graph at the air temperature (in this case 27°C), and move vertically to intersect the curve for relative humidity encountered - here 40%. From this point move horizontally to the respective line for concrete temperature - here 27°C. Move vertically down to the respective wind velocity curve - in this case interpolating for 26km per hour - and then horizontally to the left to intersect the scale for the rate of evaporation.

C247.30 MECHANICAL PAVING

1. The mechanical paver shall be a self-propelled machine with a gross operating mass of not less than 4 tonnes per lineal metre of paved width. It shall be capable of paving at a speed of one metre per minute or less as required to enable the continuous operation of the paver and obtain the required degree of compaction. It shall include the following features:- ***Paving Machine Requirements***

   (a) An automatic control system with a sensing device to control line and level to the specified tolerances.

   (b) Means of spreading the mix uniformly and regulating the flow of mix to the vibrators without segregation of the components.

   (c) Internal vibrators capable of compacting the full depth of the concrete.

   (d) Adjustable extrusion screed and/or conforming plate to form the slab profile and produce the required finish on all surfaces.

   (e) Capability of paving in the slab widths or combination of slab widths and slab depths shown on the Drawings.

2. The mechanical paver shall spread, compact, screed and finish the freshly placed concrete in such a manner that a minimum of finishing by hand will be required. A dense and homogeneous concrete with a surface exhibiting low permeability shall be provided. ***Concrete Finish***

3. Surface texture shall be steel screed or float finish except that a hessian dragged finish shall be provided where the subbase is to be overlain by asphaltic concrete.

4. The supporting surface for the tracks of the paver, curing machine and any other equipment in the paving and curing train shall be in a smooth and firm condition. ***Supporting Surface***

5. Once spreading commences, the concrete paving operation shall be continuous. The mechanical paver shall be operated so that its forward progress shall not be stopped due to lack of concrete. If disruptions occur for any reason, the Superintendent may direct that a construction joint be formed before the recommencement of paving operations. The cost of forming such construction joint shall be borne by the Contractor. ***Continuity of Paving Operation*** ***Contractor's Cost***

C247.31 HAND PLACING

1. Forms shall be so designed and constructed that they can be removed without damaging the concrete and shall be true to line and grade and braced in a substantial and unyielding manner. Forms shall be mortar tight and debonded to ensure non-adhesion of concrete to the forms. ***Formwork***

2. Concrete shall be delivered in agitator trucks and shall be deposited uniformly in the forms without segregation. The concrete shall be compacted by poker vibrators and by at least two passes of a hand-guided vibratory screed traversing the full width of the slab on each pass. Any buildup of concrete between the forms and vibratory screed shall be prevented. ***Placing in Forms***

3. If disruptions occur for any reason, the Superintendent may direct that a construction joint be formed before the recommencement of paving operations. The cost of forming such construction joint shall be borne by the Contractor. ***Disruption, Contractor's Cost***

4. A dense and homogeneous concrete with a surface exhibiting low permeability shall be provided. ***Concrete Finish***

5. Surface texture shall be steel screed or float finish except that a hessian dragged finish shall be provided where the subbase is to be overlain by asphaltic concrete.

C247.32 ALIGNMENT AND SURFACE TOLERANCES

(a) Horizontal Alignment Tolerance

1. The outer edges of the subbase shall be square to the subgrade and shall be constructed 50mm wider than the plan position of the base formation with a tolerance of 25mm. ***Outer Edge Location***

2. Where an edge of a slab is to form a longitudinal construction joint line, the allowable horizontal alignment tolerances shall comply with Clause C247.36 ***Longitudinal Construction Joint***

(b) Surface Tolerances

1. The level at any point on the top of the subbase shall not vary by more than 0mm above or 20mm below that shown on the Drawings or as directed by the Superintendent. Where the concrete is found to be above the level tolerance, it shall be removed. Where the concrete is found to be below level tolerance, it shall be made up with base concrete. ***Surface Levels***

2. The top surface of the subbase shall also not deviate from a 3m straightedge, laid in any direction, by more than 5mm. ***Surface Levels***

C247.33 CURING

1. The subbase shall be cured by the use of one of the following: ***Curing Compounds***

   (a) Chlorinated rubber curing compound complying with AS 3799 Class C Type 1D or resin-based curing compound complying with AS 3799 Class B, Type 1D or Type 2, if an asphalt base is used, or

   (b) White pigmented wax emulsion curing compound complying with AS 3799 Class A Type 2, if a concrete base is used, or

   (c) Bitumen emulsion Grade CRS/170 complying with AS 1160 for either asphalt or concrete base.

2. The Contractor shall submit, for the information of the Superintendent, a current Certificate of Compliance for the curing compound from an Australian Laboratory, approved by the Superintendent, showing an Efficiency Index of not less than 90 per cent when tested in accordance with Appendix B of AS 3799. ***Efficiency Index***

3. The curing compound shall be applied using a fine spray immediately following texturing at the rate stated on the Certificate of Compliance or at a minimum of 0.2 litres per square metre, whichever rate is the greater. Bitumen emulsion shall be applied at a minimum rate of 0.35 litres of residual bitumen per square metre. When applied with a hand lance the rates should be increased by 25 per cent. ***Application***

4. The average application rate shall be checked by the Contractor and certified to the Superintendent by calculating the amount of curing compound applied to a measured area representative of a lot and nominated by the Superintendent. ***Application Rate***

5. The curing membrane shall be maintained intact for seven days after placing the concrete. Any damage to the curing membrane shall be made good by handspraying of the affected areas. ***Curing Period***

6. The cost of making good such damaged curing membrane shall be borne by the Contractor. ***Contractor's Cost***

7. Equipment and materials for curing operations shall be kept on site at all times during concrete pours. ***Equipment on Site***

C247.34 PROTECTION OF WORK

1. The Contractor shall ensure that the temperature of the concrete does not fall below 5°C during the first twenty-four hours after placing. The Contractor shall provide, for the information of the Superintendent, details of procedures and equipment proposed to be used for the protection of sections recently placed in the event of low air temperatures. If the Contractor fails to maintain the temperature of the concrete at or above 5°C and if, in the opinion of the Superintendent, the concrete exhibits any deficiencies, due to failure to comply with this Specification, the concrete shall be rejected. ***Temperature Control***

2. The Contractor shall protect the work from rain damage and shall provide, for the information of the Superintendent, detailed proposals fro procedures and equipment to be used for such protection. ***Rain Protection***

3. Neither traffic nor construction equipment, other than that associated with testing, shall be allowed on the subbase until the strength of the subbase has reached at least 4.0MPa. Thereafter, only construction equipment necessary for the following operations shall be permitted to traffic the subbase:- ***Traffic Restrictions***

   (a) Bond-breaker and spall treatment and

   (b) Concrete or asphalt paving.

4. Notwithstanding the above, any damage caused to the subbase by the Contractor's operations shall be rectified to the Superintendent's satisfaction. The cost of rectifying such damage to the subbase shall be borne by the Contractor. ***Damage Restoration Contractor's Cost***

JOINTS

C247.35 TRANSVERSE CONSTRUCTION JOINTS

1. Transverse construction joints shall:

   - be provided only at discontinuities in the placement of concrete determined by the Contractor's paving operations.
   - be constructed normal to the edge line and to the dimensions shown on the Drawings.
   - not deviate from a 3m straightedge placed along the joint by more than 10mm.
   - be smooth across the joint.

C247.36 LONGITUDINAL CONSTRUCTION JOINTS

1. Longitudinal construction joints shall:
   - be formed no closer than 300mm of the base longitudinal joints as shown in the Drawings, unless directed otherwise by the Superintendent.
   - not deviate from the plan or nominated position at any point by more than 20mm.
   - not deviate from a 3m straightedge placed along the joint by more than 10mm, having made due allowances for any planned curvature.
   - be smooth across the joint.

BOND BREAKER AND SPALL TREATMENT

C247.37 GENERAL

1. Subbase to be covered by concrete base shall be provided with a wax emulsion bond breaker. The wax emulsion shall comply with AS 3799 Class A Type 2. ***Bond Breaker***

2. Where the base consists of asphaltic concrete, no bond breaker shall be used. In this case bond is essential and wax emulsion curing compounds shall not be permitted. ***No Bond Breaker***

3. Subbase with spalled areas shall be treated, where directed by the Superintendent, prior to application of the bond breaker or asphaltic concrete. ***Spalled Areas***

C247.38 PREPARATION OF SUBBASE

1. Immediately prior to any spalled area treatment and the application of bond breaker, the subbase surface shall be cleaned to the satisfaction of the Superintendent of all loose, foreign and deleterious material. ***Subbase Preparation***

C247.39 TREATMENT OF SPALLING

1. Where directed by the Superintendent, spalled areas shall be treated before the application of the bitumen bond breaker or asphaltic concrete by infilling with 6:1 sand/cement mortar to provide a surface flush with the surrounding concrete. The area shall be wetted and sprinkled with neat cement before screeding the mortar into the patches. ***Method***

2. A spalled area, if directed to be treated, shall have such treatment completed no earlier than five working days before the application of the bond breaker. Treated spalled areas damaged by the Contractor or others shall be made good by the Contractor. ***Spalling Repair Time***

3. The cost of making good treated spalled areas which have been damaged shall be borne by the Contractor. ***Contractor's Cost***

C247.40 APPLICATION OF BOND BREAKER

1. The wax emulsion used as bond breaker should be the same as used for curing compound. This second application shall be applied at a minimum rate of 0.2 litres per square metre and not earlier than 72 hours before the placement of the base concrete. ***Wax Emulsion***

2. The method of application shall conform to the requirements of Clause C247.33.

C247.41 TREATMENT OF UNPLANNED CRACKS

1. The Superintendent shall direct treatment of unplanned cracks whose width exceeds 0.3mm. This may take the form of applying an approved 300mm minimum width geotextile backed polymer modified bitumen strip (reference AUSTROADS Guide to Geotextiles) over the crack prior to placement of the first asphalt base layer or concrete base, or an extra application of wax emulsion for a width of 300mm along the crack when a concrete base is required.

2. The Contractor shall install the Stress Alleviating Membrane strip in accordance with the manufacturer's instructions.

SUBGRADE BEAMS

C247.42 GENERAL

1. Subgrade beams shall be provided below the subbase at expansion joints and isolation joints in the concrete base as shown in the Drawings or as directed by the Superintendent. They shall extend the full length of joints unless otherwise indicated on the Drawings. ***Scope***

C247.43 EXCAVATION

1. Excavation for subgrade beams shall be to the dimensions shown on the Drawings. All loose material shall be removed and the vertical faces trimmed to neat lines. The bottom of the trench shall be recompacted, where required, to the degree of consolidation of the adjacent undisturbed material. ***Excavation Standards***

2. Excavated material shall be legally disposed of by the Contractor. ***Disposal of Excavated Materials***

C247.44 CONCRETE

1. Concrete in subgrade beams shall comply with the requirements of the Specification for MINOR CONCRETE WORKS. The minimum compressive strength at 28 days shall be 32MPa. ***Compressive Strength***

C247.45 STEEL REINFORCEMENT

1. Steel reinforcement shall be of the type and size shown on the Drawings and shall be supplied and installed in accordance with the Specification for PLAIN OR REINFORCED CONCRETE BASE. ***Type and Size***

C247.46 CONSTRUCTION AND PROTECTION

1. Subgrade beams shall be constructed before construction of the subbase. The top surface of the subgrade beam shall be level with the top of the subgrade. Any loose subgrade material shall be recompacted to the correct level. If the contractor elects to remove any loose material, the voids shall be filled with mortar or concrete and screeded to provide a surface flush with the top of the subgrade beam and the surrounding subgrade. ***Timing and Type of Finish***

2. A steel float shall be used to produce a smooth surface finish, free of any texture.

3. The subgrade beams shall be protected from damage by plant, motor vehicles and the paving operation. Any damage shall be made good by the Contractor. The cost of making good such damage to the subgrade beams shall be borne by the Contractor.

Damage Protection Contractor's Cost

C247.47 CURING

1. The top surface of the subgrade beam shall be cured in accordance with Clause C247.33 before placing the subbase.

Curing

C247.48 BOND BREAKER

1. The top surface of the subgrade beam shall be treated with a bond breaker which shall consist of a further application of curing compound neither less than twenty-four hours nor more than seventy-two hours before placing of subbase concrete.

Time of Placement

TRIAL CONCRETE SUBBASE

C247.49 GENERAL

1. Before the commencement of paving, the Contractor shall construct a trial section of concrete subbase on the carriageway to demonstrate to the Superintendent the Contractor's capability of constructing subbase in accordance with the Specification. This section shall be constructed so that it may be incorporated in the finished work.

Location

2. The trial subbase shall be constructed using the same materials, concrete mix, equipment and methods the Contractor intends to use for the remaining subbase work. The Contractor shall demonstrate the methods proposed to be used for texturing, the application of curing compound and the construction of joints.

Purpose

3. The trial shall also be used to demonstrate that the Contractor's allowances for concrete strength, compaction and slab thickness are adequate to achieve the minimum requirements specified.

Quality Parameters

4. A trial length of between 100m and 200m or lesser length in compliance with Council requirements for mechanical paving equipment or between 20m and 50m for hand placement is required. The trial length shall be the maximum width proposed to be laid, and shall be constructed in one continuous operation.

Dimensions

5. Unless advised by the Superintendent of any deficiencies in the trial concrete subbase, due to failure to comply with this Specification, the Contractor may proceed with placing concrete subbase from a time five working days after the completion of the trial concrete subbase or such earlier time as the Superintendent may allow. In the event of deficiencies in the trial concrete subbase, the Superintendent may order the Contractor to construct a further length of trial concrete subbase which shall be treated as the first. If, after three trials, the subbase still is deficient in some way, the Superintendent may require the Contractor to justify to the satisfaction of the Superintendent why the work should be allowed to continue using that method and/or equipment and/or materials and/or personnel.

Deficiencies in Trial Section

6. The Superintendent shall have the right to call for a new trial section at any stage of work under the contract when changes by the Contractor in the equipment, materials, mix, plant or rate of paving are deemed by the Superintendent to warrant such procedure or when concrete as placed does not comply with this Specification. ***New Trial Section***

7. Trial concrete subbase, which does not comply with the Specification, shall be rejected by the Superintendent and shall be removed and disposed from the site by the Contractor. ***Payment***

8. The cost of removal of rejected trial concrete subbase and the cost of making good any damage caused by such removal to the subgrade or subgrade beams shall be borne by the Contractor. ***Contractor's Cost***

LIMITS AND TOLERANCES

C247.50 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C247.4 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Materials for Concrete**		
	a. Misshapen Particles	2 : 1 ratio < 35 percent	C247.09a
	b. Aggregates Grading	Deviation from submitted sample not greater than Table C247.1	C247.09b
	c. Durability	Wet Strength > 50 kN 10% Fines < 35 percent	C247.09c
2.	**Concrete**		
	a. Shrinkage	Drying Shrinkage <450 microstrain	C247.12
	b. Consistency	Mechanically placed: >25mm<40mm Hand Placed: >50mm <65mm	C247.13
	c. Air Content	≥3, ≤7 percent	C247.14
	d. Thickness	Concrete shall be removed if thickness >20mm below specified thickness.	C247.21
	e. Mixing and Transport	After addition of cement to the aggregate, concrete shall be incorporated into the work within: (i) One and a half hours where transported by truck mixer or agitator. (ii) One hour where transported by non agitating trucks.	C247.25
	f. Placing	Concrete shall not be placed when the air temperature in the shade is less than 5°C or >38°C. Temperature of concrete shall be >10°C but <32°C.	C247.28
		Concrete shall not be placed when the Rate of Evaporation exceeds 0.5kg per square metre per hour.	C247.29

Item	Activity	Limits/Tolerances	Spec Clause
3.	**Alignment and Surface Tolerances**		
	a. Horizontal Alignment	Outer edges not to deviate from plan position by more than ⩽25mm.	C247.32
	b. Surface	Level on top surface to be no more than +0mm or -20mm to that shown on the drawings.	C247.32
		The top surface shall not deviate from a 3m straightedge laid in any direction by more than 5mm.	C247.32
4.	**Joints**		
	a. Transverse Construction	Shall not deviate from a 3m straight-edge placed along the joint by more than 10mm.	C247.35
	b. Longitudinal Joint	(i) Shall not deviate from the plan or nominated position at any point by more than 20mm.	C247.36
		(ii) Shall not deviate from a 3m straightedge placed along the joint by more than 10mm after allowing for any curvature.	
5.	**Bond Breaker**		
	a. Wax Emulsion	Minimum 0.2 litres per square metre, not earlier than 72 hours before placement of base.	C247.40

Table C247.4 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

C247.51 RESERVED

C247.52 RESERVED

C247.53 RESERVED

C247.54 RESERVED

C247.55 RESERVED

C247.56 RESERVED

MEASUREMENT AND PAYMENT

C247.57 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed under this Specification in accordance with Pay Items C247(a) to C247(e) inclusive.

2. A lump sum price for any of these items shall not be accepted.

3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. The cost of all work, materials and equipment shall be included in the schedule rate for each Pay Item.

5. Concrete and steel reinforcement for subgrade beams is measured and paid in accordance with this Specification and not in the Specifications for MINOR CONCRETE WORKS and PLAIN OR REINFORCED CONCRETE BASE.

6. Base slab anchors are measured and paid in accordance with the Specification for PLAIN OR REINFORCED CONCRETE BASE.

Pay Item C247(a) SUPPLY AND PLACE CONCRETE IN SUBBASE

1. The unit of measurement shall be the cubic metre in place.

2. The width and length shall be as specified on the Drawings or as directed by the Superintendent.

3. The depths shall be the depths specified or as directed by the Superintendent across each section.

4. No account shall be taken of the allowable tolerances.

5. The cost of providing transverse construction joints and longitudinal construction joints shall be included in the schedule rate for this Pay Item.

Pay Item C247(b) FINISH AND CURE SUBBASE

1. The unit of measurement shall be the square metre of subbase.

2. The width and length shall be taken as specified on the Drawings or as directed by the Superintendent.

3. No account shall be taken of the allowance tolerances.

4. The sides of slabs shall not be included in the measurement of surface area.

Pay Item C247(c) CRACK TREATMENT (FOR ASPHALT BASES)

1. The unit of measurement shall be the linear metre.

2. The quantity is a provisional quantity. The actual lengths shall be measured on site.

3. The rate shall include supply and installation of the Stress Alleviating Membrane strip.

Pay Item C247(d) BOND BREAKER

1. The unit of measurement shall be the square metre.

2. The area shall be determined by multiplying the actual length with design width as shown on the Drawings. No account shall be taken of tolerances.

Pay Item C247(e) SUBGRADE BEAMS

1. The unit of measurement shall be the cubic metre.

2. The volume shall be determined by multiplying the width, length and depth as specified on the Drawings or as directed by the Superintendent.

3. The rate shall include all activities and materials to complete the subgrade beams as shown on the Drawings.

QUEENSLAND

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C248

PLAIN OR REINFORCED CONCRETE BASE

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C248
PLAIN CONCRETE BASE

CLAUSE **CONTENTS** **PAGE**

SPECIFICATION C248
PLAIN OR REINFORCED CONCRETE BASE

GENERAL

C248.01 SCOPE

1. The work to be executed under this Specification consists of the construction, by mechanical or hand placement of plain or reinforced concrete base, including trial sections, slab anchors and terminal slabs to the dimensions and levels shown on the Drawings and in accordance with the provisions of the Contract.

2. The work also includes the construction of reinforced concrete approach slabs at bridge abutments, traffic signal approach slabs, intersection and local area traffic device slabs where specified on the Drawings. ***Approach Slabs***

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***

C248.02 THICKNESS AND LEVELS OF BASE

1. The base thickness and levels shall be shown on the Drawings.

C248.03 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

C224	-	Open Drains including Kerb and Gutter
C231	-	Subsoil and Foundation Drains
C247	-	Mass Concrete Subbase

(b) Australian Standards

AS 1012.1	-	Sampling fresh concrete.
AS 1012.3.1	-	Determination of properties related to the consistence of concrete - Slump test.
AS 1012.4.2	-	Determination of air content of freshly mixed concrete - Measuring reduction in air pressure in chamber above concrete.
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 1012.12.2	-	Determination of mass per unit volume of hardened concrete - Water displacement method.
AS 1012.13	-	Determination of the drying shrinkage of concrete for samples prepared in the field or in the laboratory.
AS 1012.14	-	Securing and testing cores from hardened concrete for compressive strength or indirect tensile strength.
AS 1141.11	-	Particle size distribution by dry sieving.
AS 1141.14	-	Particle shape by proportional calliper.
AS 1141.18	-	Crushed particles of coarse aggregates.

AS 1141.22	-	Wet/dry strength variation.
AS 1141.24	-	Soundness (by use of sodium sulphate solution).
AS 1160	-	Bitumen emulsions for construction and maintenance of pavements.
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 2758.1	-	Concrete aggregates.
AS 3582.1	-	Supplementary Ccmentitious materials - flyash.
AS 3799	-	Liquid membrane - forming curing compounds for concrete.
AS 3972	-	Portland and blended cement.

(c) NSW RTA Test Methods

T 1160	-	Low Temperature Recovery of Preformed Polychloroprene Elastomeric Joint Seals for Bridge Structures.
T 1161	-	High Temperature Recovery of Polychloroprene Elastomeric Joint Seals for Bridge Structures.
T 1163	-	Resistance of Vulcanised Rubber to the Absorption of Oil.
T1192	-	Adhesion of Sealant.
T1193	-	Accelerated Ageing of Cured Sealant.

(d) ASTM Standards

D792	-	Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
C793	-	Test Method for Effects of Accelerated Weathering on Elastomeric Joint Sealants.
C794	-	Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
D2240	-	Test Method for Rubber Property Durometer Hardness.
D2628	-	Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete.
D2835	-	Specification for Lubricant for Installation of Preformed Compression Seal in Concrete Pavements.

(e) US Military Specifications

MIL-S-8802	-	Sealing Compound, Temperature Resistant, Integral Fuel Tanks and Fuel Cell Cavities, High Adhesion.

MATERIALS FOR CONCRETE

C248.04 CEMENT

1. Cement shall be Type GP Portland cement complying with AS 3972 and shall be from a source approved under the Queensland Government's State Purchasing Policy.

2. When submitting details of the nominated mix in accordance with Clause C248.19 the Contractor shall nominate the brand and source of the cement. On approval of a nominated mix by the Superintendent, the Contractor shall use only the nominated cement in the work. ***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 stage of the work. ***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, a re-test shall be required to ensure the cement still complies with AS 3972, before the cement is used in the work. ***Storage Time***

5. The cost of re-testing the cement shall be borne by the Contractor and results of the testing forwarded to the Superintendent. ***Contractor's Cost***

6. 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***

C248.05 FLYASH

1. Flyash shall be from a source approved under the Queensland Government's State Purchasing Policy. The use and quality of flyash shall comply with AS 3582.1.

2. When submitting details of the nominated mix in accordance with Clause C248.19, the Contractor shall nominate the powerhouse source of the flyash. The Contractor shall use only flyash from the nominated powerhouse. ***Source***

3. Documentary evidence of the quality and source of the flyash shall be furnished by the Contractor to the Superintendent. ***Documentary Evidence***

C248.06 WATER

1. Water used in the production of concrete shall be free from materials harmful to concrete or reinforcement, and be neither salty nor brackish. ***Quality***

C248.07 ADMIXTURES

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. An air-entraining agent shall be included in the mix and the air content of the concrete shall comply with Clause C248.13. ***Quality and Use***

2. Fresh concrete with an air content not complying with Clause C248.13 shall be rejected. ***Excess Air Content***

3. 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 C248.12. 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 C248.19. ***Retarder for Warm Season***

4. 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. If the Contractor proposes to vary the admixture between the warm and cool seasons such variation shall constitute a proposed change to an approved mix for the purposes of Clause C248.21. ***Retarder for Cool Season***

5. When submitting details of the nominated mix in accordance with Clause C248.19, the Contractor shall nominate the proprietary source, type and name for each admixture to be used. Documentary evidence of the quality shall be furnished by the Contractor to the Superintendent upon request at any stage of the work. ***Source and Type***

C248.08 AGGREGATES

(a) General

1. At least 40 per cent by mass of the total aggregates in the concrete mix shall be quartz sand. Quartz sand is aggregate having a nominal size of less than 5mm and shall contain at least 70 per cent quartz, by mass. Where present, chert fragments will be regarded as `quartz' for the purpose of this specification, but the ratio of chert to quartz shall not exceed unity. ***Quartz Sand Content***

2. When submitting details of the nominated mix in accordance with Clause C248.19, the Contractor shall nominate the sources of aggregate to be used in the concrete and shall submit details of the geological type of each aggregate. ***Source and Type***

(b) Fine Aggregate

1. Fine aggregate shall consist of clean, hard, tough, durable, uncoated grains uniform in quality. Fine aggregate shall comply with AS 2758.1 in respect of bulk density, water absorption (maximum 5 per cent), material finer than 2 micrometres, and impurities and reactive materials. The sodium sulphate soundness, determined by AS 1141.24, shall not exceed the limits in Table C248.1. ***Quality***

Australian Standard Sieve	Per Cent Loss by Mass
4.75mm to 2.36mm	4
2.36mm to 1.18mm	6
1.18mm to 600μm	8
600μm to 300μm	12

Table C248.1 - Sodium Sulphate Soundness Limits

2. In the case of a blend of two or more fine aggregates, the above limits shall apply to each constituent material. ***Blending***

3. The grading of the fine aggregate, determined by AS 1141.11, shall be within the limits given in Table C248.2. ***Grading***

4. When submitting details of the nominated mix the Contractor shall submit to the Superintendent a NATA Certified Laboratory Test Report on the quality and grading of the fine aggregate proposed to be used. The grading shall be known as the "proposed fine aggregate grading". ***Proposed Grading***

5. If the Contractor proposes to blend two or more fine aggregates to provide the proposed grading then Test Reports for each constituent material shall be submitted separately and the Superintendent advised of the proportions in which the various sizes and constituents are to be combined. The fine aggregate from each source and the combined aggregate shall comply with the requirements of this clause. ***Test for Each Constituent***

6. The grading of the fine aggregate used in the work shall not deviate from that of the proposed grading by more than the amounts in Table C248.2. ***Grading Deviation***

7. Notwithstanding these tolerances, the fine aggregate used in the work shall comply with the limits shown in Table C248.2.

Australian Standard Sieve	Proportion Passing (% of Mass of Sample)	Deviation from Proposed Grading (% of Mass of Sample)
9.50mm	100	
4.75mm	90 - 100	± 3
2.36mm	65 - 95	± 10
1.18mm	40 - 80	± 10
600μm	24 - 52	± 10
300μm	8 - 25	± 5
150μm	1 - 8	± 2
75μm	0 - 3	

Table C248.2 - Fine Aggregate Grading

(c) Coarse Aggregate

1. Coarse aggregate shall consist of clean, crushed, hard durable rock, metallurgical furnace slag or gravel. Coarse aggregate shall comply with 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. ***Quality***

2. The grading of the coarse aggregate, determined by AS 1141.11, shall be within the limits given in Table C248.3. ***Grading***

3. When submitting details of the nominated mix the Contractor shall submit to the Superintendent a NATA Certified Laboratory Test Report on the quality and grading of the coarse aggregate proposed to be used. The grading shall be known as the "proposed coarse aggregate grading". ***Proposed Grading***

4. If the Contractor proposes to blend two or more coarse aggregates to provide the proposed grading then Test Reports for each constituent material shall be submitted separately and the Superintendent advised of the proportions in which the various sizes and constituents are to be combined. The coarse aggregate from each source and the combined aggregate shall comply with the requirements of this clause. ***Test for Each Constituent***

5. The grading of the coarse aggregate used in the work shall not deviate from that of the proposed grading by more than the amounts in Table C248.3. ***Grading Deviation***

Australian Standard Sieve	Proportion Passing (% of Mass of Sample)	Deviation from Proposed Grading (% of Mass of Sample)
26.50 mm	100	
19.00 mm	95 - 100	± 2
13.20 mm	(accepted design mix)	± 5
9.50 mm	25 - 55	± 5
4.75 mm	0 - 10	± 3
2.36 mm	0 - 2	

Table C248.3 - Coarse Aggregate Grading

6. Notwithstanding these tolerances, the coarse aggregate used in the work shall comply with the limits shown in Table C248.3.

7. The coarse aggregate shall also conform to the following requirements:- ***Additional Tests***

(i) Wet Strength - AS 1141.22.

Shall not be less than 80 kN for any fraction and/or constituent.

(ii) 10 per cent Fines Wet/Dry Variation - AS 1141.22.

Shall not exceed 35 per cent for any fraction and/or constituent.

(iii) Soundness - AS 1141.24

The loss in mass when tested with sodium sulphate shall not exceed 9 per cent for any constituent.

(iv) Particle Shape - AS 1141.14

The proportion of misshapen particles (2:1 ratio) shall not exceed 35 per cent.

(v) Fractured Faces - AS 1141.18.

At least 80 per cent by mass of the particles shall have two or more fractured faces.

(d) Storage

1. Storage and handling facilities shall be such as to prevent the aggregates becoming intermixed or mixed with foreign materials, and to prevent segregation occurring. ***Facilities***

2. The area surrounding the storage facilities and mixing plant shall be so constructed that delivery vehicles, loaders and trucks shall not be capable of introducing foreign matter to the aggregates at any time. If foreign matter is introduced or the area reaches a condition where, in the opinion of the Superintendent, foreign matter may be introduced to the aggregates, production of concrete and delivery of materials shall cease until the condition is corrected to the satisfaction of the Superintendent. ***Introduction of Foreign Matter***

QUALITY REQUIREMENTS OF CONCRETE

C248.09 CEMENT AND FLYASH CONTENT

1. The minimum Portland cement content shall be 270 kilograms per yielded cubic metre of concrete. The maximum flyash content shall be 50 kilograms per yielded cubic metre of concrete. ***Cement and Flyash***

C248.10 COMPRESSIVE STRENGTH

1. The compressive strength of concrete shall be determined in accordance with AS 1012.9. The minimum compressive strength at twenty-eight days shall be 36MPa. ***Compressive Strength***

C248.11 SHRINKAGE

1. The drying shrinkage of the nominated mix, determined by AS 1012.13, shall not exceed 450 microstrain after three weeks air drying. The drying shrinkage at the nominated slump plus 10mm shall be taken as the average of the reading or readings within 5 per cent of the median of the three readings obtained in accordance with AS 1012.13. ***Shrinkage Limit***

C248.12 CONSISTENCY

1. The Contractor's nominated slump, determined in accordance with AS 1012.3.1, shall be neither less than 30mm nor more than 40mm for mechanically placed concrete and shall be neither less than 55mm nor more than 65mm for hand placed concrete. ***Slump Tolerance***

C248.13 AIR CONTENT

1. The air content of the concrete, determined in accordance with AS 1012.4.2, shall be neither less than 4 per cent nor more than 7 per cent, when discharged from the transport vehicle ready for placement. ***Tolerances***

STEEL REINFORCEMENT

C248.14 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 1.2m in length. The cost of all samples and tests shall be borne by the Contractor. ***Sampling*** ***Contractor's Cost***

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. ***Wire Chairs***

C248.15 BENDING

1. Reinforcement shall be formed to the dimensions and shapes shown on the Drawings. Reinforcement shall not be bent or straightened in a manner that will damage the material. Bars with kinks or bends not shown on the Drawings shall not be used. 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. ***Bending***

C248.16 SPLICING

1. All reinforcement shall be furnished in the lengths indicated on the Drawings. Except where shown on the Drawings, splicing of bars shall only be permitted with the approval of the Superintendent as to the location and method of splicing. ***Plan Lengths***

   The length of lapped splices not shown on the Drawings shall be as follows for unhooked bars:-

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 measured as the overlap between the outermost wire in each sheet of fabric transverse to the direction of splice. This overlap shall not be less than the pitch of the transverse wires plus 25mm. ***Splice Dimensions***

3. In welded splices, bars shall only be welded by an approved electrical method. Grade 400 deformed bars shall not be welded. ***Welded Splice***

4. Welding shall comply with AS 1554.3. The welded splice shall meet requirements of tensile and bend tests specified for the parent metal. ***Welding Standard***

C248.17 STORAGE

1. Reinforcement, unless promptly incorporated into the concrete, shall be stored under a waterproof cover and supported clear of the ground, and shall be protected from damage and from deterioration due to exposure. ***Protection of Reinforcement***

C248.18 PLACING

1. Reinforcing bars and wire reinforcing fabric shall be accurately placed to the dimensions and details shown on the Drawings. They shall be securely held by blocking from the forms, by supporting on concrete or plastic chairs or metal ***Position***

hangers, as approved by the Superintendent, and by wiring together where required using annealed iron wire not less than 1.25 mm diameter. These supports shall be in a regular grid not exceeding 1 m and steel shall not be supported on metal supports which extend to any surface of the concrete, on wooden supports, nor on pieces of aggregate.

2. Tack welding instead of wire ties may be used on reinforcing steel. Cold-worked reinforcing bars shall not be tack welded. ***Tack Welding***

3. The minimum cover of any bar to the nearest concrete surface shall be 50mm unless otherwise shown on the Drawings. ***Bar Cover***

4. Tie bars shall be placed in the pavement such that after placement they remain in their specified location. Tie bars shall not be placed through the finished upper surface of the pavement. Tie bars shall be placed either ahead of paving or by a bar vibrator into the edge of the joint or by an automatic tie bar inserter on the mechanical paver. Irrespective of the method of placement, tie bars extending from any side face of base concrete or gutter shall be anchored in a manner which will develop 85 per cent of the yield strength of the bar in tension. ***Tie Bars***

5. Placing and fastening of all reinforcement in the work shall be approved by the Superintendent before concrete is placed and adequate time shall be allowed for inspections and any corrective work which the Superintendent may require. Notice for inspection shall not be less than four working hours before the intended time of commencement of concrete placement or such time as determined by the Superintendent. ***Inspection***

DESIGN AND CONTROL OF CONCRETE MIXES

C248.19 GENERAL

1. The Contractor shall submit, for approval by the Superintendent, details of the concrete mix (or mixes) and the materials, including source, to be used for each of mechanically placed and hand placed base, including nominated slump and moisture condition of the aggregates (oven dry, saturated surface dry, or other specified moisture content) on which the mix is based. Each such mix shall be known as a 'nominated mix'. ***Nominated Mix***

2. Also, the Contractor shall provide a Certificate from a laboratory with appropriate NATA registration stating that each nominated mix and its constituents meet the requirements of this Specification. All relevant test results shall accompany the Certificate. All phases of any particular test must be performed at one laboratory. The certificate shall confirm that the required testing has been carried out in the twelve month period before the date of submission to the Superintendent. ***Certified Test Results***

3. In the tests supporting the above certification, the compressive strength gain curve shall be submitted showing the compressive strengths at ages 3, 7, 10 and 28 days determined in accordance with AS 1012.9. Each of the results shall be based on three specimens of concrete produced from a batch of the nominated mix. The compressive strength shall be the average of individual results within 2.0 MPa of the median. The compressive strength for 28 days shall not be less than 36.0 MPa. ***Compressive Strength***

4. These details shall be submitted at least 21 days before using the nominated mix in the work. ***Submission of Details***

C248.20 VARIATIONS TO APPROVED MIXES

1. The Contractor shall not make any changes to the approved mix, its method of production or source of supply of constituents without the prior written approval of the Superintendent. ***Approval for Mix Variation***

2. Where changes to an approved mix are proposed, the Contractor shall provide details of the nominated mix and materials, in accordance with Clause C248.19. If the variations to the quantities of the constituents in the approved mix are less than 10 kg for Portland cement and flyash and 5 per cent by mass for each other constituent, except admixtures, per yielded cubic metre of concrete the Superintendent may approve the changes without new trials being carried out. ***Contractor's Responsibility***

3. Notwithstanding these tolerances the minimum Portland cement content shall be 270 kilograms per yielded cubic metre of concrete and the maximum flyash content shall be 50 kilograms per yielded cubic metre of concrete. ***Content per Cubic Metre***

CONFORMANCE OF CONCRETE STRENGTH, COMPACTION AND THICKNESS

C248.21 CONCRETE CYLINDERS

(a) Test Specimens

1. Test specimens for determining the compressive strength of concrete shall be standard cylinders complying with AS 1012.8. The Contractor shall supply a sufficient number of moulds to meet the requirements for the frequency of testing specified in this Clause and shall also arrange for a laboratory with appropriate NATA registration to conduct the sampling of fresh concrete and the making, curing, delivery and testing of specimens. Copies of test results shall be forwarded to the Superintendent. ***Contractor's Responsibility***

2. Samples of concrete for testing shall be taken in accordance with AS 1012.1. The selection of the batches to be sampled shall be taken randomly. The specimens shall be moulded from each sample so that they are as identical as practicable. ***Sampling***

3. The method of making and curing specimens shall be in accordance with AS 1012.8 with compaction by internal vibration. ***Curing***

4. The Contractor shall mark the specimens for identification purposes. ***Marking***

5. The cost of all work and material required in the making, curing, delivery and testing of specimens shall be borne by the Contractor. ***Contractor's Cost***

(b) Frequency of Moulding of Test Specimens ***Moulding of Cylinders***

1. Test specimens shall be moulded as follows:-

   (i) For the determination of the compressive strength at twenty-eight days.

   For each lot of up to 50 cubic metres of concrete placed at the one time: One pair of specimens

   (ii) For the determination of the compressive strength at seven days.

   For each lot of up to 50 cubic metres of concrete placed at the one time: One pair of specimens

(iii) For the determination of compressive strength for any early testing as deemed necessary by the Contractor.

For each lot of up to 50 cubic metres of concrete placed at the one time: One pair of specimens

2. A lot is defined as a continuous pour of up to 50 cubic metres of concrete placed. ***Lot Size***

(c) Inspection, Capping and Crushing of Specimens

1. Specimens required by this Specification shall be tested at the NATA registered laboratory nominated by the Contractor. The cost of such testing shall be borne by the Contractor. ***Contractor's Cost***

2. Specimens shall be inspected, capped and crushed in accordance with AS 1012.9. ***Standards***

3. Before crushing, the mass per unit volume of the seven day specimens shall also be determined in accordance with AS 1012.12.2, so that the relative compaction of cores taken from the same lot of concrete base can be determined. ***Mass Unit Volume***

C248.22 COMPRESSIVE STRENGTH OF CONCRETE

(a) General

1. The compressive strength of the concrete represented by a pair of specimens moulded from one sample shall be the average compressive strength of the two specimens unless the two results differ by more than 3MPa, in which case the higher result shall be taken to represent the compressive strength of the lot of concrete. ***Determination of Strength***

(b) Adjustment of Test Compressive Strength for Age of Specimen

1. Should any specimen be tested more than twenty-eight days after moulding the equivalent twenty-eight day compressive strength shall be the test compressive strength divided by the factor applying to the age of the specimen at the time of the test shown in Table C248.4. For intermediate ages the factor shall be determined by interpolation. ***Strength Age Factor***

Age of Specimen at time of test (days)	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 or greater	1.25

Table C248.4 - Concrete Age Conversion Factors

(c) Conformance for Compressive Strength

1. If the 28 day compressive strength of test cylinders for any lot is less than 33MPa or greater than 45MPa, the lot represented by the test cylinders shall be removed and replaced in accordance with Clauses C248.50, C248.51 and C248.52. ***Limits***

2. In case of non-conformance the Contractor may elect to core the in situ base concrete for testing of the actual compressive strength to represent the particular lot. The locations for testing shall be nominated by the Superintendent and Councils Engineer. Such locations may be determined by the use of a nuclear density meter, or any approved alternative method. Testing shall be carried out at the request of the Contractor. Base concrete failing to reach the required in situ compressive strength shall not be retested for at least 72 hours after the determination of the value of the in situ compressive strength. ***Coring***

3. After testing for compressive strength of cores, where required, the Superintendent shall consider the test results and shall at his absolute discretion determine the compressive strength of the concrete to be either:- ***Superintendent's Absolute Discretion***

   (i) The average of the twenty-eight day compressive strength of the pair of specimens moulded at the time of placing; or

   (ii) The equivalent twenty-eight day compressive strength of the core.

4. A lot is defined as a continuous pour of up to 50 cubic metres of base represented by a pair of test specimens cast from a sample of the concrete used in its construction. ***Lot Size***

C248.23 CONFORMANCE FOR THICKNESS

1. Thickness measurements of the concrete base shall be determined by survey, measurements at the edges or by coring. Audit checks using a suitable probe may be carried out whilst the concrete is being placed. The readings shall be rounded off to the nearest 5mm. ***Thickness Measurement***

2. Base which is below the specified thickness shall be removed and replaced in accordance with Clauses C248.50, C248.51 and C248.52. ***Remove and Replace***

3. Base which is thicker than the design thickness will be acceptable provided the finish satisfies the requirements of Clause C248.31.

C248.24 RELATIVE COMPACTION OF CONCRETE

(a) Test Specimens

1. Test specimens for determining the relative compaction of the concrete placed in the work shall be cores cut from the work. Cores shall be cut from the full depth of the concrete base to the requirements of AS 1012.14, with the following exceptions:- ***Cores***

(i) The requirement that the concrete shall be at least 28 days old before the core is removed shall not apply. However concrete must be not less than three days old in the warm season and six days old in the cool season, before removal.

(ii) The nominal diameter of the cores shall not be less than 75mm.

2. The location of coring shall be chosen to exclude joints, steel reinforcement or tie bars from the core. The locations are not intended to be random, but are intended to ensure that the whole of the concrete base conforms to the minimum ***Location of Cores***

requirements of the Specification. Cores shall be marked for identification.

3. Cores shall be placed immediately either in a tank of lime saturated water or in an individual plastic bag and sealed to prevent water loss. Cores stored in plastic bags shall be kept in the shade. ***Storage***

4. Cores shall not be subjected to temperatures in excess of either ambient temperature or 23°C whichever is the higher and they shall not be subjected to temperature less than 10°C, until delivered to the testing laboratory. ***Temperature Control***

(b) Frequency of Coring

1. The Contractor shall take a minimum of one core specimen from each lot of concrete base represented by standard cylinders moulded in accordance with Clause C248.21. ***Minimum***

2. In the case of hand-placed base concrete, two cores shall be taken to represent a section of work. A section of work shall be confined between construction joints. Hand-worked or placed base that is cast with machine-placed concrete and not separated from the machine-placed concrete shall be deemed to be part of the machine-placed concrete, and be cored and tested as part of the machine-placed concrete base. ***Hand Placed Concrete***

(c) Repair of Core Holes

1. The Contractor shall clean and restore all core holes taken in the base with non-shrink cementitious concrete having a compressive strength of not less than that in the base and a maximum nominal aggregate size of 10mm. ***Contractor's Responsibility***

2. The surface of the restored hole shall be similar to the surrounding surface in texture and colour. ***Surface Condition***

3. The cost of restoring core holes shall be borne by the Contractor. ***Contractor's Costs***

(d) Testing of Cores for Compaction

1. The core specimens shall be wet conditioned in accordance with AS 1012.14 for not less than 24 hours immediately prior to testing for compaction. Testing to determine mass per unit volume shall be carried out on specimens at age seven days. ***Curing***

2. The relative compaction of a core specimen shall be the ratio, expressed as a percentage, of the mass per unit volume of the core specimen to the average mass per unit volume of the standard cylinders used to determine the seven day compressive strength from the same lot of concrete base. The mass per unit volume of both standard cylinders and cores shall be determined in accordance with AS 1012.12.2. All costs associated with obtaining, curing and testing of cores shall be borne by the Contractor. ***Relative Compaction*** ***Contractor's Cost***

(e) Conformance for Compaction

1. If the relative compaction is less than 97 per cent, the lot represented by the core shall be removed and replaced in accordance with Clauses C248.50, C248.51 and C248.52. ***Rejection Percentage***

2. Core specimens for compressive strength testing shall be wet-conditioned, prepared and tested in accordance with AS 1012.14. Cores obtained for compaction shall not be re-used for compressive strength testing. ***Core Preparation***

3. The test strength shall be adjusted for age at test in accordance with Clause C248.22 and for length/diameter ratio in accordance with Table C248.5 by multiplying by the correction factor in Table C248.5. ***Adjustment for Age***

4. If the 28 day compressive strength of the core is less than 33MPa, the lot represented by the compaction core shall be removed and replaced in accordance with Clauses C248.50, C248.51 and C248.52. ***Core Compressive Strength***

Length/Diameter Ratio	Correction Factor
2.00	1.00
1.75	0.98
1.50	0.96
1.25	0.93
1.00	0.89

Table C248.5 - Correction Factors

PRODUCTION, TRANSPORT AND CONSISTENCY OF CONCRETE

C248.25 PRODUCTION AND HANDLING OF CONCRETE

1. At least four weeks before commencing work under this Specification, the Contractor shall submit, for the information of the Superintendent, details of the proposed methods of handling, storing and batching materials for concrete, details of proposed mixers and methods of agitation, mixing and transport. ***Contractor's Responsibility***

2. The methods of handling, storing and batching materials for concrete shall be in accordance with AS 1379, with the following additional requirements:- ***Handling and Batching Methods***

   (a) Certificates of Calibration issued by a recognised authority shall be made available for inspection by the Superintendent, as evidence of the accuracy of the scales.

   (b) Cementitious material shall be weighed in an individual hopper, with the Portland cement weighed first.

   (c) The moisture content of the aggregates shall be determined at least daily immediately prior to batching. Corresponding corrections shall be made to the quantities of aggregates and water.

3. Details of proposed mixers and agitation methods shall be in accordance with the plant and equipment sections of AS 1379, with the additional requirement that in Appendix A of AS 1379 the maximum permissible difference in slump shall be 10mm. ***Mixer Requirements***

C248.26 MIXING AND TRANSPORT

1. Mixing and transport methods shall be in accordance with the production and delivery sections of AS 1379, with the following additional requirements:- ***Methods***

(a) The mixer shall be charged in accordance with the manufacturer's instructions.

(b) For the purpose of conducting mixer uniformity tests in accordance with Appendix A of AS 1379 on a split drum mixer producing centrally mixed concrete, the whole of the batch shall be discharged into the tray of a moving vehicle. The concrete shall then be sampled from the tray of the vehicle at points approximately 15 per cent and 85 per cent along the length of the tray.

(c) For truck-mixed concrete, addition of water in accordance with the batch production section of AS 1379 shall be permitted only within ten minutes of completion of batching and within 200m of the batching facilities. The delivery docket must clearly indicate the amount of water added, but in no circumstance shall the water : cement ratio be exceeded. Mixing of the concrete shall be completed at that location.

(d) Admixtures shall be separately prediluted with mixing water and shall be incorporated by a method which ensures that no adverse interaction occurs.

(e) After addition of the cement to the aggregate, concrete shall be incorporated into the work within:-

- One and a half hours, where transported by truck mixer or agitator;
- One hour, where transported by non-agitating trucks.

Means of verification, satisfactory to the Superintendent, of the times of addition of cement to the aggregate shall be provided. The times within which the concrete shall be incorporated into the work may be reduced if the Superintendent considers the prevailing weather, mix type, or materials being used warrant such a change.

(f) The size of the batch in an agitator vehicle shall not exceed the manufacturer's rated capacity nor shall it exceed 80 per cent of the gross volume of the drum of the mixer.

C248.27 MIXING TIME

1. Minimum mixing time will be as determined for the approved mix and verified when trial concrete base is constructed.

2. Where by reason of delay, it is necessary to hold a batch in the mixer, mixing may be continued for a maximum of ten minutes except for split drum mixers where the maximum shall be five minutes. ***Batch in Mixer***

3. For longer periods, the batch may be held in the mixer and turned over at regular intervals, subject to the time limits specified for incorporation of the concrete into the work not being exceeded. ***Long Delays***

C248.28 CONSISTENCY

1. At all times between mixing and discharge, the slump shall be within 10mm of the Contractor's nominated slump for the nominated mix for mechanically placed concrete and within 15mm thereof for hand placed concrete. ***Tolerances***

2. The consistency of the concrete shall be checked by use of a slump cone in accordance with AS 1012.3.1. The test shall be made on concrete samples obtained in accordance with AS 1012.1. ***Test Method***

3. The consistency of the concrete shall be checked within 30 minutes of adding cement to the aggregate. If the actual haul time exceeds 45 minutes, the consistency shall also be checked immediately prior to discharge. Concrete which is non-conforming in relation to consistency shall not be incorporated into the work. Check tests shall be done on each truck load of concrete. The cost of consistency testing shall be borne by the Contractor. ***Timing of Testing*** ***Contractor's Cost***

4. Check tests shall be done on each truckload of concrete. ***Check Tests***

PLACING AND FINISHING CONCRETE BASE

C248.29 GENERAL

1. At least four weeks before commencing work under this Specification, the Contractor shall submit as part of the Quality Plan, for the information of the Superintendent, full details of the equipment and methods proposed for placing and finishing the concrete base together with a paving plan showing proposed paving widths, sequence and estimated daily outputs. ***Contractor's Responsibility***

2. The Contractor shall give the Superintendent seven days written notice of the intention to commence construction of the base on any section of work (including the placement of the trial concrete base in accordance with Clause C248.39. ***Written Notice***

3. The subbase surface shall be clean and free of loose or foreign matter and prepared in accordance with the Specification for MASS CONCRETE SUBBASE. ***Subbase Condition***

4. Concrete shall not be placed either during rain or when the air temperature in the shade is below 5°C or above 38°C. ***Air Temperature***

5. The temperature of the concrete at the point of discharge from transport vehicles shall be neither less than 10°C nor more than 32°C. ***Concrete Temperature***

6. Where required, slab anchors shall be constructed prior to construction of the base. ***Slab Anchors***

C248.30 RATE OF EVAPORATION

1. When the value of Rate of Evaporation, determined from the graph in Figure C248.1, exceeds 0.50 kilograms per square metre per hour the Contractor shall take precautionary measures satisfactory to the Superintendent for the prevention of excessive moisture loss. If, in the opinion of the Superintendent, such precautionary measures prove to be unsatisfactory, the Contractor shall cease work while the evaporation rate is in excess of 0.50 kilograms per square metre per hour. ***Evaporation Limit***

2. Should the Contractor elect to use an evaporation retarder to prevent excessive moisture loss, application shall be by fine spray after all finishing operations, except minor manual bull-floating, are complete. ***Use of Retarder***

3. The Contractor shall be responsible for measuring and recording concrete temperature and wind velocity at the point of concrete placement, and for continuously measuring and recording air temperature and relative humidity at the site throughout the course of the work. The Contractor shall provide and maintain all equipment and shall provide suitable personnel necessary for all such measuring and recording. ***Contractor'sResponsibility***

4. The cost of providing and maintaining such equipment, providing suitable personnel and taking precautionary measures for the prevention of excessive moisture loss shall be borne by the Contractor. ***Contractor's Costs***

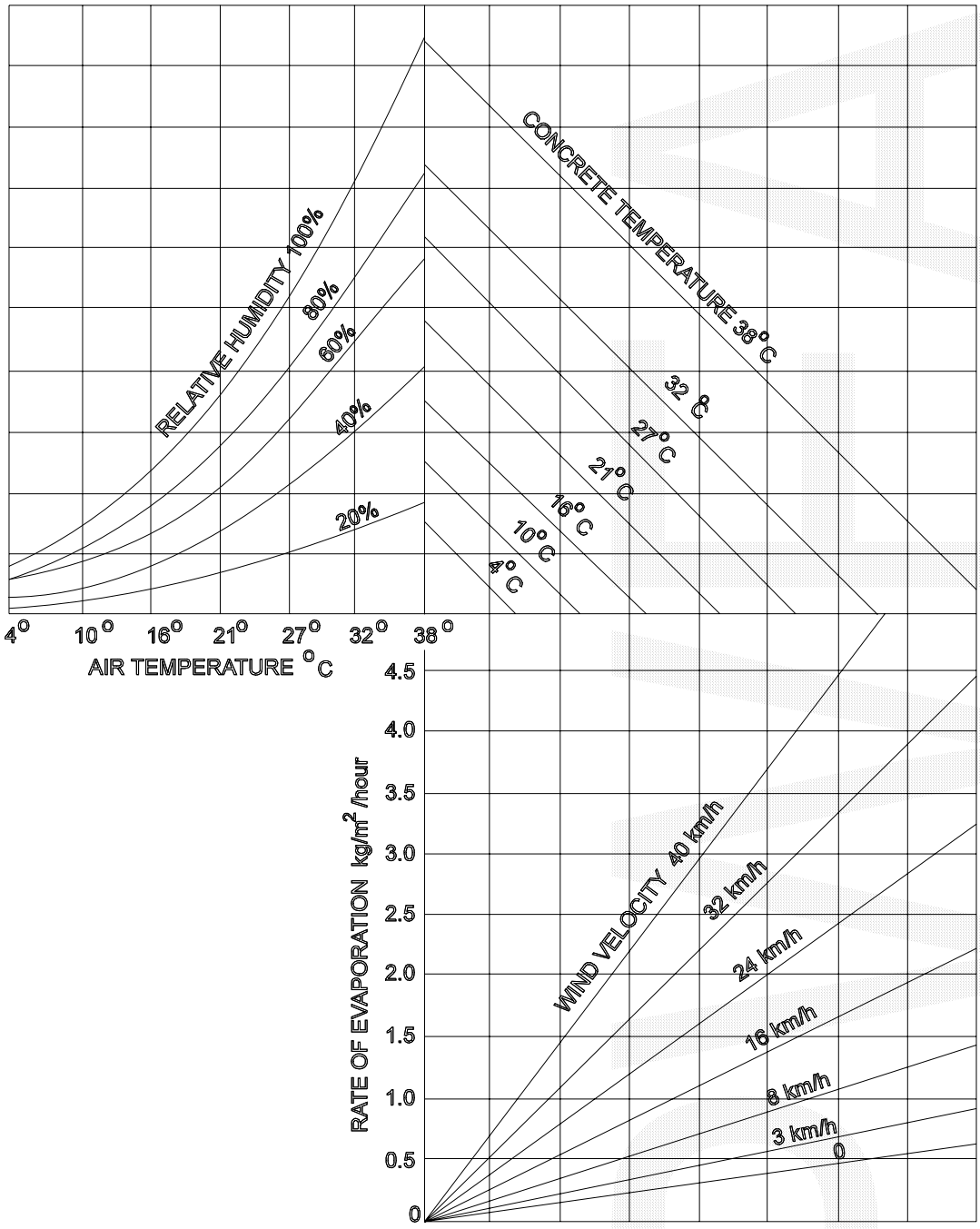


Figure C248.1 - Rate of Evaporation

The graph shows the effects of air temperature, humidity, concrete temperature and wind velocity together on the rate of evaporation of water from freshly placed and unprotected concrete.

Example:

- with air temperature at 27°C
- with relative humidity at 40%
- with concrete temperature at 27°C
- with a wind velocity of 26km/h the rate of evaporation would be 1.6 kg/m^2/hour.

To determine the evaporation rate from the graph, enter the graph at the air temperature (in this case 27°C), and move vertically to intersect the curve for relative humidity encountered - here 40%. From this point move horizontally to the respective line for concrete temperature - here 27°C. Move vertically down to the respective wind velocity curve - in this case interpolating for 26km per hour - and then horizontally to the left to intersect the scale for the rate of evaporation.

C248.31 MECHANICAL PAVING

1. The mechanical paver shall be a self-propelled machine with a gross operating mass of not less than 4 tonnes per lineal metre of paved width. It shall be capable of paving at a speed of one metre per minute or less as required to enable the continuous operation of the paver and obtain the required degree of compaction. It shall include the following features:- ***Paving Machine***
   (a) An automatic control system with a sensing device to control line and level to the specified tolerances.
   (b) Means of spreading the mix uniformly and regulating the flow of mix to the vibrators without segregation of the components.
   (c) Internal vibrators capable of compacting the full depth of the concrete.
   (d) Adjustable extrusion screed and/or conforming plate to form the slab profile and produce the required finish on all surfaces.
   (e) Capability of paving in the slab widths or combination of slab widths and slab depths shown on the Drawings.

2. The mechanical paver shall spread, compact, screed and finish the freshly placed concrete in such a manner that a minimum of finishing by hand will be required. A dense and homogeneous concrete with a surface exhibiting low permeability, shall be provided. It shall be textured in accordance with Clause C248.34. ***Concrete Finish***

3. The supporting surface for the tracks of the paver, curing machine and any other equipment in the paving and curing train shall be in a smooth and firm condition. ***Supporting Surface***

4. Once spreading commences, the concrete paving operation shall be continuous. The mechanical paver shall be operated so that its forward progress shall not be stopped due to lack of concrete. If disruptions occur for any reason, the Superintendent may direct that a construction joint be formed before the recommencement of paving operations. The cost of forming such construction joint shall be borne by the Contractor. ***Continuity of Paving Operation Contractor's Cost***

5. Where an interruption to paving occurs, which is likely to result in a non-monolithic concrete mass, the Contractor shall form a transverse construction joint in accordance with Clause C248.41. ***Interruption to Paving***

6. Should subsequent testing at the location of an interruption indicate the presence of non-monolithic concrete, such concrete shall be removed and replaced in accordance with Clauses C248.50, C248.51 and C248.52. ***Non-monolithic Concrete***

C248.32 HAND PLACING

1. Hand placement shall only be used in areas where mechanical placement is impracticable or where it has been approved by the Superintendent prior to commencement of work. ***Restriction***

2. Forms shall be so designed and constructed that they can be removed without damaging the concrete and shall be true to line and grade and braced in a substantial and unyielding manner. Forms shall be mortar tight and debonded to ensure non-adhesion of concrete to the forms. ***Formwork***

3. Concrete shall be delivered in agitator vehicles and shall be deposited uniformly in the forms without segregation. The concrete shall be compacted by poker vibrators and by at least two passes of a hand-guided vibratory screed traversing the full width of the slab on each pass. Any buildup of concrete between the forms and vibratory screed shall be prevented. ***Placing in Forms***

4. If disruptions occur for any reason, the Superintendent may direct that a construction joint be formed before the recommencement of paving operations. The cost of forming such construction joint shall be borne by the Contractor. ***Disruption, Contractor's Cost***

5. A dense and homogeneous concrete with a surface exhibiting low permeability, shall be provided. It shall be textured in accordance with Clause C248.34. ***Concrete Finish***

6. Where an interruption to placing occurs, which is likely to result in a non-monolithic concrete mass, the Contractor shall form a transverse construction joint in accordance with Clause C248.41. ***Transverse Construction Joint***

7. Should subsequent testing at the location of an interruption indicate the presence of non-monolithic concrete, such concrete shall be removed and replaced in accordance with Clauses C248.50, C248.51 and C248.52. ***Non-Monolithic Concrete***

C248.33 ALIGNMENT AND SURFACE TOLERANCES

(a) Horizontal Alignment Tolerance

1. The outer edges of the base shall be square to the subbase and shall not deviate from the plan position at any point by more than 10mm. ***Outer Edge***

2. Where an edge of a slab is to form a longitudinal joint line the allowable horizontal alignment tolerances shall comply with Clause C248.46. ***Longitudinal Joint Line***

(b) Tolerances and Rideability

1. The tolerance on thickness of the base shall be zero below the specified thickness and in accordance with Clause C248.23 for excess thickness. ***Top of Base Level***

2. The top surface of the base shall also not deviate at any measurement from a 3 m straightedge, laid in any direction, by more than 5mm. Measurements for conformance shall be taken in accordance with the maximum lot size and minimum test frequencies in the Specification Part for Quality Requirements. Notwithstanding this requirement, the surface shall not pond water. ***Surface Level***

C248.34 TEXTURING OF SURFACE

1. Texturing of the concrete surface may be effected by use of a fine broom or hessian-drag. The Contractor shall submit to the Superintendent details of the proposed texturing method and equipment.

C248.35 CURING

1. The base shall be cured by the use of one of the following: ***Compounds***

   (a) Chlorinated rubber curing compound complying with AS 3799 Class C Type 1D or resin-based curing compound complying with AS 3799 Class B, Type 1D or Type 2, if an asphalt wearing surface is used, or

   (b) White pigmented wax emulsion curing compound complying with AS 3799 Class A Type 2, if no asphalt wearing surface is used, or

   (c) Bitumen emulsion Grade CRS/170 complying with AS 1160 for either

asphalt wearing or no asphalt wearing surface.

2. The Contractor shall submit, for the information of the Superintendent, a current Certificate of Compliance from an Australian laboratory, approved by the Superintendent, showing an Efficiency Index of not less than 90 per cent when tested in accordance with Appendix B of AS 3799. ***Efficiency Index***

3. The curing compound shall be applied using a fine spray immediately following texturing at the rate stated on the Certificate of Compliance or at a minimum of 0.2 litres per square metre, whichever rate is the greater. Bitumen emulsion shall be applied at a minimum rate of 0.5 litres per square metre. When applied with an hand lance the rates shall be increased by 25 per cent.

4. The average application rate shall be checked by the Contractor and certified to the Superintendent by calculating the amount of curing compound applied to a measured area representative of a lot and nominated by the Superintendent. ***Application Rate***

5. The curing membrane shall be maintained intact for seven days after placing the concrete. Any damage to the curing membrane shall be made good by handspraying of the affected areas. ***Curing Period***

6. The cost of making good such damaged curing membrane shall be borne by the Contractor. ***Contractor's Cost***

7. Equipment and materials for curing operations shall be kept on site at all times during concrete pours. ***Equipment on Site***

C248.36 PROTECTION OF WORK

1. The Contractor shall ensure that the temperature of the concrete does not fall below 5°C during the first twenty-four hours after placing. The Contractor shall provide, for the information of the Superintendent, details of procedures and equipment proposed to be used for the protection of sections recently placed in the event of low air temperatures. If the Contractor fails to maintain the temperature of the concrete at or above 5°C and if, in the opinion of the Superintendent, the concrete exhibits any deficiencies, due to failure to comply with this Specification, the concrete shall be rejected. ***Temperature Control***

2. The Contractor shall protect the work from rain damage and shall provide, for the information of the Superintendent, detailed proposals for procedures and equipment to be used for such protection. ***Rain Protection***

3. Neither traffic nor construction equipment, other than that associated with testing, sawcutting, groove cleaning or joint sealing, shall be allowed on the finished base until the joints have been permanently sealed and at least 10 days have elapsed since placing concrete, and the concrete has reached a compressive strength of at least 20MPa. ***Traffic Restrictions***

C248.37 ODD-SHAPED AND MISMATCHED SLABS

1. A slab is a portion of concrete base bounded by joints or free edges. A slab shall be considered to be odd-shaped if the ratio of the longer dimension to the shorter dimension exceeds 1.6 or if the joint pattern produces an angle of less than 80 degrees between two adjacent sides. Slab dimensions shall be taken as the average dimension measured normal and parallel to the longitudinal joints. Slabs containing blockouts for drainage structures shall be considered as odd-shaped. ***Definition***

2. Where any joint meets a slab and is not continued across that slab, that slab shall be considered a mismatched slab.

3. Unless otherwise shown on the Drawings, odd-shaped and mismatched slabs shall be reinforced with F82 reinforcing fabric placed with 50mm to 60mm cover to the surface of the base. Fabric shall be clear of all transverse and longitudinal joints by 50mm to 100mm. ***Reinforcing Fabric***

C248.38 TERMINAL SLABS

1. Terminal slabs shall be constructed adjoining bridge approach slabs and at changes from a rigid pavement to a flexible pavement. Terminal slabs shall be constructed to the dimensions and details shown on the Drawings. ***Position***

C248.39 TRIAL CONCRETE BASE

1. Before the commencement of paving, the Contractor shall construct a trial section of concrete base on the carriageway to demonstrate to the Superintendent the Contractor's capability of constructing base in accordance with the Specification. This section shall be constructed so that it may be incorporated in the finished work. ***Location***

2. The trial base shall be constructed using the same materials, concrete mix, equipment and methods the Contractor intends to use for the remaining base work. The Contractor shall demonstrate the methods proposed to be used for texturing, the application of curing compound, the construction and sawing of joints and the placement of tie bars and dowels. ***Purpose***

3. The trial shall also be used to demonstrate that the Contractor's allowances for concrete strength, compaction and slab thickness are adequate to achieve the minimum requirements specified. ***Quality Parameters***

4. A trial length of between 20m and 100m for mechanical paving equipment or between 10m and 30m for hand placement is required. The maximum width proposed to be laid, shall be constructed in one continuous operation. ***Dimensions***

5. Unless advised by the Superintendent of any deficiencies in the trial concrete base, due to failure to comply with this Specification, the Contractor may proceed with placing concrete base from a time ten working days after the completion of the trial concrete base or such earlier time as the Superintendent may allow. In the event of deficiencies in the trial concrete base, the Superintendent may order the Contractor to construct a further length of trial concrete base which shall be treated as the first. If, after three trials, the base still is deficient in some way, the Superintendent may require the Contractor to justify to the satisfaction of the Superintendent why the work should be allowed to continue using that method and/or equipment and/or materials and/or personnel. ***Deficiencies in Trial Section***

6. The Superintendent shall have the right to call for a new trial section at any stage of work under the contract when changes by the Contractor in the equipment, materials, mix, plant or rate of paving are deemed by the Superintendent to warrant such procedure or when concrete as placed does not comply with this Specification. ***New Trial Section***

7. Trial concrete base, which does not comply with the Specification, shall be rejected by the Superintendent and shall be removed by the Contractor in accordance with Clauses C248.50, C248.51 and C248.52. ***Payment***

JOINTS

C248.40 GENERAL

1. Joints shall be provided at locations indicated on the Drawings or as approved by the Superintendent. ***Location***

C248.41 TRANSVERSE CONSTRUCTION JOINTS

1. Transverse construction joints shall: ***Location***

   - be provided only at discontinuities in the placement of concrete determined by the Contractor's paving operations.
   - not be placed closer than 1.5m to a transverse contraction joint. Where necessary, the Superintendent shall authorise a change in the spacing and/or skew of transverse contraction joints to ensure that sufficient clearance is obtained.
   - be constructed normal to the control line and to the dimensions and details shown on the Drawings. The tie bars shall comply with Clauses C248.14 and C248.18.
   - be smooth across the joint before texturing.
   - not deviate from a 3m straightedge placed along the joint by more than 10mm.

2. Prior to placing adjacent concrete the surface of the concrete shall be roughened to expose coarse aggregate. The roughened surface and the projecting reinforcement shall be washed clean and all excess water and loose material removed. ***Placing Adjoining Concrete***

C248.42 TRANSVERSE CONTRACTION JOINTS

(a) General

1. Transverse contraction joints shall be continuous across the full width of the base and shall be sawn unless otherwise approved by the Superintendent. ***Details***

2. Where the concrete base is to be overlaid with asphalt wearing course, the Superintendent may approve the joint to be formed with a suitable plastic joint inducing system.

3. Transverse contraction joints shall be constructed normal to the control line and to the dimensions and details shown on the Drawings. Where necessary, the joint may be skewed to a maximum 1 in 12 to accommodate construction joints and slab anchors. ***Skewed Joints***

(b) Sawcutting

1. The Contractor shall ensure that sawcutting be conducted between 6 and 24 hours after initial paving so as not to cause excessive ravelling of aggregate adjacent to the cut and so as to prevent cracking of the base concrete other than at the bottom of the 3mm sawcut. The Contractor shall use the type of blade and equipment and the method of control best suited to the hardness of the concrete being sawn and shall have sufficient standby equipment available on site to maintain continuity of sawing. ***Timing and Equipment***

2. The line of the transverse contraction joint shall be without any discontinuities. No edge shall deviate from a 3m straight edge by more than 10mm. ***Tolerances***

3. The surface of the transverse contraction joint shall not exhibit more than 5mm of vertical or horizontal edge ravelling. The length of edge ravelling shall not be more than 300mm in any 1m length of joint on each edge. Saw debris shall be washed from the joint and pavement immediately after sawing.

4. Sawcuts, which do not conform to the requirements of this Clause, shall be rejected by the Superintendent. Rejected sawcuts may be repaired by a method approved by the Superintendent. ***Rejected Sawcuts***

(c) Cleaning

1. Immediately after any sawing, the sawcut shall be cleaned of all debris. The cleaning method used shall not damage the sawcut nor leave any substance deleterious to the concrete or to the adhesion of the joint sealants to be used. The method shall incorporate a pressurised liquid or liquid/air jet. Cleaning liquid shall not be gravity fed from tanks. ***Debris Removed***

(d) Temporary Sealing

1. Immediately after cleaning following the second sawcut, if the transverse contraction joint is produced by a two-cut operation, the joint shall be temporarily sealed by a continuous closed-cell polyethylene backer rod of diameter shown on the Drawings or as required by the Superintendent. ***Material***

2. The top of the sealant shall be neither higher than nor more than 10 mm below the concrete surface. The backer rod shall pass over any longitudinal joint seal already in place. ***Tolerance***

3. The temporary sealant shall be maintained by the Contractor until the joint is sealed permanently. Damaged or disturbed temporary sealants shall be removed, the transverse contraction joint recleaned to the satisfaction of the Superintendent and a new temporary sealant inserted. ***Maintenance***

(e) Permanent Sealing

(i) General

1. Within ten days of initial sawing and immediately on removal of the temporary sealant, the permanent sealant shall be placed in the joint. ***Timing***

2. The permanent sealant shall be either a neoprene compression seal or an in situ cast silicone sealant. The Contractor shall submit for the approval of the Superintendent, a full technical description of the proposed sealant, including its operating parameters and the method of installation recommended by its manufacturer. ***Sealant Quality***

(ii) Neoprene Compression Sealants

1. Neoprene compression sealants shall comply with all the requirements of ASTM 2628. Test methods used to determine compliance with these requirements shall include Test Methods T1160, T1161 and T1163. ***Standards***

2. At least four weeks before installation of the sealant, the Contractor shall submit to the Superintendent a Certificate of Compliance from a NATA registered laboratory showing that the sealant meets all the requirements of ASTM 2628. ***Certification of Compliance***

3. At the time of installation, the sides of the neoprene sealant shall be coated with a clear or concrete-coloured lubricant compound approved by the ***Installation***

Superintendent and complying with ASTM D-2835. The sealant shall be inserted into the joint by means of suitable equipment which shall not damage the sealant during its insertion. The maximum increase in length of the sealant after installation shall be 5 per cent of original length. Any sealant exceeding 5 per cent extension shall be rejected. The sealant shall be located in the transverse contraction joint in the design orientation without twist or buckle.

4. The sealant shall be continuous between formed longitudinal joints. Where such a discontinuity occurs, the sealant shall be angle butt jointed by a method approved by the Superintendent. The top of the sealant shall be neither less than 5mm nor more than 7mm below the surface of the base and shall overlay any longitudinal sealants. ***Tolerances***

(iii) Silicone Sealants

1. Silicone sealants shall be formed using a silicone joint sealant complying with the requirements listed in Table C248.6. At least four weeks before the installation of the sealant, the Contractor shall submit to the Superintendent a Certificate of Compliance, from a NATA registered laboratory, showing that the sealant meets all the requirements of Table C248.6. ***Certificate of Compliance***

2. The silicone joint sealant shall be grey in colour and shall be stored and installed in accordance with the manufacturer's written instructions. Installation of a silicone sealant shall take place only when the side walls of the groove have been grit blasted and are surface dry. ***Installation***

3. Immediately before introducing the silicone sealant into the groove, any foreign or disturbed material shall be cleaned from the joint and from the top of the backer rod by dry air jet. The backer rod shall then be depressed to the depth such that the bottom of the silicone sealant shall be at the planned location and of the correct shape. ***Action Before Sealing***

4. If the backer rod is damaged in any way it shall be replaced for the full length of the joint.

5. The method to be used for permanent sealing with silicone sealant shall be approved by the Superintendent before permanent sealing commences. Notwithstanding any approval given by the Superintendent to a proposed method, the Contractor shall be responsible for producing a permanent seal complying with all requirements of this Specification. ***Contractor's Responsibility***

Test Method	Test	Requirements
ASTM-D-792	Specific Gravity	1.1 to 1.55
MIL-S-8802	Extrusion Rate	90 to 250 g per min
MIL-S-8802	Tack Free Time	30 to 70 min
ASTM D 2240	Durometer	10 to 25
T1192 T1193	Durability	Extension to 70% Compression to 50%
ASTM C794	Adhesion to Concrete	35N minimum average peel strength
ASTM C 793-7	Accelerated Weathering at 5,000 hours	No cracks, blisters or bond loss

Table C248.6 - Silicone Joint Sealant Requirements.

C248.43 TRANSVERSE ISOLATION JOINTS

1. Transverse isolation joints shall be provided at bridge approach slabs and at slab anchors where shown on the Drawings and where directed by the Superintendent. ***Location***

2. Transverse isolation joints shall be continuous across the full width of the base normal to the control line and shall be constructed in accordance with the Drawings. ***Construction***

3. Transverse isolation joints shall not be placed closer than 2m to other transverse joints. Where necessary, the Superintendent shall authorise a change in the spacing and/or skew of adjacent transverse contraction joints to ensure that sufficient clearance is obtained. ***Spacing***

4. Joint filler shall consist of preformed jointing material of bituminous fibreboard and the joint sealant shall comply with the silicone sealant requirements of Clause C248.42. They shall be installed in accordance with the Drawings and in a manner conforming to the manufacturers recommendations except that reference to backer rods shall not apply. ***Standards***

5. The line of the isolation joint shall not deviate from a 3m straightedge more than 10mm. ***Tolerance***

C248.44 LONGITUDINAL TIED JOINTS

(a) General

1. Longitudinal tied joints shall be provided at the locations shown on the Drawings or where directed by the Superintendent. The joints shall be parallel to the control line and/or to the dimensions and details shown on the Drawings. ***Location***

2. Longitudinal tied joints shall be formed or induced either by sawing or by machine insertion of a crack inducer ribbon. ***Formation***

3. The ties shall be 12mm diameter deformed steel bars Grade 400Y, 1m long and shall be inserted in accordance with Clause C248.18. Tie bars shall be located and spaced as shown on the Drawings. All parts of any tie bar shall lie within 50mm of its designed position. Tie bars shall be omitted within 500mm of a transverse joint. The epoxy to be used when installing tie bars in existing concrete shall be hydrophilic epoxy resin. The setting system used shall develop an anchorage strength at least 85 per cent of the yield strength of the bar. ***Ties***

4. The line of longitudinal tied joints shall not deviate from the designed position at any point by more than 10mm. The line shall also not deviate from a 3m straightedge by more than 10mm having made due allowance for any planned curvature. ***Tolerances***

5. Where the longitudinal tied joint is formed or slipformed, the joint face shall be corrugated in accordance with the details shown on the Drawings. ***Corrugated Joint Face***

6. Where the multi-lane width is greater than 18m, a longitudinal isolation joint shall be constructed at each location shown on the Drawings and in accordance with Clause C248.46. ***Isolation Joint***

(b) Sawn-Induced Joints

1. Sawn longitudinal tied joints shall be provided to the dimensions shown on the Drawings. Sawcutting shall comply with Clause C248.42(b). ***Location***

2. Within twenty-four hours of sawing, the longitudinal tied joint shall be thoroughly cleaned of all debris and a neoprene backing rod, shall be inserted in accordance with the details shown on the Drawings. ***Sealant Quality***

3. The sealant shall be coated with a lubricant-adhesive compound approved by the Superintendent. The compound shall have a colour compatible with the pavement colour. The sealant shall be inserted into the groove by means of suitable equipment which shall not damage the sealant during insertion. The maximum increase in length of the sealant after installation shall be 10 per cent of the original length, otherwise the sealant shall be rejected. ***Sealant Insertion***

4. Joints in the sealant shall be kept to a minimum and shall be cemented together by an adhesive recommended by the Manufacturer. The top of the sealant shall be neither less than 5mm nor more than 7mm below the surface of the base, except where the sealant is depressed to lie under the transverse joint sealant. ***Sealant Joints***

(c) Ribbon-Induced Joints

1. Ribbon-induced longitudinal tied joints shall be provided to the dimensions and details shown on the Drawings. The inducer ribbon shall be machine-inserted so that the top of the ribbon does not protrude above the surface of the base, nor shall it lie below the surface of the base by more than 3mm. ***Location and Insertion***

2. The inducer ribbon shall be a minimum of 0.5mm thick. When placed, it shall be within 5^{o} of the vertical plane. Inducer ribbon which curls on placement and when cut in the base is found to be curved in transverse section by more than 3mm from straight shall be rejected. ***Finish***

3. At transverse construction joints, the inducer ribbon shall be carried through the joint sufficiently to allow a connection by strong stapling, or other method approved by the Superintendent, to the inducer ribbon to be used on the other side of the joint. When a join is necessary in the inducer ribbon during paving, the inducer ribbon on the new spool shall be similarly joined to the tail of the inducer ribbon on the old spool. ***Join in Ribbon***

(d) Treatment of Sawn Longitudinal Tied Joints Prior to Asphalt Overlay

1. Where asphalt surfacing over sawn longitudinal tied joints is specified, the sealant shall be depressed to a depth below the concrete surface of not less than 10 mm and, following thorough cleaning, the joint shall be sealed flush with the concrete surface with a bituminous rubber compound, approved by the Superintendent, compatible with the narrow groove. ***Bituminous Rubber Compound***

C248.45 LONGITUDINAL JOINT WITH KERB AND/OR GUTTER

1. Where kerbs and/or gutters are to be constructed within the shoulder of a concrete base, they shall be formed directly onto the concrete subbase and they may be cast either integrally with the concrete base or separately. ***Form***

2. Where constructed separately, they shall be tied to the concrete base by 12mm diameter deformed steel tie bars Grade 250S or 400Y, 1000mm long at 1m centres. ***Tie Bars***

3. The longitudinal joint shall be constructed parallel to the control line (parallel to the centre line for ramps) and to the dimensions shown on the Drawings. The tie bars shall be inserted in accordance with the Drawings and Clause C248.18. ***Location***

4. The face of the longitudinal joint need not be scabbled and the joint need not be sealed. ***Face of Joint***

5. The line of the longitudinal joint shall be constructed to the tolerances specified for longitudinal tied joints in accordance with Clause C248.44. ***Tolerances***

6. The construction of kerb and/or gutter shall be in accordance with the Specification for OPEN DRAINS INCLUDING KERB AND GUTTER regardless of method of construction except that the strength of the concrete used in the kerb and/or gutter shall be 36MPa. ***Specification***

C248.46 LONGITUDINAL ISOLATION JOINTS

1. Longitudinal isolation joints shall be provided where shown on the Drawings and where directed by the Superintendent. ***Location***

2. The line of the longitudinal isolation joint shall not deviate from the specified position by more than 10mm. The line of the joint shall not deviate from a 3m straightedge by more than 10mm. ***Tolerances***

3. The joint filler shall consist of preformed jointing material of bituminous fibreboard and the joint sealant shall comply with the silicone sealant requirements of Clause C248.42. They shall be installed in accordance with the Drawings and in a manner conforming to the manufacturer's recommendations except that reference to backer rods shall not apply. ***Filler and Sealant***

SLAB ANCHORS

C248.47 GENERAL

1. Slab anchors shall be constructed normal to the control line, to the dimensions and at the locations shown on the Drawings. ***Location***

2. Slab anchors shall extend over the full width of the base and the associated transverse expansion joint shall not be placed closer than 2.0m to other transverse joints. Where necessary, the Superintendent shall authorise a change in the spacing of transverse contraction joints to ensure that this minimum clearance is obtained. ***Transverse Joint***

C248.48 EXCAVATION

1. Excavation of trenches for slab anchors shall be to the dimensions and details shown on the Drawings. ***Dimensions***

2. All loose material shall be removed and the vertical faces trimmed to neat lines. The bottom of the trench shall be recompacted, where required, to the degree of consolidation of the adjacent undisturbed material. ***Trim and Consolidate***

3. The Contractor shall dispose of excavated material at locations approved by the Superintendent. ***Spoil***

4. Where a slab anchor is required at the junction of an existing flexible pavement, a straight sawcut to the full depth of the asphaltic concrete or bituminous seal shall be made in the flexible pavement along the joint line. Excavation of the trench shall then take place as described above without disturbance or damage to the existing flexible pavement. Any disturbance or damage to the flexible pavement shall be made good as directed by the Superintendent. ***Adjacent to Flexible Pavement***

5. The cost of making good any disturbance or damage to the flexible pavement shall be borne by the Contractor. ***Contractor's Cost***

6. A subsoil drain shall be provided at the bottom of the trench, in accordance with the Specification for SUBSOIL AND FOUNDATION DRAINS and details shown on the Drawings. ***Sub-Soil Drains***

C248.49 CONCRETE

1. Concrete for slab anchors shall be produced, transported and placed in accordance with the requirements for hand-placed base concrete. ***Slab Anchors***

2. Slab anchors shall be poured separately from the base slabs to the dimensions and details shown on the Drawings up to the top surface of the subbase. ***Detail***

3. A transverse isolation joint shall be provided on the downhill side of the slab anchor. ***Isolation Joint***

4. Steel reinforcement in slab anchors shall be of the type and size shown on the Drawings and shall be supplied and fixed in accordance with Clauses C248.14 and C248.18 of the Specification. ***Steel Reinforcement***

5. Bridge approach slabs, if not in the bridge contract, shall be constructed at bridge abutments to the dimensions and details shown on the Drawings and in accordance with the requirements for base concrete. ***Bridge Approach Slabs***

REMOVAL AND REPLACEMENT OF BASE

C248.50 GENERAL

1. Where directed by the Superintendent, rejected base shall be removed and replaced in accordance with this Clause. Rejected base, which extends more than 25m longitudinally, shall be replaced by mechanical means unless the slabs are odd-shaped or mismatched. Replacement shall be in full slab widths between longitudinal joints and/or external edges. ***Replacement Method***

2. At least seven days before the commencement of base removal, the Contractor shall submit, for the approval of the Superintendent, details of the proposed methods of carrying out the work which shall be such as to prevent damage to the adjoining base and the underlying subbase. ***Details***

3. The cost of all work and materials under this Clause shall be borne by the Contractor. ***Contractor's Cost***

C248.51 REMOVAL AND DISPOSAL OF BASE

1. At each end of the section of base to be removed, a transverse sawcut shall be made for the full depth of the base layer. Such transverse sawcuts shall be normal to the control line and not closer than 1.5m to an existing contraction joint in the base. No oversawing into the adjoining base or underlying subbase shall be permitted. ***Transverse Sawcut***

2. Longitudinal sawcuts shall be made along existing longitudinal joints to define the edges of the base section to be removed. Such longitudinal sawcuts shall not extend more than 250 mm past the transverse sawcut at each end of the section to be removed and shall not extend into the underlying subbase. ***Longitudinal Sawcuts***

3. No oversawing shall be permitted on any additional internal sawcuts the Contractor may make to aid the removal of the base. ***Oversawing***

4. The Contractor shall dispose of the removed base slabs at locations acceptable ***Disposal***

to the Superintendent.

5. Any slab, adjoining the removed slabs, damaged by the Contractor's operations shall also be removed and replaced in accordance with this Clause. ***Contractor's Responsibility***

C248.52 REPLACEMENT OF BASE

1. Before construction of the replacement base, the subbase shall be prepared and debonded in accordance with the Specification for MASS CONCRETE SUBBASE. ***Subbase Preparation***

2. All work involved in the replacement of base shall comply with the Specification, including the following additional requirements:- ***Additional Requirements***

   (a) The joint faces on the adjoining slab at the transverse sawcuts shall be deeply scabbled below the top 25mm which shall be left smooth. Tie bars shall be provided to form a transverse construction joint in accordance with Clause C248.41.

   (b) Transverse contraction joints shall be continuous across the full width of the base containing the replaced section. The length of the joint across the full width of the base shall be sealed with the same sealant as in adjacent work and in accordance with Clause C248.42.

   (c) The lower two-thirds of the depth of the longitudinal joint faces shall be deeply scabbled and any concrete considered to be unsound by the Superintendent shall be removed. A crack inducer ribbon shall be attached to the surface of any formed longitudinal joint in the replacement base and tie bars provided to form a longitudinal tied joint in accordance with Clause C248.44.

   (d) Tie bars placed into hardened concrete shall be set by the use of a hydrophilic epoxy resin. The setting system used shall develop an anchorage strength at least 85 per cent of the yield strength of the bar.

   (e) Neither traffic nor construction equipment other than that associated with testing, sawcutting, groove cleaning or joint sealing shall be allowed on the section of base containing the replacement base until the joints have been permanently sealed and at least ten days have elapsed since placing replacement base concrete or the concrete has reached a compressive strength of at least 20MPa.

LIMITS AND TOLERANCES

C248.53 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C248.7 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Aggregates**		
	a. General	Mass of the total aggregates in concrete mix shall consist of at least 40% quartz sand	C248.08a
	b. Fine Aggregate		
	(i) Grading	To be within the limits as per Table C248.2 and shall not deviate from Proposed Grading by more than amounts in Table C248.2	C248.08b
	(ii) Wet Strength	Not less than 80kN for any fraction and/or constituent	C248.08c
	(iii) 10% Fines Wet/Dry Variation	Not to exceed 35% for any fraction and/or constituent	C248.08c
	(iv) Soundness	The loss in mass when tested with sodium sulphate to be less than 9% for any constituent	C248.08c
	(v) Particle Shape	The proportion of misshapen particles (2:1 ratio) to be less than 35%	C248.08c
	(vi) Fractured Faces	At least 80% by mass of the particles shall have two or more fractured faces	C248.08c
2.	**Concrete Quality**		
	a. Cement Content	At least 270kg per yielded cubic metre of concrete	C248.09
	b. Flyash	Not greater than 50kg per yielded cubic metre of concrete	C248.09
	c. Compressive Strength	The minimum 28 day compressive strength shall be 36.0 Mpa	C248.10
	d. Shrinkage	Not to exceed 450 microstrain after 3 weeks of air drying	C248.11
	e. Consistency	Nominated slump shall be neither less than 30mm nor more than 40mm for mechanically placed concrete. It shall be neither less than 55mm nor more than 65mm for hand placed concrete.	C248.12
	f. Air content	Shall not be less than 4% nor more	C248.13

Item	Activity	Limits/Tolerances	Spec Clause
		than 7% when discharged from the transport vehicle ready for placement	
3.	**Concrete Mixing and Transport**	After addition of cement to the aggregate, concrete shall be incorporated into the work within: (i) One and a half hours where transported by truck mixer or agitator. (ii) One hour where transported by non-agitating trucks.	C248.26
4.	**Concrete Placing**	Concrete shall not be placed when the air temperature in the shade is below 5^{o}C or above 38^{o}C. The temperature of the concrete shall be neither less than 10^{o}C nor more than 32^{o}C.	C248.29
		Where the value of Rate of Evaporation exceeds 0.50kg per square metre per hour, the Contractor shall cease work.	C248.30
5.	**Alignment and Surface**		
	a. Horizontal Alignment	The outer edges of the base shall not deviate from the plan position at any point by more than 10mm.	C248.33a
	b. Surface Level	The level at any point on the top of the base shall not vary by more than +10mm or -0mm from that shown on the Drawings or as directed by the Superintendent. The top surface of the base shall not deviate from a 3m straightedge, laid in any direction, by more than 5mm.	C248.33b
6.	**Concrete Protection**		
	a. Temperature	The temperature of the concrete shall not be permitted to fall below 5^{o}C during the first twenty-four hours after placing.	C248.36
7.	**Joints**		
	a. Transverse Construction	The line of the transverse construction joints shall not deviate from a 3m straightedge placed along the joint by more than 10mm.	C248.41

Item	Activity	Limits/Tolerances	Spec Clause
	b. Transverse Contraction	(i) May be reduced locally to a skew of 1 in 12 to accommodate construction joints and slab anchors.	C248.42
		(ii) No edge shall deviate from a 3m straightedge by more than 10mm.	
		(iii) The surface of the transverse contraction joint shall not exhibit more than 5mm of vertical or horizontal edge ravelling. The length of edge ravelling shall not be more than 300mm in any 1m length of joint on each edge.	
		(iv) Temporary Sealing - the top of the sealant shall be neither higher than nor more than 10mm below the concrete surface.	
		(v) Permanent Sealing The top of the sealant shall be neither less than 5mm nor more than 7mm below the surface of the base.	
	c. Transverse Isolation	The line of the transverse expansion joint shall not deviate from a 3m straight edge more than 10mm.	C248.43
7.	d. Longitudinal Tied Joints	(i) All parts of any tie bar shall be within 50mm of its designed position.	C248.44
		(ii) The line of longitudinal tied joints shall not deviate from the designed position at any point by more than 10mm. The line shall also not deviate from a 3m straightedge by more than 10mm having made due allowance for any planned curvature.	
		(iii) For Sawn-Induced joints, the maximum increase in length of the sealant after installation shall be 10% of the original length. The top of the sealant shall be neither less than 5mm nor more than 7mm below the surface of the base.	
		(iv) For Ribbon-Induced joints, the inducer ribbon shall be a minimum of 0.5mm thick and when placed it shall be within 5^{o} of the vertical plane.	

Item	Activity	Limits/Tolerances	Spec Clause
	e. Longitudinal Isolation Joints	The line of the longitudinal isolation joint shall not deviate from the specified position by more than 10mm. The line of the joint shall not deviate from a 3m straightedge by more than 10mm.	C248.46
8.	**Slab Anchors**	Not placed closer than 2.0m to transverse joints (other than associated transverse expansion joints).	C248.47

Table C248.7 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

C248.54 RESERVED

C248.55 RESERVED

C248.56 RESERVED

C248.57 RESERVED

C248.58 RESERVED

MEASUREMENT AND PAYMENT

C248.59 PAY ITEMS

1. Payment shall be made for the activities associated with completing the work detailed in this Specification in accordance with Pay Items C248(a) to C248(j) inclusive.

2. A lump sum price for any of these items shall not be accepted.

3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. Where the 28 day compressive strength of test cylinders for any lot is less than 33MPa, the lot represented by the test cylinders shall be removed, in which case no payment shall be made.

5. Where the relative compaction of the concrete is determined at less than 97 per cent, the lot represented by the core shall be removed, in which case no payment shall be made.

6. Where the concrete base thickness is more than 10mm below the specified thickness, the concrete shall be removed, in which case no payment shall be made.

7. Preparation of subbase and application of bond breaker is measured and paid in accordance with the Specification for MASS CONCRETE SUBBASE.

8. Construction of kerb and/or gutter is measured and paid in accordance with the Specification for OPEN DRAINS INCLUDING KERB AND GUTTER.

9. Subsoil drains at slab anchors are measured and paid in accordance with this Specification and not in the Specification for SUBSOIL AND FOUNDATION DRAINS.

Pay Item C248(a) SUPPLY AND PLACE CONCRETE IN BASE.

1. The unit of measurement shall be the cubic metre in place

2. The width and length shall be as specified on the Drawings, including odd-shaped and mismatched slabs, or as directed by the Superintendent. The depth shall be the depth specified or as directed by the Superintendent across each section.

3. No account shall be taken of the allowable tolerances.

4. The cost of providing transverse construction joints shall be included in the schedule rate for Pay Item C248(a).

5. The cost of longitudinal tied joints in association with kerbs and/or gutters shall be included in the schedule rate for Pay Item C248(a).

Pay Item C248(b) FINISH, CURE AND TEXTURE BASE

1. The unit of measurement shall be the square metre of surface of the base.

2. The width and length shall be as specified on the Drawings, including odd-shaped and mismatched slabs, or as directed by the Superintendent.

3. No account shall be taken of the allowable tolerances.

4. The sides of slabs shall not be included in the measurement of surface area.

Pay Item C248(c) SUPPLY AND PLACE WIRE REINFORCING FABRIC

1. The unit of measurement shall be the square metre of wire reinforcing fabric placed.

2. The width and length shall be as specified on the Drawings, including odd-shaped and mismatched slabs, or as directed by the Superintendent. No account shall be taken of the allowable tolerances nor of any laps.

3. Unless otherwise indicated elsewhere, all wire reinforcing fabric shall be paid for at the schedule rate for Pay Item C248(c).

Pay Item C248(d) SUPPLY AND INSTALL STEEL BAR REINFORCEMENT

1. The unit of measurement shall be the tonne of steel reinforcement.

2. The mass shall be determined from the unit masses given in Table 4 of AS 1302 and the actual length of bar measured in place. No account shall be taken of laps and splices.

3. Unless otherwise indicated elsewhere, all steel bar reinforcement shall be paid for at the schedule rate for Pay Item C248(d).

4. The pay items excludes dowels and tie bars.

Pay Item C248(e) TRANSVERSE CONTRACTION JOINTS

1. The unit of measurement shall be the linear metre.

2. The distance shall be measured along the line of the joint.

Pay Item C248(f) TRANSVERSE EXPANSION AND ISOLATION JOINTS

1. The unit of measurement shall be the linear metre.

2. The distance shall be measured along the line of the joint.

Pay Item C248(g) LONGITUDINAL TIED JOINTS

1. The unit of measurement shall be the linear metre.

2. The distance shall be measured along the line of the joint.

3. The pay item includes provision of tie bars.

Pay Item C248(h) LONGITUDINAL ISOLATION JOINTS

1. The unit of measurement shall be the linear metre.

2. The length shall be measured along the line of the joint.

3. The pay item includes the provision of dowels where specified or shown on the Drawings.

Pay Item C248(i) SLAB ANCHORS

1. The unit of measurement shall be the cubic metre of concrete.

2. The volume shall be taken from the Drawings with appropriate adjustments being made for any authorised variation. The depth shall be measured from the top of the subbase.

3. The pay item includes all work, materials and equipment required for the construction of slab anchors including excavation, disposal of material, supply and placing of reinforcement and the subsoil drain.

Pay Item C248(j) BRIDGE APPROACH SLABS

1. The unit of measurement shall be the cubic metre.

2. The width, depth and length shall be as specified on the Drawings or as directed by the Superintendent.

3. No account shall be taken of the allowable tolerances.

4. The pay item includes all work, materials and equipment required for the construction of a bridge approach slab, including provision of a transverse expansion joint at the bridge abutment but excluding the supply and fixing of steel which shall be paid for at the schedule rate for Pay Item C248(d).

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C254

SEGMENTAL PAVING

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C254 - SEGMENTAL PAVING

CONTENTS

SPECIFICATION C254 - SEGMENTAL PAVING

GENERAL

C254.01 SCOPE

1. This Specification covers the construction of both clay and concrete segmental paving for , medians, traffic islands, driveways, cycleways, footpaths and other pedestrian areas and road pavements where specifically approved by the local authority.

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.

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***

C254.02 TERMINOLOGY

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. ***Size***

2. Concrete pavers are identified by shape as being one of the following types: ***Concrete Pavers***

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.

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. ***Clay Pavers***

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. ***Classification***

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 90^o or 45^o 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 Gutter
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
Access and Collector	5	3	80	Any	DPB2	5
Trunk Collector	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 gutter, 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 finished surface level, and to the design grade and crossfalls of the finished surface, as shown on the Drawings in accordance with the Specification MRS11.05 – Unbound Pavements. ***Levels***

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 MRS11.05 – Unbound 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 gutter or edge strips shall be constructed along the perimeter of all segmental paving as shown on the Drawings. Concrete kerb and/or gutter and edge strips shall be constructed in accordance with the Specifications for OPEN DRAINS INCLUDING KERB AND GUTTER 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 more than two metres in advance of the laying face at the completion of work on any day. ***Screeding***

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 or approved equivalent. ***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 ***Compaction***

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.

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 all other areas of segmental paving. ***Finished Levels***

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

C254.22 RESERVED

C254.23 RESERVED

C254.24 RESERVED

C254.25 RESERVED

C254.26 RESERVED

MEASUREMENT AND PAYMENT

C254.27 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in the Specification in accordance with Pay Items C254(a) to C254(c) inclusive.

2. A lump sum price for any of these items shall not be accepted.

3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. Excavation and preparation of subgrade is measured and paid in accordance with the Specification for EARTHWORKS.

5. Subbase and Base are measured and paid in accordance with the Specifications for STABILISATION, FLEXIBLE PAVEMENTS, or MASS CONCRETE SUBBASE as appropriate.

6. Kerb and/or gutter is measured and paid in accordance with the Specification for OPEN DRAINS INCLUDING KERB AND GUTTER.

7. Edge strips are measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS.

8. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.

Pay Item C254(a) EDGE STRIPS

1. The unit of measurement shall be the linear metre measured along the length of the edge strip.

2. The schedule rate shall include all activities involved in the excavation forming, concreting, contraction joints, backfilling and compaction adjacent to the completed edge strip.

Pay Item C254(b) SEGMENTAL PAVING - ROAD PAVEMENTS

1. The unit of measurement shall be the square metre of surface of segmental paving for road and driveway pavements.

2. The width and length shall be as shown on the Drawings or as directed by the Superintendent.

3. The schedule rate shall include all activities involved in the supply, laying and compaction of segmental paving units, bedding sand and joint filling sand, including any cutting of unit joints, overlying concrete pavement joints, and concrete surrounds or aprons around surface penetrations.

Pay Item C254(c) SEGMENTAL PAVING - OTHER THAN ROAD PAVEMENTS

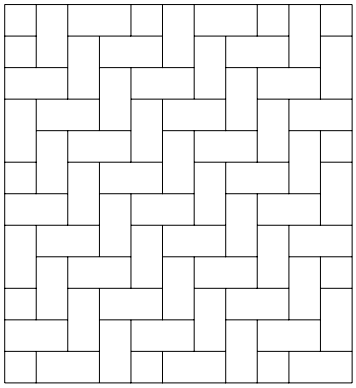
1. The unit of measurement shall be the square metre of surface of segmental paving for other than road pavements, including medians, traffic islands, footpaths, cycleways, and other pedestrian areas.

2. The width and length shall be as shown on the Drawings or as directed by the Superintendent.

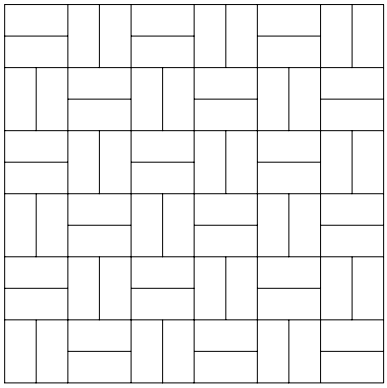
3. The schedule rate shall include all activities involved in the supply, laying and compaction of segmental paving units, bedding sand and joint filling sand, including any cutting of unit joints, overlying concrete pavement joints, and concrete surrounds or aprons around surface penetrations.

ANNEXURE C254-A

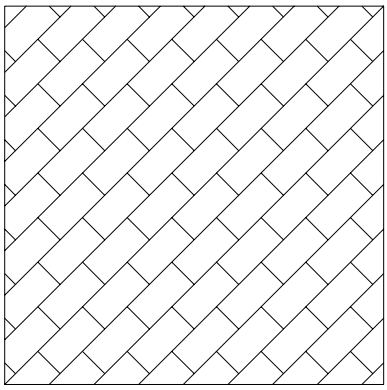
LAYING PATTERNS



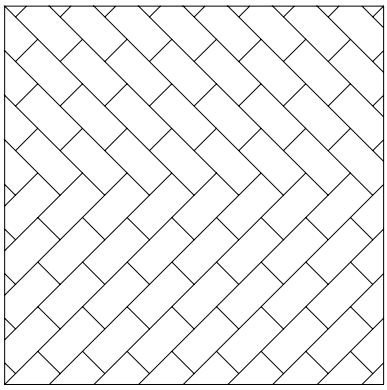
Herringbone



Basketweave



Stretcher



Zig Zag Running Bond

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C255

BITUMINOUS MICROSURFACING

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C255: BITUMINOUS MICROSURFACING

CLAUSE **CONTENTS** **PAGE**

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

Users of this specification should be aware that where terms are not specifically defined in the following section, AS 1348 should be the default standard.

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

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 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 1141.25.1	-	Methods for sampling and testing aggregates - Degradation factor - Source rock
AS 1141.25.2	-	Methods for sampling and testing aggregates - Degradation factor - Coarse aggregate
AS 1141.25.3	-	Methods for sampling and testing aggregates - Degradation factor - Fine aggregate
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 1348	-	Glossary of terms - Roads and traffic engineering
AS 2008	-	Residual bitumen for pavements
AS 2350	-	Methods of testing Portland and blended cements
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. 25.1	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 2350.. ***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	≥ 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 covering the same materials and approved mix shall be acceptable provided that calibration has been carried out within the previous twelve months. ***Calibration***

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. ***Documen-tation***

3. No paving unit shall be allowed on the work until the calibration has been verified and approved by the Superintendent. ***Approval by Super-intendent***

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^{o}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 gutter the finished surface level shall not be below nor more than 10mm above the level of the lip of the adjacent gutter. ***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.

C255.25 RESERVED

C255.26 RESERVED

C255.27 RESERVED

MEASUREMENT AND PAYMENT

C255.28 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification for BITUMINOUS MICROSURFACING in accordance with Pay Items 255(a) and C255(b) inclusive.

2. A lump sum price for any of these items will not be accepted.

3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

Pay Item C255(a) Size 5 Bituminous Microsurfacing

1. The unit of measurement shall be the cubic metre of the combined mix as spread on the road surface.

2. The volume of the combined mix in cubic metres shall comprise the volume of the dry mineral aggregate (excluding filler) used in completing the works recorded by the paving unit. Documentation of the calibration of this measure shall be made available to the Superintendent and shall be subject to Superintendent's approval.

3. The schedule rate shall include preparation of the surface, mix design, all sampling and testing, supply of all materials to site, and loading, mixing and spreading the bituminous microsurfacing including finishing, joint treatment and clean-up.

Pay Item C255(b) Size 7 Bituminous Microsurfacing

1. The unit of measurement shall be the cubic metre of the combined mix as spread on the road surface.

2. The volume of the combined mix in cubic metres shall comprise the volume of the dry mineral aggregate (excluding filler) used in completing the works recorded by the paving unit. Documentation of the calibration of this measure shall be made available to the Superintendent and shall be subject to Superintendent's approval.

3. The schedule rate shall include preparation of the surface, mix design, all sampling and testing, supply of all materials to site, and loading, mixing and spreading the bituminous microsurfacing including finishing, joint treatment and clean-up.

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C261

PAVEMENT MARKINGS

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C261 - PAVEMENT MARKINGS

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SPECIFICATION C261 : PAVEMENT MARKINGS

GENERAL

C261.01 SCOPE

1. The work to be executed under this Specification consists of the setting out, supply and application of pavement marking paint, thermoplastic pavement marking material, pavement marking tape and raised pavement markers as shown on the Drawings and in accordance with this Specification.

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***

3. This Specification shall not override any applicable State or Local Government legislation AND shall be read in conjunction with AS 1742.3 AND the Roads and Traffic Authority (NSW) RTA QA Specification R141 Pavement Marking (or equivalent document in other states). ***Conformance***

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 1906.3	-	Raised pavement markers (retroreflective and non-retroreflective).
AS 2009	-	Glass beads for road-marking materials.
AS 4049.2	-	Thermoplastic road marking materials.
AS 4049.3	-	Waterborne paint - For use with drop-on beads
AS 1742.3.	-	Manual of uniform traffic control devices - Traffic control devices for works on roads

(c) Queensland Department of Main Roads Publications

QMUTCD	-	Queensland Manual of Uniform Traffic Control Devices.

C261.03 TYPE OF MARKINGS

1. Details of the various types of pavement markings and devices are generally in accordance with the requirements of the QMUTCD. ***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.

(f) Cold Applied Plastics

To be installed in accordance with manufacturers specification

Notice to Compiler
This specification does not cover Cold Applied Plastics (CAP) although their use throughout Australia is quite common as a long life product. For details of application and installation refer to the manufacturers specifications.

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 (unless otherwise directed).. ***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 and any State Road Authority specifications (where applicable) 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 Note that this specification details the application of class B “drop-on beads” and class D “large wet weather beads” only. Other types of glass beads may be used (refer to Annexure C261B). In each case, beads shall be specified and installed in accordance with AS 2009. ***Glass Beads Quality`***

Notice to Compiler
The use of angular materials such as Quartz on transverse or longitudinal markings is not covered in this specification. However it is recognised as being widely used throughout Australia in varying forms to increase skid resistance in road markings. For details of their application and installation refer to the manufacturers instructions.

Other materials

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 (unless otherwise directed by the superintendent)... ***Longitudinal Lines***

2. Hand spraying with the use of templates (where necessary) 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 dry film thickness shall be a minimum of 0.20mm for class B beads, or 0.30mm for class D beads ***Paint Thickness***

4. Class B glass beads shall be applied to the surface of all longitudinal lines at a min application rate of 0.50 kilograms per square metre immediately after application of the paint. 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***

5. Class B glass beads shall be similarly applied to all other paint markings at a min application rate of 0.30 kilograms per square metre immediately after application of the paint by a method approved by the Superintendent. Class D glass beads shall be similarly applied to all other markings at a min application rate off 0.5kg/m^2. ***Beads for other Markings***

6. 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***

7. The lengths of longitudinal lines shall conform to any applicable local or state requirements and not vary by more than +20mm -0mm from the lengths shown in AS 1742.2 The widths of longitudinal lines shall not vary by more than +10mm -0mm from the widths shown in AS 1742.2. ***Longitudinal Line Tolerances***

8. The lengths and widths of transverse lines shall not vary by more than 10mm from the lengths and widths shown in QMUTCD ***Transverse Line Tolerance***

9. The dimensions of arrows, chevrons, painted medians, painted left turn islands and speed markings shall conform to any applicable local or state requirements and 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***

Notice to Compiler

Class D beads are not suited for use with solvent-based paints (AS 4049.1). Class D beads are suited for use with thermoplastic (AS 4049.2) and with waterborne paint (AS 4049.3). Class D beads intended for use with thermoplastic shall be supplied with a proprietary adhesive coating, which shall be clearly labelled on the packaging.

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**			
	80mm		**80mm**	
8	396	8	396	8
13	643	13	643	13
16	791	16	791	16

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 a min 20% of the total mass, as part of the aggregate constituent and shall comply with the requirements of AS 2009, Intermix type class C beads with 20-30 per cent by mass wet weather beads. ***Glass Bead Proportion***

4. Glass beads for surface application shall comply with the requirements of AS 2009, class B “Drop-on beads” or class D “wet weather 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 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 (or extruded in the case of profiled markings) 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 3.0mm with a tolerance of plus or minus 0.5mm. ***Longitudinal Lines***

3. Class B glass beads shall be applied by air propulsion or gravity fed 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. Class D glass beads shall be applied at a min rate of 0.5kg/m^2. ***Beads for Longitudinal Lines***

4. Where transverse lines, symbols, legends and arrows are to be screeded, the screeded thermoplastic material shall be applied using a mobile applicator, ***Screed***

approved by the Superintendent, and templates to control the pattern.

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 0..5mm. The surface finish shall be smooth. ***Tolerance***

6. Class B glass beads for other than longitudinal lines shall be uniformly applied to screeded markings at a min application rate of 0.30 kilograms per square metre immediately after application of the thermoplastic material by a method approved by the Superintendent. Class D glass beads shall be applied at a min application rate of 0.50kg/m^2. ***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 QMUTCD. The widths of longitudinal lines shall not vary by more than 10mm from the widths shown in QMUTCD. ***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 QMUTCD. ***Transverse Line Tolerances***

10. The dimensions of arrows, chevrons, painted medians, painted left turn islands and speed markings shall conform to any applicable local or state requirements and 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***

Notice to Compiler
Glass beads of class D wet weather beads intended for use with thermoplastic applications shall be supplied with a proprietary adhesive coating, and shall be clearly labelled on the packaging**.**

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 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 10 mm. 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 dimesion 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. The removal of markings shall be performed in a "block type" manner, so as to avoid "ghosted" images. Blacking out of markings should only be used as a temporary measure and complete removal should occur within 48 hours. ***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 QMUTCD	C261.16
	(b) Width	± 10mm from widths shown in QMUTCD	C261.12 C261.16
3.	**Transverse Lines**		
	(a) Length) (b) Width)	± 10mm from lengths and widths shown in QMUTCD	C261.12 C261.16
4.	**Arrows, Chevrons, Painted Medians, Speed Markings etc.**	± 50mm from the dimensions shown in QMUTCD	C261.12 C261.16
5.	**Application of Paint**		
	(a) Film Thickness	Depends on the beads to be used: for class B beads – min 0.2mm dry film; for class D beads – min 0.3mm dry film	C261.12
6.	**Application of Thermoplastic**		
	(a) Longitudinal Lines - Cold Film Thickness	3.0mm ± 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	Min class B - 0.30 kg/m^2 Min class D - 0.50 kg/m^2	C261.12 C261.16

Table C261.2 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

C261.25 RESERVED

C261.26 RESERVED

C261.27 RESERVED

MEASUREMENT AND PAYMENT

C261.28 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification on a schedule of rates basis in accordance with Pay Items C261(a) to C261(e) inclusive.

2. A lump sum price for any of these items shall not be accepted.

3. If any item, for which a quantity of work is listed in the Schedule of Rates, has not been priced by the Contractor, it shall be understood that due allowance has been made in other items for the cost of the item which has not been priced.

4. No additional payment shall be made for maintenance and replacement of pavement markers in accordance with Clause C261.09.

5. Provision for traffic is measured and paid in accordance with this Specification and not in the Specification for CONTROL OF TRAFFIC.

Pay Item C261(a) PAVEMENT MARKING PAINT - LONGITUDINAL LINES

1. The unit of measurement shall be per line pattern kilometre (including any gaps)..

2. The area shall be calculated from the specified width (excluding tolerances) and the actual application length measured along the centre line of the longitudinal line.

3. The schedule rate shall cover all costs associated with the setting out of the work, the supply and application of the paint and beads and provision for traffic control.

Pay Item C261(b) PAVEMENT MARKING PAINT - TRANSVERSE LINES, SYMBOLS, LEGENDS, ARROWS, CHEVRONS, TRAFFIC ISLANDS AND KERBS

1. The unit of measurement shall be as per schedule below;.

Transverse lines	lineal metres
Arrow	each
Symbols	each
Chevrons	square metres
Kerbs	metres
Traffic Islands	square metres.
Legends	each or square metres.

2. The area of the painted surface shall be determined by direct measurement of the markings as applied.

3. The schedule rate shall cover all costs associated with the setting out of the work, the supply and application of all material and the provision for traffic control

Pay Item C261(c) THERMOPLASTIC PAVEMENT MARKING MATERIAL - LONGITUDINAL LINES

1. The unit of measurement shall be per line pattern kilometre (including any gaps)..

2. The area shall be calculated from the specified width (excluding tolerances) and the actual application length measured along the centre line of the longitudinal line.

3. The schedule rate shall cover all costs associated with the setting out of the work, tack coating where necessary, the supply and application of the thermoplastic material and beads and provision for traffic.

Pay Item C261(d) THERMOPLASTIC PAVEMENT MARKING MATERIAL - TRANSVERSE LINES, SYMBOLS, LEGENDS AND ARROWS

1. The unit of measurement shall be as per schedule below.

Transverse lines	lineal metres
Arrow	each
Symbols	each
Chevrons	square metres
Kerbs	metres
Traffic Islands	square metres.
Legends	each or square metres

2. The surface area of the thermoplastic material applied shall be determined by direct measurement of the markings as applied (as above)..

3. The schedule rate shall cover all costs associated with the setting out of the work, tack coating where necessary, the supply and application of all material and the provision for traffic.

Pay Item C261(e) RAISED PAVEMENT MARKERS (all applications)

1. The unit of measurement shall be 'each' raised pavement marker installed.

2. The schedule rate shall cover all costs associated with the setting out of the work, the supply and application of all material including the provision of an initial pad of adhesive when required on rough surfaces and the provision for traffic.

ANNEXURE C261A

PROCEDURE FOR MEASUREMENT OF RATE OF APPLICATION OF SPHERICAL GLASS BEADS

1. **SCOPE**

The following procedure shall be adopted for field measurement of the rate of application of spherical glass beads on to wet paint or thermoplastic surfaces.

2. **SPHERICAL GLASS BEADS**

The glass beads shall comply with AS 2009.

3. **MEASUREMENT**

The method of field measurement shall be as follows:

(a) Turn off the paint or thermoplastic supply valves and operate the glass bead dispenser for exactly 10 seconds allowing glass beads to run into a plastic bag or tray.

(b) Pour the glass beads from the bag or tray into a suitable measuring cylinder calibrated in millilitres to measure the volume of glass beads collected. Level but do not compact the glass beads in the cylinder.

(c) Compare the volume of glass beads collected with the correct figure given in Table C261.1.

Table C261.1 shows the correct volumes of glass beads required to give a net application rate on the marked line of approximately 0.30 kilograms per square metre for different line widths and road speeds. The glass bead volume figures given in Table C261.1 are calculated for an actual application rate of 0.34 kilograms per square metre. These figures are used for calibrating the machine because there is a loss of beads between the bead dispenser and the marked line and the volume is measured with beads not compacted. For the calibration of application rates to suit class D beads the above table will need to be altered to 0.50kg/m^2

ANNEXURE C261B

TYPES OF GLASS BEADS

1. Class A beads (premix)

Class A beads are mixed into road-marking material by the manufacturer prior to application, and are intended to provide retroreflectivity throughout the life of the marking. These beads are to be mixed at a rate of not less than 30% by mass.

2. Class B beads (drop-on)

Class B glass beads are applied under gravity or pressure as a surface application to a wet film of pavement marking to provide initial retroreflectivity. These beads should be applied on a smooth substrate. A nominal rate of 270-300 G/m2 may be appropriate, while a coarse surface substrate usually requires a higher application rate to achieve the required level of retroreflectivity.

NOTE: These beads have a moisture-proof coating to facilitate flow and reduce the risk of 'caking'.

3. Class C beads (intermix)

Class C beads are mixed into thermoplastic road-marking material by the manufacturer prior to application, and are intended to provide retroreflectivity throughout the life of the marking. These beads should be intermixed at a rate of not less than 20% by mass. These beads may also be used for surface applications to a wet film of pavement marking to provide initial retroreflectivity. These beads should be applied on a smooth substrate. A nominal rate of 350 G/m2 may be appropriate, while a coarse surface substrate usually requires a higher rate of application to achieve the required level of retroreflectivity.

NOTE: These beads are not moisture-proof coated, and if used for surface applications, could 'cake' during handling.

4. Class D beads (large wet-weather beads)

Class D glass beads are applied under gravity or pressure as a surface application to a wet film of pavement marking to provide initial retroreflectivity. These beads should be applied on a smooth substrate. A nominal rate of 500 G/m2 may be appropriate, while a coarse surface substrate usually requires a higher rate of application to achieve the required level of retroreflectivity.

NOTE: These beads have no moisture-proof coating and are, therefore, also suitable for intermixing into thermoplastic road-marking material to provide retroreflectivity in both dry and wet conditions throughout the life of the marking. These beads should be intermixed at a rate of not less than 20% by mass.

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C262

SIGNPOSTING

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C262 - SIGNPOSTING

CLAUSE **CONTENTS** **PAGE**

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 QMUTCD.

   (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 20^o, 60^o and 85^o
AS 1580.108.2	-	Dry film thickness - Paint inspection gauge
AS 1734	-	Aluminium and aluminium alloys - flat sheet, coiled sheet and plate
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.

(c) Queensland Department of Main Roads Publications

QMUTCD	-	Queensland Manual of Uniform Traffic Control Devices.

C262.03 PROVISION FOR TRAFFIC

1. The Contractor shall provide for traffic in accordance with the requirements of the ***Minimise***

Specification for CONTROL OF TRAFFIC while undertaking the work and shall organise the work to avoid or minimise delays and inconvenience to traffic. ***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 80 mm 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***

6. The cost of regalvanising such damaged coating areas shall be borne by the Contractor. ***Contractor's Costs***

(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. The Contractor shall submit details of and set out, for the Superintendent's inspection and approval, the proposed location and alignment of each sign support structure. ***Contractor's Responsibility***

4. 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 Superintendent***

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 at the Contractor's cost. ***Sign Damage*** ***Contractor's Cost***

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 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. ***Treatment of Damaged Areas***

6. The cost of regalvanising such damaged coating areas shall be borne by the Contractor. ***Contractor's Costs***

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 NAME, SERVICE AND TOURIST SIGNS

1. All street name, service and tourist 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 Parts 1 and 6 of QMUTCD 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.

C262.19 RESERVED

C262.20 RESERVED

C262.21 RESERVED

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

MEASUREMENT AND PAYMENT

C262.23 PAY ITEMS

1. Payment shall be made for ALL activities associated with completing the work detailed under this Specification in accordance with Pay Items C262(a) to C262(g) inclusive.

2. A lump sum price for any of these items shall not be accepted.

3. If any item, for which a quantity of work is listed in the Schedule of Rates, has not been priced by the Contractor, it is then understood that due allowance has been made in other items for the cost of the item which has not been priced.

4. The cost of any provision for traffic and covering of signs shall be deemed to be included in the various pay items for signposting.

5. Sign structure support concrete footings are measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS.

6. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.

Pay Item C262(a) SUPPLY AND DELIVERY OF SIGNS (AREA LESS THAN 1 sq m)

1. The unit of measurement shall be each.

2. The schedule rate shall include the costs of mounting extrusions, fittings, labelling, packaging and delivery to site.

Pay Item C262(b) SUPPLY AND DELIVERY OF SIGNS (AREA BETWEEN 1 AND 3 sq m)

1. The unit of measurement shall be each.

2. The schedule rate shall include the costs of mounting extrusions, fittings, labelling, packaging and delivery to site.

Pay Item C262(c) SUPPLY AND DELIVERY OF SIGNS (AREA GREATER THAN 3 sq m)

1. The unit of measurement shall be the area in square metres of signs supplied.

2. The area shall be calculated by totalling the face surface area of each sign supplied.

3. The schedule rate shall include the costs of mounting extrusions, fittings, labelling, packaging and delivery to site.

Pay Item C262(d) SUPPLY AND ERECTION OF SIGN SUPPORT STRUCTURES (STANDARD ROUND GALVANISED POSTS)

1. The unit of measurement shall be 'each' post erected.

2. The schedule rate shall include the costs of clearing, excavation, erection and bracing and casting of concrete footings.

Pay Item C262(e) SUPPLY AND ERECTION OF SIGN SUPPORT STRUCTURES (PURPOSE-DESIGNED)

1. The unit of measurement shall be 'each' post erected.

2. The schedule rate shall include the costs of clearing, excavation, erection and bracing and casting of concrete footings with anchor bolt assemblies and steel reinforcement.

Pay Item C262(f) ERECTION OF SIGNS

1. The unit of measurement shall be each sign erected.

2. The schedule rate shall include the costs of erection and attachment costs and any necessary temporary covering of signs with plastic or other approved opaque covering.

Pay Item C262(g) ADJUSTMENT OF EXISTING SIGNS AND SUPPORT STRUCTURES

1. The unit of measurement shall be the area in square metres of signs adjusted.

2. The area shall be determined by totalling the face surface area of the signs adjusted.

3. The schedule rate shall include the costs of dismantling of signs and sign structure, relocation or replacement of sign structures including foundations, concrete footings, and re-erection of signs including all fittings.

4. Separate pay items shall be included for each adjustment required to re-erect existing signs and sign support structures and shall cover all work required that is not covered by the other pay items under signposting.

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C263

GUIDE POSTS

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C263 - GUIDE POSTS

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..

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 The tops of the guide posts shall be square. Refer MR1356 Standard Drawing.

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***

5. Where Council Standard Drawings provides specific details in relation to the construction and location guideposts the details of Council's Standard Drawings shall apply. ***Council's Standards***

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 ***Vertical Alignment***

the range of the beam of vehicle headlights.

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 in the ground to the satisfaction of the Superintendent. ***Backfilling***

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***

4. Where Council Standard Drawings provides specific details in relation to the construction and location guideposts the details of Council's Standard Drawings shall apply. ***Council's Standards***

SPECIAL REQUIREMENTS

C263.08 RESERVED

C263.09 RESERVED

C263.10 RESERVED

MEASUREMENT AND PAYMENT

C263.11 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification in accordance with Pay Item C263(a).

2. A lump sum price shall not be accepted.

3. Traffic control is measured and paid in accordance with the Specification for CONTROL OF TRAFFIC.

Pay Item C263(a) GUIDE POSTS

1. The unit of measurement shall be 'each' guide post.

2. The schedule rate shall cover all costs associated with the erection of each post, including supply of post, erection, painting (if applicable), and supply and fixing of corner-cubed delineators.

QUEENSLAND

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C264

NON-RIGID ROAD SAFETY BARRIER SYSTEMS
(Public Domain)

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

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1	Adopted by Burnett Shire Council		M	RT	10/05/2006

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

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 at its own expense. ***Contractor's Cost***

C264.07

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 at its own expense. ***Contractor's Cost***

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

C264.11 RESERVED

C264.12 RESERVED

C264.13 RESERVED

C264.14 RESERVED

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

MEASUREMENT AND PAYMENT

C264.16 PAY ITEMS

1. Payment shall be made for all the activities associated with completing the work detailed in this Specification on a schedule of rates basis in accordance with Pay Items C264(a) to C264(g) inclusive.

2. A lump sum price for any of these items shall not be accepted.

3. If any item, for which a quantity of work listed in the Schedule of Rates, has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. Concrete footings for timber posts are measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS.

5. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.

6. Traffic control is measured and paid in accordance with the Specification for CONTROL OF TRAFFIC.

Pay Item C264(a) SINGLE SIDED ROAD SAFETY BARRIER

(i) Single W-beam
(ii) Nested W-beam
(iii) Single Thrie-beam
(iv) Nested Thrie-beam
(v) Single Modified Blockout Thrie-beam
(vi) Nested Modified Blockout Thrie-beam
(vii) Single W-Thrie-beam Transition
(viii) Nested W-Thrie-beam Transition

1. The unit of measurement shall be the linear metre.

2. The distance shall be measured along the centre line of the rail, centre to centre of posts, excluding terminal sections and connectors to rigid safety barriers or bridge parapets..

3. The schedule rate shall include the supply of all components and fixings and all activities associated with the erection of each type of road safety barrier.

Pay Item C264(b) MODIFIED ECCENTRIC LOADER TERMINAL (MELT)

1. The unit of measurement shall be "each" MELT section supplied and erected as detailed on the Drawings.

Pay Item C264(c) TERMINAL SECTION

(i) Leading Terminal
(ii) Trailing Terminal

1. The unit of measurement shall be "each" terminal section supplied and erected as detailed on the Drawings.

Pay Item C264(d) CONNECTORS TO RIGID ROAD SAFETY BARRIERS (RSB) OR BRIDGE PARAPET

(i) W-beam to RSB
(ii) W-beam to Thrie-beam to RSB
(iii) Thrie-beam to RSB

1. The unit of measurement shall be "each" connector supplied and erected as detailed on the Drawings, excluding the anchorage assemblies cast into the rigid road safety barrier or bridge parapet.

Pay Item C264(e) DELINEATOR BRACKETS

1. The unit of measurement shall be "each".

Pay Item C264(f) DOUBLE SIDED ROAD SAFETY BARRIER

(i) Single W-beam
(ii) Nested W-beam
(iii) Single Thrie-beam
(iv) Nested Thrie-beam
(v) Single Modified Blockout Thrie-beam
(vi) Nested Modified Blockout Thrie-beam
(vii) Single W-Thrie-beam Transition
(viii) Nested W-Thrie-beam Transition

1. The unit of measurement shall be the linear metre.

2. The distance shall be measured along the centre line of the rails, centre to centre of posts, excluding terminal sections and connectors to rigid safety barriers or bridge parapets.

3. The schedule rate shall include the supply of all components and fixings and all activities associated with the erection of each type of road safety barrier.

Pay Item C264(g) DOUBLE SIDED ROAD SAFETY BARRIER TERMINAL SECTION

1. The unit of measurement shall be "each" terminal section supplied and erected as detailed on the Drawings.

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C265

FENCING

Amendment Record for this Specification Part

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1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C265 - FENCING

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SPECIFICATION C265 - 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 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	-	Chain-link fabric security fencing and gates AS 2423
	-	Galvanised Wire Fencing Products

(c) Queensland Department of Main Roads Publications

QMUTCD	-	Queensland Manual of Uniform Traffic Control Devices

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, BRACES AND RAILS

1. All posts, bracing and rails 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, 1200mm high, 1,450mm high or1830mm high for Manproof Fencing shall be of 3.15mm diameter wire woven to a 50 x 50mm square mesh. Chain wire 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. ***Dimensions and Zinc 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. 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's authorised officer. ***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 tie 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 cement mortar consisting of one part of cement to two parts of clean sand. ***Variations to Post Length***

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

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. No extra payment will be made for this requirement. ***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 not burn any timber, vegetation or refuse on site unless specifically approved by Council's authorised officer. ***Fire Control***

C265.24 CATTLE GRIDS

1. 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 QMUTCD, shall be provided on each approach to the cattle grid in accordance with the Specification for SIGNPOSTING.

SPECIAL REQUIREMENTS

C265.25 RESERVED

C265.26 RESERVED

C265.27 RESERVED

C265.28 RESERVED

C265.29 RESERVED

C265.30 RESERVED

MEASUREMENT AND PAYMENT

C265.31 PAY ITEMS

1. Payment shall be made for all the activities associated with completing the work detailed in this Specification on a schedule of rates basis in accordance with Pay items C265(a) to C265(d) inclusive.

2. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

3. A lump sum price for any of these items shall not be accepted.

4. Clearing and grubbing is measured and paid in accordance with this Specification and not in the Specification for CLEARING AND GRUBBING.

5. Concrete backfilling and blocks are measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS.

6. Cattle grid signposting is measured and paid in accordance with this Specification and not in the Specificaiton for SIGNPOSTING.

Pay Item C265(a) - SUPPLY AND ERECTION OF FENCING

1. The unit of measurement shall be the linear metre of fencing, chain link, stock-proof or rabbit-proof, measured on site.

2. Separate pay items shall be shown for each type of fence specified.

3. The schedule rate under this Pay Item shall include the supply of all materials, the clearing of site, and all activities associated with the erection of the fence, including the levelling of mounds (if required), concreting, the provision of crossings for watercourses and depressions as necessary, flood gates as necessary and the connection of the new fence to existing fence where required. The schedule rate shall also cover all types of excavation material encountered during construction work, both earth and rock and the removal and disposal of surplus material and rubbish.

Pay item C265(b) - SUPPLY & ERECTION OF FENCE GATES

1. The unit of measurement shall be "each" gate erected.

2. The schedule rate shall include the supply of all material and all activities associated with the erection of each gate.

Pay item C265(c) - SUPPLY & INSTALLATION OF CATTLE GRID

1. The unit of measurement shall be "each" cattle grid installed.

2. The schedule rate shall include the supply of the cattle grid together with all activities associated with the construction of the cattle grid including bedding, approach ramps, wings, drainage, adjustment to fencing and the provision of signs.

Pay item C265(d) - REMOVAL OF EXISTING FENCE

1. The unit of measurement shall be the linear metre of fencing removed as measured on site.

2. The schedule rate shall include all activities associated with the demolition and disposal of the existing fence.

QUEENSLAND

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C271

MINOR CONCRETE WORKS

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C271
MINOR CONCRETE WORKS

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 1289.5.4.1	-	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.

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 95 per cent as determined by AS 1289.5.4.1 for standard 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. ***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 reduced to 100mm. ***Rock Foundations***

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, hole 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 and shall be from a source approved under the Queensland Government's State Purchasing Policy.

2. When submitting details of the nominated mix in accordance with Clause C271.17, the Contractor shall nominate the brand and source of the cement. On approval of the nominated mix by the Superintendent, the Contractor shall only use the nominated cement for the work. ***Nominated Brand and Source***

3. Documentary or other acceptable evidence of the quality of the cement shall be furnished by the Contractor if required by the Superintendent. ***Proof of Quality***

4. 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***

5. 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 used in the production of concrete shall generally be free from materials harmful to concrete and to its reinforcement and neither salty nor brackish. ***Quality***

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

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. ***Quality***

2. The percentage of wear shall be determined by AS 1141.23, and the loss of weight shall not exceed 30 per cent. ***Wear Test***

3. When required by the Superintendent, coarse aggregate shall be tested for conformance for any or all of the properties set out below: ***Additional Tests***

(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.

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. ***Grading Requirements***

Australian Standard Sieve (mm)	Proportion Passing (% of Mass)				Deviation Proposed Grading (% of Mass of Sample)
	40mm Nominal	20mm Nominal	10mm Nominal	Extrusion Concrete	
	For Walls exceeding 150mm thickness	For all other structures	For Concrete block infill		
53.0	100				
37.5	95 - 100				±10
26.5		100			
19.0	30 - 70	95 - 100			±10
13.2			100	100	
9.50	10 - 35	25 - 35	85-100		±5
4.75	0 - 10	0 - 10	0-20		±5
2.36	0 - 2	0 - 2	0-5		

Table C271.2 - Coarse Aggregate Gradings

C271.16 ADMIXTURES

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. ***Quality and Use***

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) 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 area acceptable to the Superintendent. The chutes shall be long enough to permit delivery to the whole of the area enclosed by the forms. ***Cleansing and Positioning of Chutes***

(iii) The contractor may submit alternative mix designs for ready mix concrete for the approvalof the Superintendent at least 14 days prior to use. Full details of the proposed mix, target strength, target slump are to be provided in accordance with section 10 and Main roads specification MRS1170. ***Alternative Mix Design***

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^{o}C or while the shade temperature exceeds 38^{o}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 ***Placement in Forms,***

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. ***Vibrating***

4. Exposed surfaces of the concrete shall be struck off and finished with a wooden float. 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 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. ***Finish for Wearing Surfaces***

2. Where an asphaltic concrete 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 ***Surface Tolerance***

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.

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 10^{o}C 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 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. ***Barrier 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 10m and where the pavement abuts against gutters, pits and structures. Expansion joints shall consist of a preformed jointing material of bituminous fibreboard or equivalent material.

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 $4m^2$. 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	25	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	25	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 ofdate 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. The cost of all samples and tests shall be borne by the Contractor. ***Further Sampling Contractor's Cost***

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 ***Marking***

Details

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.

C271.35 STORAGE

Protection of Reinforcement

Reinforcement shall be stored above the surface of the ground and shall be protected from damage and from deterioration by exposure.

C271.36 DELIVERY AND RECEIPT OF REINFORCEMENT

Test Before Delivery

1. Unless the Contractor elects to have the reinforcement inspected at the site, no reinforcement shall be delivered to the site until all tests and inspections have been satisfactorily completed and permission to deliver has been granted by the Superintendent.

Notice to Test

2. The Contractor shall give 10 working days notice to the Superintendent for carrying out inspection and testing. The Superintendent will carry out the inspection and testing with reasonable expediency, but the Contractor shall not be entitled to an extra as a result of any delays in this connection.

C271.37 PLACING

Reinforcement Position

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.

Tack Welding

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.

Inspection Required

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.

Splices

4. Splices shall be staggered where practicable and when not shown on the drawings they shall be arranged as directed by the Superintendent.

Lapped Splice

5. Bars forming a lapped splice shall be securely wired together in at least two places, unless welded.

Bar Cover

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:

   (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.

2. ***Adjacent to Walls***

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.

3. ***Selected Backfill***

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

1. ***Size & Type of Backfill Material***

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.

2. ***Extent of Material***

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.

3. ***Synthetic Membrane***

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

1. ***Definition***

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.

2. The minimum depth of sprayed concrete to be applied shall be 75mm. ***Depth***

3. Sprayed concrete lining in open drains shall be coloured to match the adjoining rock colour unless otherwise specified. ***Colour***

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. ***Strength***

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. The cost of all work and material required in the taking, handling, delivery and testing of cores shall be borne by the Contractor. ***Contractor's Cost***

7. 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. 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. ***Procedure***

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 5^{o}C. ***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 30^{o} and 45^{o} 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
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

Item	Activity	Limits/Tolerances	Spec Clause
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. Where non-agitating equipment is used the concrete shall be completely discharged not more than 30 minutes after the addition of water.	C271.22
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^{o}C or the shade temperature is likely to exceed 38^{o}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 Surfaces		
	(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

C271.46 RESERVED

C271.47 RESERVED

C271.48 RESERVED

C271.49 RESERVED

C271.50 RESERVED

MEASUREMENT AND PAYMENT

C271.51 PAY ITEMS

1. Payment shall be made for the activities associated with completing the work detailed in this Specification in accordance with Pay Items C271(a) to C271(f) inclusive.

2. The pay items applicable to particular activities are listed in the Specifications for these activities.

3. A lump sum price for any of these items shall not be accepted.

4. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

PAY ITEM C271(a) EXCAVATION

1. The unit of measurement shall be the cubic metre measured as bank volume of the excavation.

2. This pay item applies to works included in pay items (b), (c) and (d).

3. The disposal of surplus material shall be included in the excavation rates.

4. No additional payment shall be made for drying out wet excavated material or replacement of over excavation for any reason.

5. The schedule rate for excavation shall allow for excavation and backfilling of all types of material. Separate rates shall not be included for earth and rock.

6. The control of stormwater runoff shall be included in the rate for excavation.

PAY ITEM C271(b) NEW JERSEY TYPE BARRIER AND WORKS OF SIMILAR NATURE

1. The unit of measurement shall be the linear metre measured along the length of the barrier.

2. The schedule rate under this Pay Item shall include all operations involved in the forming, compaction of foundations, subbase, concreting, curing, and backfilling adjacent to the barrier.

PAY ITEM C271(c) FOOTPATHS, DRIVEWAYS, MEDIAN TOPPINGS AND WORKS OF SIMILAR NATURE.

1. The unit of measurement shall be the square metre, measured as the horizontal surface area of the concrete footpath, driveways, median topping, or similar as constructed.

2. The schedule rate under this Pay Item shall include all operations involved in the forming, compaction of foundations, subbase, concreting, finishing, curing and backfilling.

3. Where specified on the Drawings, this Pay Item shall include the supply and placement of reinforcing steel.

PAY ITEM C271(d) SPRAYED CONCRETE

1. The unit of measurement shall be the square metre of sprayed concrete in place.

2. The schedule rate under this Pay Item shall include all the operations involved in the surface preparation, spraying, jointing, removal of splash and rebound material and curing.

PAY ITEM C271(e) 20MPa CONCRETE FOR MISCELLANEOUS MINOR CONCRETE WORK

1. The unit of measurement shall be the cubic metre of concrete supplied and placed.

PAY ITEM C271(f) 32 MPa CONCRETE FOR MISCELLANEOUS MINOR CONCRETE WORK

1. The unit of measurement shall be the cubic metre of concrete supplied and placed.

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C273

LANDSCAPING

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C273 - LANDSCAPING

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ANNEXURES

C273A LANDSCAPING MATERIALS

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, pathwayverges, 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 50mm in size;
   - have an organic content of at least 3 per cent by mass;
   - have a pH neither less than 5.5 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 a glyphosate based herbicide listed in Annexure C273A.

(c) Seed

Seed Type and Supplier

1. All seed used shall be of the species and varieties listed in Annexure C273A and shall be sown at the application rates specified therein. The Contractor shall submit to the Superintendent the name/s of the proposed seed supplier/s 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. Grass and clover seed shall be pre-packed commercially with an accompanying certificate of germination. ***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 selected from Annexure C273A 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 organic type listed in Annexure C273A with Nitrogen: Phosphorus: Potassium (N:P:K) ratios of 8 : 3.6 : 2. ***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 10 mm. 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) Water

1. Water used shall be potable. ***Quality***

(h) Binder

1. The binder used in hydromulching and strawmulching shall be Grade ASS, slow setting anionic bitumen emulsion, complying with AS 1160.

(i) Wetting Agent

1. The soil wetting agent added in hydromulching or hydroseeding shall be listed in Annexure C273A and applied at the application rate specified therein.

(j) Pesticide

1. Pesticide used shall be a liquid or powder listed in Annexure C273A. The storage and handling of pesticides shall be in accordance with AS 2507.

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 200 mm 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 50mm 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 in Annexure C273A to the equivalent mass of seed to be spread on 1 hectare of the surface in accordance with Annexure C273A. ***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 specified in Annexure C273A. 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 to correct any undulations or unevenness in the established turf. ***Topdressing***

(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 SLOPES STEEPER THAN 3 TO 1

(a) General

1. Where shown on the Drawings or directed by the Superintendent, slopes shall be vegetated by one of the following methods: ***Method***

   (i) Topsoiling and hydromulching;

   (ii) Topsoiling, hydroseeding and straw mulching;

   (iii) Hydroseeding.

(b) Preparation of Surface

1. Weeds shall be killed by spraying with herbicides as specified under Clause C273.05(a). ***Herbicide Treatment***

2. No more than seven days before seeding all loose material shall be removed from fill batters and cut batters, which are not stepped, by dragging a heavy steel chain of minimum weight of 30 kilograms per metre of length or by other methods approved by the Superintendent. ***Preparation***

(c) Topsoiling

1. Where batters have been stepped, the steps shall be loosely filled with topsoil. Elsewhere, topsoil shall be uniformly applied to provide an average thickness of 50mm with a minimum compacted thickness of 30mm at any location. ***Application***

(d) Hydromulching or Hydroseeding

1. The hydromulch or hydroseed shall comprise the materials shown in Table C273.1. The materials shall be applied at the application rates shown in Table C273.1. ***Application Rate***

2. Dry surfaces shall be watered by a fine spray before the application of the hydromulch. ***Watering***

3. The mixing and treatment of seed shall be carried out in accordance with Clause C273.05(c). ***Treatment of Seed***

4. During preparation of the hydromulch or hydroseed slurry, liquid form pesticide shall be added to the storage tank, to facilitate surface application, at a rate of 5 litres of pesticide to the equivalent volume of hydromulch or hydroseed slurry to be spread on 1 hectare of surface in accordance with Table C273.1. ***Pesticide***

5. Storage tanks, containers and equipment to be used in hydromulching or hydroseeding of slopes shall be clean and free of contamination from previous operations. ***Equipment***

6. A slurry mixture shall be produced by addition of the specified materials in the tank and agitated to maintain a uniform consistency during application. It shall be applied uniformly over the whole surface. ***Uniform Mix***

7. Hydromulch or hydroseed shall not be applied under the following weather conditions at the site: ***Weather Conditions***
   - when temperature is higher than 35^{o}C
   - when winds exceed 15 km/hr;
   - where, in the opinion of the Superintendent, the surface is too wet or
   - during rain periods or when rain appears imminent.

8. Application rates shall be in accordance with Table C273.1

Material	Application Rate per Hectare	
	Hydromulching	Hydroseeding
i) Vegetable Mulch (kg)	2,500	Nil
ii) Water (l)	35,000	20,000
iii) Binder (l)	700	Nil
iv) Fertiliser	See Annexure C273A	
v) Seed	See Annexure C273A	
vi) Wetting Agent (l)	35	20
vii) Pesticide (l)	5	5

Table C273.1 - Materials and Application Rates

(e) Straw Mulching

1. The mulch to be applied after hydroseeding shall comprise a matrix of straw and an anionic slow setting bitumen emulsion binder. Meadow hay shall not be used. The straw mulch shall be uniformly applied by a suitable blower unit at a rate of 250 bales (each of 20 kilograms) of straw per hectare of surface. The bitumen emulsion shall be incorporated as a spray into the air stream of the mulch blower at a rate of not less than 2,500 litres of bitumen emulsion per hectare of surface. The finished straw mat shall have a minimum thickness of 20mm at any location. ***Method***

C273.07 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 in Annexure C273A 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 organic fibre mat listed in Annexure C273A. 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 as specified under Clause C273.05(g).

LANDSCAPE PLANTING

C273.08 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 35^{o}C or below 10^{o}C). ***Notice of Commence-ment***

C273.09 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, listed in Annexure C273A, with a nine months' release period and having Nitrogen:Phosphorus: Potassium (N:P:K) ratios of 6.3 : 1.8 : 2.8. ***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 as indicated in Annexure C273A. 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 job site 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 as indicated in Table C273.2, and planted in accordance with the Drawings. ***Quality***

	Type or Stock				
	50mm Tube	**Gro-Tube**	**Semi Advanced**	**Advanced Stock**	**Super Advanced**
Plant Container: dia (mm)	50	75	150	200	300
depth (mm)	75	100	150	200	300
Plant Height (mm)	200 min	300 min	300 min	300 min	500 min
(leaf & stem)	300 max	400 max	400 max	500 max	750 max
Planting Holes: side dia (mm)	200	200	300	400	600
depth (mm)	200	200	300	400	600
Number of Fertilizer Pellets	2	3	5	5	7

Table C273.2 - Plant Stock

(f) Stakes

1. All stakes shall be 25mm square by 1,500mm long hardwood and sharpened at one end. ***Size***

C273.10 PLANTING

(a) Mass Planting in Mulched Bed

1. The area to be planted shall be sprayed with herbicide, as specified under Clause C273.05(a). Sprayed areas shall remain undisturbed for two weeks. Alternatively, where approved by Council, a synthetic weed blocking fabric shall be applied to the area to be planted. ***Herbicide/ Weed Blocking Treatment***

2. The surface shall be ripped at 500mm centres to a depth of 300mm and the top 200mm of the planting bed broken up by cultivation to a maximum size of 50mm. Mulch, 100mm thick, shall be spread over the planting bed. After removal of the localised mulch, planting holes shall be excavated to the dimensions and depths as shown in Table C273.2 and the material removed. ***Surface Preparation***

3. The specified number of fertilizer pellets as shown in Table C273.2 shall be placed beside the rootball of each plant. ***Fertilizer Pellets***

4. The planting hole shall be backfilled with topsoil complying with Clause C273.04(a) and compacted by foot up to surface level, care being taken to avoid mixing mulch with topsoil. A stake shall be driven 300mm deep and 200mm clear of each 'Advanced' and 'Super Advanced' size stock and the stock tied to it by a strip of 50mm wide hessian webbing. ***Backfill and Staking***

5. Each backfilled hole shall receive 10 litres of water before the mulch is respread over the disturbed area. The mulch shall be left just clear of the plant stem. ***Watering and Mulching***

(b) Individual Planting

1. A planting area 600mm dia. or square shall be loosened to a depth of 400mm. Planting holes shall be excavated to dimensions and depths as shown in Table C273.2 and the material spread evenly around each hole ***Planting Holes***

2. The specified number of fertiliser pellets, as shown in Table C273.2, shall be placed beside the rootball of each plant. ***Fertilizer Pellets***

3. The planting hole shall be backfilled with topsoil complying with Clause C273.04(a) and compacted by foot up to surface level. A stake shall be driven 300mm deep and 200mm clear of each 'Advanced' and 'Super Advanced' size stock and the stock tied to it by a strip of 50mm wide hessian webbing. ***Backfill and Staking***

4. Each backfilled hole shall receive 10 litres of water. ***Watering***

5. Weed infestation for a distance of 800 mm surrounding each proposed planting shall be killed by spraying with a herbicide as specified in Clause C273.05(a). All due care shall be taken to avoid damage caused by contact between herbicide and the plant by means of spray drift etc. Alternatively, where approved by Council, a synthetic weed blocking fabric shall be applied to the 800mm area surrounding each proposed planting. ***Herbicide /Weed Blocking Treatment***

6. Immediately after planting, mulch 100mm thick, starting just clear of the plant stem, shall be spread over an area of 600mm radius surrounding the plant. ***Mulch***

C273.11 CARE OF LANDSCAPE PLANTING

1. The Contractor shall water all plants, from the time of planting, at the rate of 10 litres per plant every third day for the first twelve weeks. ***Watering***

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. The cost of replacement shall be borne by the Contractor. ***Replacement Plants Contractor's Cost***

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

C273.12 RESERVED

C273.13 RESERVED

C273.14 RESERVED

C273.15 RESERVED

C273.16 RESERVED

LIMITS AND TOLERANCES

C273.17 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C273.3 below.

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Topsoil**		
	a) Organic Content	>3% by mass	C273.04a
	b) pH	>5.5 <7.5	C273.04a
	c) Soluble Salt	<0.06% by mass	C273.04a
2.	**Turf**	Widths >300mm.	C273.04d
3.	**Vegetable Mulch**		
	a) Material	maximum size <10mm	C273.04f
	b) Paper Pulp	<50% by mass of total mulch	C273.04f
4.	**Topsoiling**	Minimum compacted thickness at any location of 30mm	C273.05b C273.06c C273.07a
5.	**Straw Mulching**		
	a) Straw Mat	Finished thickness >20mm.	C273.06e
6.	**Landscape Planting**		
	a) Temperature	Planting not to be undertaken when temperatures >35^{o}C or <10 ^{o}C.	C273.08
7.	**Mulch**		
	a) Fines	Shall not exceed 5% by volume.	C273.09d
	b) Woodchip	Maximum size <50mm.	C273.09d
8.	**Plant Material**		
	a) Container Soil Mix	Contain >20% <25% by volume of clay.	C273.09e

Table C273.3 - Summary of Limits and Tolerances

MEASUREMENT AND PAYMENT

C273.18 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in the Specification in accordance with Pay Items C273(a) to C273(d) inclusive.

2. A lump sum price for any of these items shall not be accepted.

3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. Notwithstanding any general statements to the contrary that may be made elsewhere in this Specification, in the context of landscape works all areas shall be measured in the plane of the surface and thicknesses specified shall apply perpendicular to the surface.

5. Erosion and sedimentation control measures are measured and paid in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION.

6. Topsoil stockpiling is measured and paid in accordance with the Specification for EARTHWORKS.

Pay Item C273(a) VEGETATION OF SLOPES 3 TO 1 OR FLATTER

1. The unit of measurement shall be the square metre.

2. The schedule rate shall cover all costs associated with the vegetation of such areas, including surface preparation, topsoiling, sowing and/or turfing, and watering.

Pay Item C273(b) VEGETATION OF SLOPES STEEPER THAN 3 TO 1

1. The unit of measurement shall be the square metre.

2. The schedule rate shall cover all costs associated with the vegetation of such areas, including surface preparation, topsoiling, and as appropriate hydroseeding, hydromulching and/or straw mulching, and watering.

Pay Item C273(c) VEGETATION OF OPEN DRAINS

1. The unit of measurement shall be the square metre.

2. The schedule rate shall cover all costs associated with the vegetation of such areas, including surface preparation, topsoiling, sowing, surface protection by bitumen emulsion spraying, lining and/or turfing as appropriate, and watering.

Pay Item C273(d) LANDSCAPE PLANTING

Pay Item C273(d)(i) Provision of Mulched Bed for Mass Planting

1. The unit of measurement shall be the square metre.

2. The schedule rate shall cover all costs associated with the preparatory work of the mulched bed before planting.

Pay Item C273(d)(ii) Mass Planting

1. The unit of measurement shall be `each' plant.

2. The schedule rate shall cover all costs associated with the planting in the mulched bed and subsequent care of each plant.

Pay Item C273(d)(iii) Individual Planting

1. The unit of measurement shall be `each' plant.

2. The schedule rate shall cover all costs associated with the preparatory work, planting and subsequent care of each plant.

ANNEXURE C273A

LANDSCAPING MATERIALS

(SAMPLE ONLY - TO BE COMPLETED BY COMPILER)

	MATERIAL	TYPE	MINIMUM APPLICATION RATE
1.	HERBICIDE *	'Roundup'	9 litres/200 litres water/ha
2.	SEED		
	a) Grass	Rye Corn (April-August) or	60 kg/ha
		Japanese Millet (September-March	60 kg/ha
		Hulled Couch	5 kg/ha
		Red Clover (Inoculated)	5 kg/ha
		White Clover (Inoculated)	5 kg/ha
		"Elka" Perennial Rye	5 kg/ha
	(b) Native	Acacia dealbata	4 kg/ha
		Acacia buxifolia	1 kg/ha
		Acacia decurrens	1 kg/ha
		Acacia pravissima	1 kg/ha
		Leptospermum lanigerum	1 kg/ha
		Hardenbergia violacea	500 g/ha
		Kennedia prostrata	500 g/ha
		Acacia implexa	200 g/ha
		Banksia marginata	200 g/ha
		Bursaria spinosa	200 g/ha
		Callistemon pallidus	200 g/ha
		Dodonaea viscoca	200 g/ha
3.	TURF GRASS		
	(a) Medians	Couch	Refer to Drawings
	(b) Verges/Footpaths	Buffalo	"
	(c) Other Areas	Couch	"
4.	FERTILISER *		
	(a) Vegetation of Slopes/Drains	Dynamic Lifter 'Nitro"	1000 kg/ha
	(b) Landscape Planting	'Kokei' pellets	Refer Table C273.2
5.	WETTING AGENT *	'Aquasoil'	1 litre/1000 litres of mix water
6.	PESTICIDE *		
	(a) Liquid	'Lorsban 500 EC'	5 litres
	(b) Powder	'Lorsban 250 W'	10 kg
7.	ORGANIC FIBRE MAT *	'Sta-firma' (light grade)	-
8.	MULCH	Composted/Pasteurized	100mm thick

* Material shall be as listed or equivalent as approved by Council.

QUEENSLAND

SPECIFICATION

C306

ROAD OPENINGS AND RESTORATIONS

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of nonconformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION 306 - ROAD OPENINGS AND RESTORATION

CLAUSE **CONTENTS** **PAGE**

SPECIFICATION 306 : ROAD OPENINGS AND RESTORATIONS

GENERAL

306.01 SCOPE

1. The work to be executed under this Specification consists of the clearing, excavation, backfilling and restoration activities associated with the installation of Council and/or public utility services within public road reserves or other reserves under the control of the Council.

2. The Specification shall apply to Works under Contract where the Principal to the Contract is either:
   a) The Council
   b) The relevant Public Utility Authority for the works under execution.

3. This Specification excludes the installation activities of the relevant public utility service.

4. Installation of utility services by open trenching methods in carriageway concrete pavements shall not be permitted without the prior approval of the Superintendent, or Council in the case where the Utility Authority is the Principal in the Contract. Utility services under carriageway concrete pavements shall be installed in accordance with the Specification for TRENCHLESS CONDUIT INSTALLATION. ***Utility Services Under Concrete Pavements***

5. The Council may require removal and restoration to footpaths and/or carriageway pavements, adjacent to the Works, in addition to the removal and restoration requirements of the scope of this specification. Such additional work shall be identified and defined by Council's Restoration Officer at the Set Out Inspection and Approval hold point of the Contract. In this case, payment for the additional removal and restoration activities shall be made as a Variation to the Contract at the schedule rates for the particular activities. ***Additional Work***

306.02 DEFINITIONS

For the purposes of this Specification the definition of terms used to define the components of the road reserve shall be in accordance with AS 1348.1. ***Standard***

The terms are:

Carriageway - That portion of a road or bridge devoted particularly to the use of vehicles, inclusive of shoulders and auxiliary lanes.

Clearing - The removal of vegetation or other obstacles at or above ground.

Footpath - The paved section of a pathway.

Pathway - A public way reserved for the movement of pedestrians and of manually propelled vehicles.

Pavement - That portion of a carriageway placed above the subgrade for the support of, and to form a running surface for, vehicular traffic.

Shoulder - The portion of the carriageway beyond the traffic lanes and contiguous and flush with the surface of the pavement.

Verge - That portion of the formation not covered by the carriageway or footpath.

306.03 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

201	-	Control of Traffic
242	-	Flexible Pavements
243	-	Bituminous Cold Mix
244	-	Sprayed Bituminous Surfacing
245	-	Asphaltic Concrete
254	-	Segmental Paving
305	-	Trenchless Conduit Installation

(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)
AS 1289.F1.2	-	Determination of the California bearing ratio of a soil, Standard laboratory method for an undisturbed specimen.
AS 1348.1	-	Road and traffic engineering - Glossary of terms, Road design and construction.

(c) Other

Street Openings Conference - Information Bulletin on Codes and Practices, 1997.

306.04 PROVISION FOR TRAFFIC

1. The Contractor shall construct the Works in a safe manner with the least possible obstruction to traffic, both vehicular and pedestrian.

2. The Contractor shall submit a Traffic Guidance Scheme and carry out all activities for controlling traffic, both vehicular and pedestrian, in accordance with the Specification for CONTROL OF TRAFFIC.

Guidance Scheme

3. Safe, all weather vehicular and pedestrian access to properties shall be maintained wherever possible. Notice of 48 hours shall be provided to property owners whose access will be restricted.

Access

CLEARING

306.05 SET OUT

1. The Contractor shall set out the limits of the proposed excavation for trenches, pits and chambers required for the utility service installation. The set out shall be in chalk or crayon so as to be readily understandable by Council's Restoration Officer and will not permanently deface any surface.

Initial Limits

2. In order to minimise or eliminate residue small portions of paving slabs the set out shall be adjusted as necessary. Any adjustments will be with respect to the existing paved surfaces and joint patterns. Adjustments shall be in accordance with the following guidelines:

Adjusted Limits

(a) Pathways

1. The set out line shall be varied in accordance with the reinstatement requirements of the Street Opening Conference's publication, Information Bulletin on Codes and Practices.

(i) Bitumen and Concrete Paving - In accordance with the reinstatement provisions and sketches of the above Information Bulletin.

(ii) Segmental Paving Units - The set out line shall be at least one whole unit clear of both sides of the minimal alignment of the trench.

(iii) Textured or Patterned Concrete - The set out line shall be as determined by Council's Restoration Officer in conjunction with the Contractor's surveyor.

2. Where the Superintendent directs that driveways are not to be disturbed, the utility services under driveways shall be installed in accordance with the Specification for TRENCHLESS CONDUIT INSTALLATION.

(b) Carriageways

1. In asphalt pavements, the proposed trench set out shall be at the minimum width for the depth of service and, wherever possible, shall be at right angles to the road reserve boundary. ***Minimum Width***

2. Any trench or surface work proposed in the vicinity of Permanent or State Survey Marks shall be referred to the Land Information Centre of the Department of Land and Water Conservation, prior to commencement or Work, to obtain protection or relocation requirements. ***Survey Marks***

3. The set out line shall be presented to the Superintendent for approval prior to the commencement of any surface clearing work. This action constitutes a **HOLD POINT**. The Superintendent and Council's Restoration Officer shall inspect and approve the set out, and define any additional removal and restoration work required by Council, prior to the release of the hold point. ***HP***

306.06 SURFACE TREATMENT REMOVAL

1. Trench set out lines located on concrete or asphalt footpaths, and asphalt carriageway pavements, shall be sawcut for the full depths of the bound pavement layers except where the set out line is located along expansion joints. Where a concrete subbase is found, upon removal of segmental pavers, it shall also be sawcut along the trench set out lines. ***Sawcut***

2. Concrete or asphalt footpath and carriageway pavement material shall be broken out, between the trench set out lines, removed and legally disposed of off-site by the Contractor or stockpiled at a site nominated by the Superintendent. ***Concrete and Asphalt***

3. Segmental paving units both full and cut, between the trench set out lines, shall be taken up by hand and neatly stacked on wooden pallets at locations as directed by the Superintendent. Any dimension stone kerb and gutter units within the set out lines shall also be taken up and stacked in a similar manner. ***Pavers***

4. Concrete edging, associated with the lifted segmental pavers, shall be broken out, removed and legally disposed of off-site by the Contractor or stockpiled at a site nominated by the Superintendent. ***Paver Edging***

5. Grass turf, between trench set out lines, shall be neatly cut into squares of approximately 300mm square, taken up and stored at locations as directed by the Superintendent and shall be watered as directed during the storage period. If the grass is considered by the Superintendent to be unsuitable for reuse, it shall be removed and legally disposed of off-site by the Contractor. ***Grass***

6. Small plants, shrubs and trees, between the set out lines, identified as being suitable for replanting shall be taken up and stored at locations nominated by the Superintendent. The root ball of such plants, shrubs and trees shall be wrapped in a hessian or plastic bag with drain holes and shall be watered as directed during the storage period. ***Plants, Shrubs, Trees***

7. Other plants, shrubs and trees deemed unsuitable for replanting shall be removed and legally disposed of off-site by the Contractor. ***Unsuitable Vegetation***

8. House stormwater pipes discharging into carriageway gutters shall be maintained at all times. Any damage to these pipes caused by the Contractor's activities shall be repaired or replaced to the satisfaction of the Superintendent. The costs of such rectification works shall be borne by the Contractor. ***House SW Pipes Contractor's Cost***

EXCAVATION

306.07 TOPSOIL

1. Before undertaking trench excavation, topsoil which is considered by the Superintendent to be suitable for reuse in the restoration work, shall be removed and stockpiled at a site nominated by the Superintendent. ***Suitable for Reuse***

306.08 TRENCH EXCAVATION

1. Trenches shall be excavated to the standard widths and depths for the particular utility service installation or to dimensions as shown on the Drawings.

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 other public utilities exist in the vicinity of the Works, the Contractor shall obtain the approval of the relevant authority to the method of excavation before commencing excavation. The locations of existing underground services shall be established by exploratory excavation prior to the principal trench excavation. Proof of approval of the relevent authority shall be provided to the Superintendent, if requested. ***Approval by Other Public Utility authorities***

4. The "Dial Before You Dig" Service, telephone 1100, shall be contacted to obtain locations of water, sewer, stormwater, gas, electricity and telephone services. ***Location of Services***

5. The Utility Authorities' contact names listed in the Specification - GENERAL shall also be contacted to verify the location of services. ***Services Verification***

6. Existing retired services shall be excavated and removed off-site and legally disposed of by the Contractor. The resulting excavation shall be backfilled in accordance with Clause 306.11. ***Retired Services***

7. Trench or foundation excavation shall be undertaken to the planned level for the bottom of the specified bedding or foundation level or such other depth as directed by the Superintendent. This action constitutes a **HOLD POINT**. The Superintendent's approval of the trench or foundation level is required prior to the ***Excavation Level***

HP

release of the hold point.

8. The excavated earth and rock material shall be segregated and stockpiled, at sites nominated by the Superintendent, for reuse in backfilling operations. Excavated material shall not, at any time, be stockpiled against tree trunks, buildings, fences or obstruct the free flow of water along gutters where stockpiling is permitted along the line of the trench excavation. Where stockpiling is not permitted the excavated material shall be legally disposed of off-site. ***Stockpiles***

9. Any material at the bottom of the trench or at foundation level which the Superintendent deems to be unsuitable shall be removed and legally disposed of off-site 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 aligned at the specified level and slope of the utility service. ***Unsuitable Material***

306.09 PROTECTION OF TREES

1. Existing trees shall be protected from all damage during the Works.

2. The Contractor shall not store, stockpile, dump or otherwise place under or near trees bulk materials and harmful materials including oil, waste concrete, clearings, boulders and the like and shall prevent wind blown materials from harming trees and plants. ***Materials Clear of Trees***

3. The Contractor shall not attach stays, guys and the like to trees and shall prevent damage to tree bark. ***No Attachments***

4. When working near trees the Contractor shall not remove topsoil from within the drip line of trees unless otherwise specified or directed. Where it is necessary to excavate within the drop line, hand methods or trenchless methods, such that root systems are preserved intact, shall be used. The duration of open excavations under tree canopies shall be determined by the Superintendent at the time of the excavation and shall comply with the requirements of Council's Tree Preservation Officer. ***Work Near Trees***

5. The Contractor shall not cut tree roots exceeding 50mm in diameter without the approval of Council's Tree Preservation Officer. Where it is necessary to cut tree roots, a saw or similar means shall be used such that the cutting does not unduly disturb or rock the remaining root system. Immediately after cutting, an approved bituminous fungicidal sealant shall be applied to the cut to prevent the incursion of root disease. ***Tree Roots***

BACKFILL

306.10 BEDDING ZONES

1. Bedding material for the bed, haunch, side and overlay zone shall be to the requirements, and shall be installed in accordance with the Specification for the particular utility service being installed. ***Particular Service Specification***

2. The overlay zone is defined as that part of the trench backfill immediately over the utility service for a maximum of 300mm. With the side zones material, overlay zone material typically comprises selected backfill compacted in accordance with Clause 306.12. ***Overlay Zone***

306.11 TRENCH BACKFILL

1. Between the overlay zone and the top of subgrade, the trench shall be backfilled with 14 to 1 moist sand/cement mix using washed river sand or non-cohesive backfill material approved by the Superintendent in layers as directed. Backfill material shall be nominated for approval of the Superintendent at least 7 days prior to commencement of work. ***Approved Material***

2. Where the trench excavation material has been disposed of off-site, the trench shall be backfilled with imported backfill material, from a source approved by the Superintendent, free of tree stumps and roots and capable of being compacted in accordance with Clause 306.12. ***Imported Material***

3. Where excavation is through a selected material zone below the subbase layer, the section of trench within the select material zone shall be backfilled with selected material free from stone larger than 100mm maximum dimension and the fraction passing a 19mm AS sieve shall have a 4 day soaked CBR value, in accordance with AS 1289.F1.2, not less than that of the adjacent selected material zone. ***Selected Material Zone***

4. Except in carriageway pavements, backfilling, for a minimum 300mm thickness, around tree roots shall consist of a topsoil mixture approved by the Superintendent, placed and compacted in layers of 150mm minimum depth to a dry density equal to that of the surrounding soil. ***Tree Roots***

5. The Contractor shall not place backfill material above the original ground surface around tree trunks or over the root zone unless approved by the Superintendent ***Backfill at Trees***

6. Immediately after backfilling the tree root zone shall be thoroughly watered. ***Watering Root Zone***

306.12 COMPACTION

1. Backfilling shall be compacted to the following requirements when tested in accordance with AS 1289.5.4.1 for modified compactive effort.

	Relative Compaction
Foundations or trench base to a depth of 150mm below foundation levels	92%
Material replacing unsuitable material	92%
Bedding material	92%
Selected backfill and ordinary backfill material	
· below 1.5m of finished surface	92%
· within 1.5m of finished surface	97%
Backfill material within the selected material zone	97%

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 (modified compaction). ***Moisture Content***

4. The Contractor shall arrange for compaction testing in accordance with AS 1289.5.7.1 on the completed backfill and shall submit the results of such tests to the Superintendent within 2 weeks of the tests being performed. Compaction tests shall be undertaken by the Contractor at a minimum frequency of 1 per every second layer per 50 square metres of backfill surface area. ***Testing***

5. When compacting adjacent to utility services, the Contractor shall adopt compaction methods which will not cause damage or misalignment to any utility service. ***Precautions***

RESTORATION

306.13 GENERAL

1. Carriageway pavements and pathways shall be restored in a continuous manner to a condition equivalent to that existing at the commencement of the Works as determined by Council's Restoration Officer. ***Equivalent Condition***

2. Utility service surface pits, access chamber frames and lids, etc, shall be set such that carriageway pavements and footpaths can be restored to original levels. The Contractor shall liaise with other utility authorities should any other utility service surface box be required to be adjusted or replaced prior to restoration. ***Surface Pits, etc***

3. The Contractor shall form up and prepare the areas for paved restoration and present the prepared areas to the Superintendent for approval prior to the commencement of any paving restoration work. This action constitutes a **HOLD POINT**. The Superintendent and Council's Restoration Officer shall inspect and approve the prepared areas, and verify any additional restoration work required by Council, prior to the release of the hold point. ***HP***

306.14 TEMPORARY PAVEMENT

(a) Carriageways

1. Immediately after backfilling to subgrade level the carriageway pavement shall be temporarily restored and re-opened to traffic, if the planned date for final restoration exceeds 5 days. ***Re-open to Traffic***

2. Temporary restoration shall consist of either:

   - Bituminous cold mix, of a maximum thickness 50mm, on a base of compacted crushed stone, gravel or other material approved by the Superintendent. ***Flexible Pavement***

   - Steel plating, over the trench, of sufficient thickness to support traffic loadings and suitably secured with pins or bituminous cold mix to the satisfaction of the Superintendent. ***Steel Plating***

3. Where steel plating is used, advance warning signs shall be provided in accordance with AS 1742.3.

(b) Footpaths, including driveways

1. Immediately after backfilling to subgrade level the footpaths, including driveways, shall be temporarily restored and re-opened for pedestrian use, if the planned date for final restoration exceeds 2 days. ***Re-open to Traffic***

2. Temporary restoration shall consist of:

   - Bituminous cold mix, of maximum thickness 50mm, or other material approved by the Superintendent.

306.15 CARRIAGEWAY SUBBASE AND BASE

1. Prior to final carriageway pavement restoration, the temporary pavement material shall be removed and disposed of off-site by the Contractor. If approved by the Superintendent, the temporary base material may remain in place and be incorporated into the final pavement. In any case the asphaltic material shall be removed and disposed of off-site by the Contractor. ***Remove Temporary Pavement***

2. Subbase and base shall consist of crushed rock, DGS20 or DGB20 material, from a source approved by the Superintendent and configured in layers and depths as indicated in Annexure 306A. Subbase and base layers shall be supplied and installed in accordance with the Specification for FLEXIBLE PAVEMENTS. ***Material***

3. Each layer of the subbase and base courses shall be uniformly compacted over the full area and depth within the trench to a relative compaction of 100 per cent when tested in accordance with AS 1289.5.4.1. Compaction tests shall be undertaken by the Contractor at a minimum frequency of 1 per every second layer per 50 square metres of restoration surface area. ***Uniform Compaction***

4. Services trenches shall be backfilled from the top of the sand surround layer to the underside of pavement with Cement Modified Base (CBR 35, 1.5% Cement) shall be compacted to 95% Standard in the lower layers and to 100% Standard in the top 300mm below subgrade. Alternatively backfill with or 7Mpa lean-mix concrete. (Higher strength is not permitted, to avoid problems when rehabilitating roads in the future.) ***Reinstatement of Trenches***

306.16 CARRIAGEWAY BITUMINOUS WEARING SURFACE

1. The bituminous wearing surface shall meet the requirements set out in Annexure 306A. Bituminous wearing surface shall also be supplied and laid in accordance with the Specifications for SPRAYED BITUMINOUS SURFACING or ASPHALTIC CONCRETE, as applicable.

2. The evenness of the resulting restored surface shall be such that when tested with a 3m straightedge, seven to ten days after completion, departures from the straightedge are less than ±5mm and the surface is such that an impact is not transmitted to traffic passing over the restoration. ***Surface Tolerance***

3. The bituminous surfacing tack coat for asphalt or seal coat for sprayed bituminous seals shall present a waterproof surface at application. This bituminous surfacing shall extend a minimum dimension of 100mm beyond the perimeter of any trench excavation. ***Tack Coat Limits***

4. Asphalt placed as restoration shall similarly extend in plan a minimum dimension of 100mm beyond the perimeter of any trench excavation. ***Asphalt Limits***

5. The joint between new and existing asphalt shall be vertical and cut by diamond saw or milling machine. The vertical face and subgrade surface of the old asphalt shall be treated by bituminous tack coating. ***Joint***

6. The thickness of asphalt at any point shall not vary from the specified layer thickness by more than +10mm or less than –0mm. ***Thickness Tolerance***

306.17 PATHWAYS

1. Pathways, and other public areas, shall be restored with materials consistent with the existing surface before commencement of the Works, or as directed by the Superintendent.

2. Prior to final footpath restoration, the temporary pavement material shall be removed and disposed of off-site by the Contractor. If approved by the Superintendent, the temporary material may remain in place and be incorporated into the final subbase. ***Remove Temporary Material***

3. All paved footpaths, and paved areas, shall be constructed on a subbase of 150mm crushed stone DGB20 compacted to 100 percent relative compaction in accordance with AS 1289.5.4.1 ***Subbase Material***

4. For restoration patches in footpath surfaces, the surface level at any point along the patch's edge shall match the adjoining footpath surface within ±2mm. ***Patches***

(a) Concrete Footpaths, including Textured and Patterned

1. Concrete footpaths shall be constructed in 25 MPa concrete to the same thickness (with a minimum of 100mm), surface finish and pattern as the adjoining footpaths and driveways as appropriate or as directed by the Superintendent. ***Match Existing Footpaths***

2. In concrete footpaths, expansion joints consisting of a 15mm thick preformed jointing material of bituminous fibreboard or equivalent approved by the Superintendent shall be placed where new concrete abuts existing concrete and in line with joints in existing concrete. ***Expansion Joints***

3. Control joints shall be formed strictly in line with the control joints in existing concrete. ***Control Joints***

4. Around electricity supply poles, the concrete paving shall be terminated 200mm from the pole and the resulting space filled with cold mix asphalt. ***Poles***

(b) Asphalt Footpaths

1. Asphalt footpaths shall consist of asphalt in accordance with the Specification for ASPHALTIC CONCRETE, or BITUMINOUS COLD MIX, where nominated by Council's Restoration Officer, and shall be constructed to the same thickness as the adjoining footpath and compacted to a smooth even surface. ***Match Existing Footpaths***

(c) Segmental Paving Units

1. All activities associated with the restoration of segmental paving units shall be carried out to the requirements of the Specification for SEGMENTAL PAVING. ***Specification***

2. Existing paving units, taken up and stored, shall be relaid to match the pattern and surface levels of the existing paving. ***Match Existing***

3. Cut or damaged paving units which are unsuitable for relaying, as determined by the Superintendent, shall be replaced with new units. Such new paving units ***Damaged Units***

shall be supplied by the Contractor and shall be of the same material, type, size and colour as the existing paving units. ***Replaced***

4. The paving pattern at tree surrounds, service boxes, poles, etc, shall match the pattern at similar existing features in the immediate area or be as directed by the Superintendent in consultation with Council's Restoration Officer. ***Paving around Trees, etc.***

306.18 TURFED VERGES

1. A bed of stockpiled topsoil, of minimum thickness 50mm, shall be placed on the subgrade prior to restoration of turfed verges. ***Topsoil Bed***

2. Existing grass turfs, taken up and stored, shall be relaid to conform with the original grassed surface. Turfs shall be hard butted against each other in rows and the seams topdressed with topsoil. Turf shall be rolled and watered to ensure direct and uniform contact with the topsoil. ***Relay Turfs***

3. Any additional turf required to fully restore grassed verges shall be supplied by the Contractor and shall be the same type as the existing grass. ***Additional Turf***

306.19 VERGE PLANTS, SHRUBS AND TREES

1. Stockpiled topsoil shall be placed on the subgrade to the same thickness as the surrounding topsoil, prior to replanting. Planting holes shall be excavated, at locations determined by the Superintendent in consultation with Council's Restoration Officer, and the material spread evenly around each hole. ***Topsoil Bed***

2. Existing plants, shrubs and trees, taken up and stored which are suitable for replanting as determined by the Superintendent, shall be replanted in the prepared holes. ***Replanting***

3. The planting hole shall be backfilled with topsoil and compacted by foot up to surface level. The shrubs and trees shall be staked as directed by the Superintendent, watered and maintained for 2 months after the date of formal completion of the restoration works. ***Compacted, Staked and Watered***

306.20 CLEANUP

1. Upon completion of all restoration Works, the areas affected by the Works and associated construction activities shall be cleaned up and restored to a condition equivalent to that existing at the commencement of the Works.

2. All formwork, rubbish and residue construction materials, including material left at stockpiles, shall be legally disposed of off-site by the Contractor.

3. The Contractor shall present the cleaned up restoration works to the Superintendent for approval. This action constitutes a **HOLD POINT**. The Superintendent's approval is required prior to the formal completion of the restoration works. ***HP***

306.21 WORK-AS-EXECUTED DRAWINGS

1. The Contractor shall supply the Superintendent with fully marked-up Work-as-Executed Drawings for the whole of the Contract within 2 weeks of approval of the restoration works by the Superintendent. Prints or reproducibles of the Contract Drawings will be supplied by the Principal free of charge for this purpose. ***Submission***

SPECIAL REQUIREMENTS

306.22 RESERVED

306.23 RESERVED

MEASUREMENT AND PAYMENT

306.24 PAY ITEMS

1. Payment shall be made for all the activities associated with completing the work detailed in this specification on a schedule of rates basis in accordance with Pay Items 306(a) to 306(p) inclusive.

2. A lump sum price for any of these items shall not be accepted.

3. If any item, for which a quantity of work is listed in the Schedule of Rates, has not been priced by the Contractor it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. Provision for traffic, both vehicular and pedestrian, shall be deemed to be included in the schedule rates generally in accordance with this Specification and not in the Specification for CONTROL OF TRAFFIC.

5. Segmental paving works are measured and paid in accordance with this Specification and not in the Specification for SEGMENTAL PAVING.

6. Trenchless installation of utility services under driveways is measured and paid in accordance with the Specification for TRENCHLESS CONDUIT INSTALLATION.

Pay Item 306 (a) SAWCUT EXISTING PAVEMENT/FOOTPATH

(1) Bituminous Carriageway Pavement

(2) Bituminous Footpath

(3) Concrete Footpath, including Textured or Patterned Concrete.

1. The unit of measurement shall be the linear metre measured along the actual line of cut. Separate rates shall be given for sawcuts in each type of material.

2. The schedule rate shall include all activities associated with the sawcutting operations including hire of plant and provision of water.

Pay Item 306 (b) REMOVE EXISTING PAVEMENT/FOOTPATH

(1) To Stockpile

(2) Disposal off-site

1. The unit of measurement shall be the square metre of pavement removed including both bituminous and concrete material and including concrete subbase from segmental paving where applicable. Separate rates shall be given for removal to stockpile and disposal off-site.

2. The width and length shall be as shown on the Drawings or as directed by the Superintendent.

3. The schedule rate, for, item 306b(1), shall include all activities associated with breaking out, removing, carting and placing into stockpile.

4. The schedule rate, for item 306b(2), shall include all activities associated with breaking out, removing, transporting off-site, disposal and any tipping fees applicable.

Pay Item 306 (c) SEGMENTAL PAVING UNITS

(1) Take Up and Stack Existing Units - Carriageway

(2) Take Up and Stack Existing Units - Footpath

(3) Lay Existing Units - Carriageway

(4) Lay Existing Units - Footpath

(5) Supply and Lay New Units - Carriageway

(6) Supply and Lay New Units - Footpath

1. The unit of measurement shall be the square metre of surface of segmental paving units taken up or laid. Separate rates shall be given for taking up existing, laying existing and supply and lay new paving units for carriageways or footpaths as appropriate.

2. The width and length shall be as shown on the Drawings or as directed by the Superintendent.

3. The schedule rate, for items 306c(1) and 306c(2), shall include all activities associated with taking up and stacking units on pallets at locations as directed. Concrete subbase, where applicable, shall be removed under Pay Item 306(b).

4. The schedule rate, for items 306c(3) and 306c(4), shall include all activities involved in the laying and compaction of subbase, including concrete subbase where applicable, and existing segmental paving units, bedding sand and joint filling sand, including any cutting of units, concrete edging, joints overlying concrete pavement joints, and concrete surrounds or aprons around surface penetrations.

5. The schedule rate, for items 306c(5) and 306c(6), shall include all activities involved in the laying and compaction of subbase, including concrete subbase where applicable, and supply, laying and compaction of segmental paving units, bedding sand and joint filling sand, including any cutting of units, concrete edging, joints overlying concrete pavement joints, and surrounds or aprons around surface penetrations.

Pay Item 306 (d) REMOVE EXISTING EDGE STRIPS

1. The unit of measurement shall be the linear metre measured along the length of the edge strip.

2. The schedule rate shall include all activities associated with breaking out, removing, transporting off-site, disposal and any tipping fees applicable.

Pay Item 306 (e) GRASS TURF

(1) Take Up and Store Existing Turf

(2) Lay Existing Turf

(3) Supply and Lay New Turf

1. The unit of measurement shall be the square metre of surface of grass turf taken up or laid. Separate rates shall be given for taking up existing, laying existing and supply and lay new turf.

2. The width and length shall be as shown on the Drawings or as directed by the Superintendent.

3. The schedule rate, for item 306e(1), shall include all activities associated with cutting, taking up and storing turf at locations as directed.

4. The schedule rate, for item 306e(2), shall include all activities associated with the topsoil bedding, rolling, laying of existing turf and topdressing.

5. The schedule rate, for item 306e(3), shall include all activities associated with the topsoil bedding, rolling, supply and laying of new turf and topdressing.

Pay Item 306 (f) VERGE PLANTS, SHRUBS AND TREES

(1) Take Up and Store Existing

(2) Plant Existing

1. The unit of measurement shall be each plant, shrub or tree taken up or planted. Separate rates shall be given for taking up existing or replanting existing.

2. The schedule rate, for item 306f(1), shall include all activities associated with taking up, storing and watering at locations as directed.

3. The schedule rate, for Item 306f(2), shall include all activities associated with topsoil placement, preparatory work, planting, staking and subsequent care of each plant for 2 months after the date of formal completion of the restoration works.

Pay Item 306 (g) STOCKPILING OF TOPSOIL

1. The unit of measurement shall be the cubic metre as bank volume.

2. The volume shall be calculated by multiplying the area, derived from the width and length as shown on the Drawings or as directed by the Superintendent, by the depth of topsoil directed to be removed by the Superintendent.

3. The schedule rate shall include all activities associated with stripping topsoil, carting and placing into stockpile.

Pay Item 306 (h) TRENCH EXCAVATION

(1) To Stockpile

(2) Disposal off-site

1. The unit of measurement shall be the cubic metre as bank volume of excavation. Separate rates shall be given for excavation to stockpile and disposal off-site.

2. The volume shall be calculated by multiplying the width by the depth by the length as follows:

Width - as specified for the particular utility service installation.

Depth - average actual depth from topsoil stripped ground surface to underside of specified bedding.

Length - actual excavation length, centre to centre of pits.

3. The schedule rate shall be an average rate to cover all types of material encountered during excavation. Separate rates shall not be included for earth and rock.

4. The schedule rate shall include all activities associated with:

- Excavation, including excavation and replacement of unsuitable material.
- Replacement for over-excavation for any reason.
- Excavation, removal and disposal of retired services, and backfilling of the resulting excavations.
- Protection of trees and treatment to cut tree roots.

5. The schedule rate, for item 306h(1), shall include all activities associated with carting and placing into stockpile.

6. The schedule rate, for item 306h(2), shall include all activities associated with transporting off-site, disposal and any tipping fees applicable.

Pay Item 306 (i) TRENCH BACKFILL

(1) From Stockpiled Material

(2) From Imported Material

1. The unit of measurement shall be the cubic metre measured as backfill compacted volume in place in the trench.

2. The volume shall be calculated by multiplying the width by the depth by the length as follows:

Width - average trench width

Depth - average actual depth from top of subgrade to top of bedding overlay material around theutility service.

Length - actual trench length, centre to centre of pits.

3. The schedule rate shall include all activities associated with backfilling, compaction, testing and treatment around tree roots.

4. The schedule rate, for item 306i(1), shall include all activities associated with loading and carting from stockpile.

5. The schedule rate, for item 306i(2), shall include all activities associated with supply and delivery of imported material, including material for a selected material zone where specified.

Pay Item 306 (j) TEMPORARY PAVEMENT - CARRIAGEWAY AND FOOTPATH

1. The unit of measurement shall be the square metre of trench area restored with temporary pavement.

2. The area shall be calculated by multiplying the trench width by the actual length of temporarily restored pavement.

3. The schedule rate shall include all activities associated with the supply, delivery, placing and compaction of the base material and bituminous cold mix. It shall include all activities and material necessary for maintenance of the temporary pavement in a safe condition until the permanent restoration is executed.

Pay Item 306 (k) TEMPORARY STEEL PLATING

1. The unit of measurement shall be the square metre of trench area plus adequate allowance for support on both sides of the trench.

2. The area shall be calculated by multiplying the trench width by the actual length of trench to be covered.

3. The schedule rate shall include all activities associated with the hire, delivery, placement, securing and subsequent removal and return to depot of the steel plates. It shall include all activities and materials necessary for maintenance of the plating until permanent restoration is executed.

Pay Item 306 (l) SUBBASE

1. The unit of measurement shall be the square metre of trench.

2. The area shall be calculated by multiplying the trench width by the length.

3. The schedule rate shall include all activities associated with the removal of temporary pavement, supply, delivery, spreading and compaction in accordance with Annexure 306A.

Pay Item 306 (m) BASE

1. The unit of measurement shall be the square metre of trench.

2. The area shall be calculated by multiplying the trench width by the length.

3. The schedule rate shall include all activities associated with the removal of temporary pavement where no subbase is required, supply, delivery, spreading and compaction in accordance with Annexure 306A.

Pay Item 306 (n) BITUMINOUS WEARING SURFACE

1. The unit measurement shall be the square metre of new surface area in accordance with this Specification.

2. The area shall be calculated by multiplying the trench width +200mm by the length.

3. The schedule rate shall include all activities associated with the removal of temporary pavement or existing pavement to the new perimeter, supply, delivery, spreading and compaction in accordance with Annexure 306A.

Pay Item 306 (o) FOOTPATH

(1) Asphalt/Sprayed bituminous seal

(2) Plain Concrete

(3) Textured/Patterned Concrete

1. The unit of measurement shall be the square metre of paved surface, including driveways.

2. The width and length shall be as shown on the Drawings or as Directed by the Superintendent.

3. The schedule rate, for item 306o(1), shall include all activities associated with the forming, compaction of foundations, supply, delivery and compaction of subbase and bituminous material.

4. The schedule rate, for items 306o(2) and 306o(3) shall include all activities associated with the forming, compaction of foundations, supply, delivery and compaction of subbase, supply delivery, placing, finishing and curing concrete, including texturing or patterned finish where applicable. Where shown on the Drawings or as directed by the Superintendent this pay item shall include the supply and placement of reinforcing steel.

Pay Item 306 (p) CLEANUP

1. The unit of measurement shall be the square metre of carriageway and/or footway surface or other surface as applicable.

2. The lengths and widths shall be as shown on the Drawings or as directed by the Superintendent.

3. The schedule rate shall include all activities associated with the cleaning up of the Work site, and transporting off-site and disposal of material including any tipping fees applicable.

ANNEXURE 306A

RESTORATION REQUIREMENTS

(TO BE COMPLETED BY COMPILER)

Description of Location:.....

Restoration Pavement Layers:

Wearing Surface Type.....Thickness (mm).....(or nominal stone size)

Base Layer Type.....Thickness (mm).....

Sub Base Layer Type.....Thickness (mm).....

Selected Material.....Thickness (mm).....

Special Requirements *(e.g. Linemarking, Traffic Signs, Advice to adjacent property owners etc.)*

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QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C401

WATER RETICULATION

AUS-SPEC appreciates the role of the Water Directorate in comprehensively updating the design and construction specifications for water and sewer works.

This is a construction Specification suitable for use in a *Sequential* Design and Construction (not Design/Construct) delivery of work method, with separate contracts for Design, then Construction, where:

(a) A development subdivision is likely to be certified.

(b) State Government subsidises a small town water supply scheme where the Project Director elects not to use performance based contracts for the Service Providers where the work is likely to be supervised by a designated person appointed by the Principal with defined authority.

(c) Where the augmentation is small and relates to a component or sub-component of a larger facility where the work is likely to be supervised by a designated person appointed by the Principal with defined authority.

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C401 - WATER RETICULATION

SPECIFICATION C401: WATER RETICULATION

GENERAL

C401.01 SCOPE

1. The Work to be constructed under this Specification consists of the construction of: ***Suitable Works***

(a) Mains up to DN600 nominal size;

(b) Small pump stations.

2. This Specification excludes the construction activities for: ***Exclusions***

   (a) Reservoirs, including repainting of reservoirs;

   (b) Treatment plants;

   (c) Dams;

   (d) Headworks, including bores and weirs;

   (e) Dosing plant;

   (f) Larger pump stations;

3. The Contractor shall carry out the work, and supply materials meeting the requirements of the reference documents, and, in particular, in accordance with the requirements of the WATER RETICULATION CODE OF AUSTRALIA except as otherwise specified herein. ***Compliance with Standards***

C401.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed below whilst being cited in the text in the abbreviated form or code indicated. The Contractor shall possess, or have access to, the documents required to comply with this Specification. ***Documents***

2. References to the WATER RETICULATION CODE OF AUSTRALIA are made where there are parallel sections or equivalent clauses to those in this Specification. Where not called up as part of this Specification, these references are identified by part and section numbers and enclosed in brackets thus (WSAA Part, Section). ***Water Reticulation Code***

(a) Council Specifications

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

(b) Australian Standards

References in this Specification or on the Drawings to Australian Standards are noted by their prefix AS or AS/NZS. ***Australian Standards***

Where not otherwise specified in this Specification or the Drawings, the Contractor shall use the latest Australian Standard, including amendments and supplements, ***Currency***

available within two weeks of close of tenders.

AS/NZS 1111	-	ISO metric hexagon commercial bolts and screws
AS/NZS 1112	-	ISO metric hexagon nuts, including thin nuts, slotted nuts, and castle nuts
AS 1152	-	Specification for test sieves
AS/NZS 1260	-	PVC pipes and fittings for drain, waste and vent applications
AS 1272	-	Unsintered PTFE tape for thread sealing applications
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 1349	-	Bourdon tube pressure and vacuum gauges
AS 1432	-	Copper tubes for plumbing, gasfitting and drainage applications
AS 1444	-	Wrought alloy steels – Standard, hardenability (H) series and hardened and tempered to designated mechanical properties
AS/NZS 1477	-	PVC pipes and fittings for pressure applications
AS 1565	-	Copper and copper alloys – Ingots and castings
AS 1579	-	Arc welded steel pipes and fittings for water and waste water
AS/NZS 1594	-	Hot-rolled steel flat products
AS 1627.4	-	Metal finishing – Preparation and pre-treatment of surfaces – Abrasive blast cleaning
AS 1646	-	Elastomeric seals for waterworks purposes
AS 1657	-	Fixed Platforms, walkways, stairways and ladders – Design, construction and installation
AS 1830	-	– Grey cast iron
AS 1939	-	Degrees of protection provided by enclosures for electrical equipment
AS 2032	-	Code of practice for installation of PVC pipe systems
AS 2033	-	Installation of polyethylene pipe systems
AS 2129	-	Flanges for pipes, valves and fittings
AS/NZS 2280	-	Ductile iron pressure pipes and fittings
AS 2419.2	-	Fire hydrant installations – fire hydrant valves
AS 2528	-	Bolts, studbolts and nuts for flanges and other high and low temperature applications
AS/NZS 2566	-	Buried flexible pipelines
AS 2638	-	Gate valves for waterworks purposes
AS 2837	-	Wrought alloy steels – Stainless steel bars and semi-finished products
AS/NZS 3000	-	Electrical installations (Wiring rules)
AS/NZS 3008	-	Electrical installations – selection of cable
AS 3439	-	Low voltage switchgear and controlgear assemblies
AS/NZS 3518	-	Acrylonitrile butadiene styrene (ABS) pipes and fittings for pressure applications
AS 3571	-	Glass filament reinforced thermosetting plastics (GRP) pipes – Polyester based – Water supply, sewerage and drainage applications
AS 3578	-	Cast iron non-return valves for general purposes
AS 3681	-	Guidelines for the application of polyethylene sleeving to ductile Iron pipelines and fittings
AS 3690	-	Installation of ABS pipe systems
AS 3691	-	Solvent cement and priming (cleaning) fluids for use with ABS pipes and fittings
AS/NZS 3862	-	External fusion-bonded epoxy coating for steel pipes
AS 3952	-	Water supply –Spring hydrant valve for waterworks purposes
AS 3996	-	Metal access covers, road grates and frames
AS 4087	-	Metallic flanges for waterworks purposes
AS/NZS 4129	-	Fittings for polyethylene (PE) pipes for pressure applications

AS/NZS 4130	-	Polyethylene (PE) pipes for pressure applications
AS/NZS 4158	-	Thermal-bonded polymeric coatings on valves and fittings for water supply purposes
AS/NZS 4321	-	Fusion bonded medium density polyethylene coating & lining for pipes and fittings
AS/NZS 4680	-	Hot-dipped galvanised (zinc) coatings on fabricated ferrous articles
AS/NZS 4765(Int)		Modified PVC (PVC-M) pipes for pressure applications
AS 4794	-	Non-return valves – Swing check and tilting disc

(c) Other

Institute of Public Works Engineering Australia (IPWEA)

- Streets Opening Conference Information Bulletin on Codes and Practices (Sections 3 and 4 detailing locations and depths of other services and preferred location for water reticulation pipes)
-

Water Resources Guidelines for Planning and Design of Urban Water Supply Schemes

Department of Natural Resources TB No. :3/1997
Guidelines for Planning and Design of Urban Water Supply Schemes
Update of : Chapter 3 -Quality of Water
Chapter 21A -Fire Fighting

Water Act 2000 and Sewerage and Water Supply Act 1949 incorporating amendments and subordinate legislation including Standard Water Supply Law (1998) SL No. 100

Water Services Association of Australia (WSAA)

*WSAA 03	-	Water Reticulation Code of Australia WSAA 01 Polyethlene Pipeline Code Standard Drawings
	-	WATER RETICULATION CODE OF AUSTRALIA drawings (WSAA 03 Part 4)

British Standard

BS 410	-	Specification for test sieves

Where any standard drawing used in conjunction with this Specification includes technical requirements that conflict with this Specification, the requirements of this Specification shall take precedence. ***Precedence***

MATERIALS

C401.03 GENERAL

1. The Contractor shall comply with the requirements of the manufacturer's recommendations regarding the handling, transport and storage of materials and as further specified in this Specification. ***Due Diligence***

2. The Contractor shall not use damaged or defective materials, including coatings and linings, outside the manufacturer's recommended limits. ***Rejection***

C401.04 UNPLASTICISED AND MODIFIED PVC (uPVC and PVC-M)

1. Unplasticised PVC (uPVC) and modified PVC (PVC-M) pipes and fittings for mains and suction pipes shall comply with AS/NZS 1477 and AS/NZS 4765, shall be suitable for use with rubber ring (elastomeric) seal, complying with AS 1646, joints and shall be of the class and size as shown on the Drawings. (WSAA 03 Part 3, section 12.1) ***Standard***

2. PVC pipes and fittings for mains and suction pipes shall be installed in accordance with AS 2032 and AS/NZS 2566.1. ***Installation***

3. Pipes and fittings are to be handled and stored protected from sunlight. The Contractor shall provide protection for the pipes and fittings from ultra violet light and damage. The Contractor shall take account of the time for storage and type of shelter. ***Protection***

C401.05 ACRYLONITRILE BUTADIENE STYRENE (ABS)

1. ABS pipes and fittings shall comply with AS/NZS 3518 to the class, size, use, shape and colour as shown on the Drawings and installed in accordance with AS/NZS 2566.1 and AS 3690. ***Standard***

2. ABS pipes and fittings shall be joined in accordance with the manufacturer's instructions using solvent cement to AS 3691. ***Jointing***

C401.06 GLASS REINFORCED PLASTIC (GRP)

1. Glass filament reinforced thermosetting plastics (GRP) pipes shall comply with AS 3571 and shall be of the class and size as shown on the Drawings and installed in accordance with AS/NZS 2566. (WSAA 03 Part 3, section 12.1). ***Standard***

2. Pipes and fittings shall be handled and stored protected from sunlight. The Contractor shall provide protection for the pipes and fittings from ultra violet light and damage. The Contractor shall take account of the time for storage and type of cover. ***Protection***

C401.07 DUCTILE IRON (DI) PIPE AND FITTINGS

1. Ductile iron (DI) pipes and fittings shall comply with AS/NZS 2280 and shall be of the class, size and lining, as shown on the Drawings, and installed in accordance with AS/NZS 2566.1. Jointing shall be with rubber rings (elastomeric), complying with AS 1646, to the class and type as shown on the Drawings. ***Standard***

2. Flanges shall be to the table shown on the Drawings. Bolts and nuts for flanged joints shall be galvanised, or stainless steel as for the pumps specified herein, unless shown otherwise on the Drawings. ***Flanges***

3. All pipework shall be sleeved externally with polyethylene sleeving in accordance with the requirements of AS 3681 unless specified otherwise to be coated and lined. All fittings shall be fusion-bonded coated, in accordance with AS/NZS 4321, or wrapped. The Contractor shall wrap all unprotected joints in the trench with a petrolatum tape system approved by the Superintendent. ***Corrosion Protection***

C401.08 STEEL PIPELINE AND FITTINGS

1. Steel pipelines and fittings shall comply with AS 1579 and AS/NZS 1594 and shall be of the class, size, lining and coating as shown on the Drawings. (WSAA 03 Part 3, section 12.1). ***Standard***

2 The Contractor shall wrap all unprotected joints in the trench with a petrolatum tape system approved by the Superintendent. ***Corrosion Protection***

3. The jointing system shall be rubber ring (elastomeric), complying with AS 1646, unless shown otherwise on the Drawings. ***Joints***

4 The Contractor shall not lay continuously welded steel pipelines parallel to, when in close proximity, high voltage power lines. ***High Voltage Powerlines***

C401.09 COPPER PIPE AND FITTINGS

1. Copper tube and fittings shall comply with AS 1432 and shall be of the size and type as shown on the Drawings. ***Standard***

2. The Contractor shall install copper tube, capillary and compression fittings, insulated from ferrous mains, as shown on the Drawings. (WSAA 03 Part 3, section 12.1) ***Insulated***

C401.10 POLYETHYLENE (PE)

1. Polyethylene pipe shall comply with AS/NZS 4129 and AS/NZS 4130 and shall be of the class and size as shown on the Drawings and installed in accordance with AS 2033. (WSAA 03 Part 3, section 12.1). ***Standard***

2. Jointing shall be by butt thermal fusion or by electrofusion couplings, or with compression fittings. ***Jointing***

3. Fittings up to 110mm shall comply with AS/NZS 4129. Fittings from 110mm to 600mm shall be ductile iron in accordance with AS/NZS 2280 and coated internally and externally in polyethylene in accordance with AS/NZS 4129. ***Fittings***

4. The Contractor shall provide pipe of the appropriate external diameter consistent with the required internal diameter shown on the Drawings. ***Internal Diameter***

C401.11 STEELWORK

1. Structural steelwork, including ladders, brackets, and covers, complying with AS 1657, shall be abrasive blast cleaned to AS 1627.4 Class 2.5 and hot dip galvanised to AS/NZS 4680. (WSAA 03 Part 3, section 12.1). ***Corrosion Protection***

VALVES AND HYDRANTS

C401.12 GENERAL

1. The Contractor shall ensure that the valves and hydrants supplied are compatible with the pipework such that proper sealing is provided between the pipe flanges and the valve. The concrete lining in pipework shall not be chipped away or reduced to provide clearance from the working parts of valves. ***Compatibility with Pipework***

2. The Contractor shall ensure that the valves and hydrants are installed so as to facilitate maintenance. The Contractor shall take into account the manufacturer's recommendations, the requirements shown on the Drawings, the type of connection, lubrication of connecting bolts, and the location of valves within valve chambers or type of backfill material. (WSAA 03 Part 3, section 15.11.1) ***Installation***

3. The type of external corrosion protection of buried valves and hydrants shall be fusion-bonded medium density polyethylene coating to AS 3862 and AS/NZS 4321 or thermal-bonded polymeric coating to AS/NZS 4158. ***Corrosion Protection***

4. Flanges shall comply with AS 2129 and AS 4087 and shall be of the class and size shown on the Drawings. ***Flanges***

C401.13 STOP VALVES

1. Sluice valves shall be resilient seated valves manufactured in accordance with AS 2638. The valves shall be flanged where permitted by the Water Authority unless shown otherwise on the Drawings. ***Sluice Valves***

2. Ball valves shall be flanged where permitted by the Water Authority unless shown otherwise on the Drawings. ***Ball Valves***

3. Butterfly valves shall be flanged where permitted by the Water Authority unless shown otherwise on the Drawings ***Butterfly Valves***

4. Knife Gate valves shall be flanged where permitted by the Water Authority unless shown otherwise on the Drawings ***Knife Gate Valves***

5. Scour valve assemblies shall be as shown on the Drawings. ***Scour Valves***

6. Valves shall be operated by a removable key. The Contractor shall size "Tee Key" valve operators and hand wheels to operate the valves under all operating conditions throughout their full range with no greater than 180 Newtons applied to the ends of the key bar or the rim of the wheel. ***Operation***

7. Hand wheels, where specified, shall display an embossed or engraved arrow, together with "open" and/or "close" corresponding to the valve operation. ***Hand Wheel Arrow***

C401.14 AIR VALVES

1. Air valves shall be of the double air valve type with integral isolating valve of minimum size DN80, and shall be installed as shown in the Drawings. ***Standard***

2. Air valves shall be installed such that they can be maintained without affecting supply. ***Isolation***

3. The Contractor shall obtain the consent of the Water Authority for the use of other types of air valves. ***Alternate Type***

C401.15 NON-RETURN VALVES

1. Non return valves shall be of the swing check type to AS 3578 or AS 4794 of cast iron or steel body, cover and disc with bronze body and disc seat rings. The leaf shall swing clear and provide an unobstructed waterway. Wafer style non-return valves shall not be used. ***Standard***

2. The body cover shall be located and sized to allow the valve flap to be removed and the seat to be inspected without removing the valve body. ***Maintenance***

3. Where shown on the Drawings, non-return valves shall have an extended spindle, minimum grade 316 stainless steel complying with AS 1449, fitted with an adjustable counterweight, together with a proximity switch to indicate a no-flow condition. ***No Flow Switch***

4. No flow switches shall have the following features: ***Switch Features***

(a) Be of the eccentric cam operated limit switch type.

(b) Have a minimum rating of 10 amps, 240 V AC, 50- Hz.

(c) Be oil tight and dust proof to IP 65.

(d) Be suitable for 25mm conduit entry.

(e) Be mounted on rigid stainless steel complying with AS 1449 adjustable brackets. The brackets shall be free of sharp edges and exposed corners.

C401.16 SPRING HYDRANTS

1. Spring hydrant bodies shall be manufactured in accordance with AS 3952 and installed in accordance with AS 2419.2 except as varied below. ***Standard***

2. The top of spring hydrants shall be between 100mm and 200mm below finished surface level as detailed in WSAA 03 Part 4, WAT-1104. If necessary, this shall be achieved by the use of hydrant risers of various heights. ***Access***

C401.17 PRESSURE REDUCING VALVES

1. Pressure reducing valves shall be of the type as shown on the Drawings. ***Type***

2. Pressure reducing valves shall be installed with isolating valves to facilitate maintenance. ***Installation***

PIPELINE CONSTRUCTION

C401.18 GENERAL

1. The Contractor, employees, or subcontractors, engaged in excavations, including tunnelling, are to be accredited for the work. Proof of accreditation constitutes a **HOLD POINT**. The approval of the Superintendent, to the supplied documentation, shall be required prior to the release of the hold point. ***Accreditation*** ***HP***

2. The Contractor shall not change the pipeline alignment without prior concurrence of the Water Authority. The Contractor shall provide full details, of any proposed changes to the pipeline alignment, to the Superintendent for submission to the Water Authority. This action constitutes a **HOLD POINT**. The Superintendent shall obtain the decision of the Water Authority prior to the release of the hold point. ***Alignment Changes*** ***HP***

C401.19 LOCATION

1. The location of the mains and pump stations, sizes of mains, types of chambers and covers and the classes of pipes shall be as shown on the Drawings. The pipelines shall be laid to grades and locations shown on the Drawings and to tolerances in the WATER RETICULATION CODE unless directed otherwise by the Superintendent (WSAA 03 Part 3, section 21). The Contractor shall confirm the locations immediately prior to construction. (WSAA 03 Part 3, sections 11). ***Pipe Laying Method***

C401.20 COVER OVER PIPELINES

1. The minimum depth of cover to be provided for mains, measured vertically from the finished ground level to the top of any socket, shall be as follows: (WSAA 03 Part 3 WAT –100)

Minimum Cover

(a) 750mm in embankments

(b) 600mm in roadways and commercial areas

(c) 450mm elsewhere

2. Lesser cover may be provided where special protection of the pipelines has been shown on the Drawings or directed by the Superintendent.

Special Protection

3. Greater cover may be provided where special situations occur, where there is conflict with other services or to meet grading requirements.

Special Needs

4. The maximum cover shall be 1000mm.

Maximum Cover

C401.21 CROSSINGS

1. Where a pipeline crosses a Main or State road, creek or involves features shown on the Drawings, under the control of any Authority, the Contractor shall carry out the work in accordance with the requirements of that Authority. The Contractor shall provide written notification to the Authority of the intention to carry out the work, and pay the appropriate fees. (WSAA 03 Part 3, section 15.4 - aqueducts). The Contractor shall obtain the written approval from the Authority prior to commencement of work. Such written approval shall be supplied to the Superintendent if requested. This action constitutes a **WITNESS POINT**. The Superintendent shall advise at the time of notification by the Contractor whether the option to request the written approval is to be exercised.

Contractor's Responsibility

WP

2. Where shown on the Drawings, the Contractor shall use trenchless methods for the installation of the mains. The installation of the main by open trenching shall not be permitted over the lengths designated for trenchless installation. (WSAA 03 Part 3, section 15.13).

Existing Road Crossings

3. The Contractor shall address, in its Method Statement for trenchless conduit installation, the following:

Trenchless Installation Methodology

(a) General description of method and sequence of operation.

(b) Size, depth and position of temporary pits required.

(c) Use of specialist subcontractors.

(d) Specialist equipment to be used.

(e) Grout type and method of injection.

4. The encasement pipe shall be as detailed on the Drawings. The encasement pipe shall extend 1.0m behind the back of the kerb on either side of the carriageway.

Encasement Pipe

5. The carrier pipe shall be positioned on support cradles and the carrier pipe shall be centrally located within the encasement pipe.

Support Cradles

6. After installation and pressure testing of the carrier pipe, the Contractor shall fill the annular space between the carrier pipe and the encasement pipe with suitable grout or cementitious grout filler. ***Grouting***

7. Where the carrier pipe is ductile iron cement lined (DICL), any length of pipe which is enclosed within the encasement pipe need not be wrapped in polyethylene tubing.

C401.22 EARTHWORKS

1. The Contractor shall carry out all excavations for structures and pipelines to the lines, grades and forms shown on the Drawings or as directed by the Superintendent within the specified tolerances. The Contractor shall comply with all requirements of the appropriate Authority including having regard for drainage, dewatering, silt control, noise abatement, proximity to existing buildings and generally for the amenity of adjacent owners. (WSAA 03 Part 3, section 13). ***Contractor Responsibility***

2. The Contractor shall leave a clear space of 600mm minimum between the edge of any excavation and the inner toe of stockpiles. No excavated materials shall be stockpiled against the walls of any building or fence without the written permission of the owner of such building or fence. Topsoil from excavations shall be stockpiled separately and utilised to restore the surface after backfilling. ***Excavated Material***

3. At the completion of work each day, the Contractor shall install safety fencing to Statutory requirements along the edges of open excavations to isolate them from the public. The Contractor shall provide fenced walkways and vehicular crossings across trenches to maintain access at all times from carriageway to individual properties or within individual properties and advise all affected residents beforehand. All installations shall be of adequate size and strength and shall be illuminated to prevent accidents. ***Public Safety*** ***Access to Property***

4. The Contractor shall locate, protect and repair, as necessary, all services affected by the Works at the Contractor's expense. ***Existing Services***

5. The Contractor shall carry out erosion and sedimentation control at all construction sites in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION. ***Erosion Control***

6. The Contractor shall take account of safety issues and possible wet weather effects to limit the extent of excavation left open. (WSAA 03 Part 3, section 13.2). ***Limiting Excavations***

C401.23 MINIMUM TRENCH WIDTH FOR PIPELINES

1. The minimum clear width of trench (inside internal faces of timbering or sheet piling, if used) to a height of 150mm above the top of the pipe shall be as shown in Table C401.1.

NOMINAL SIZE OF PIPE (DN)	MINIMUM CLEAR WIDTH OF TRENCH (mm) (inside timbering or sheet piling, if any)	
	PIPE OTHER THAN PVC/PE	PVC/PE PIPE
100	400	350
150	450	400
200	500	450
225	550	500
250	550	500
300	600	550
375	700	650
400	700	650
450	750	700
500	850	800
525	850	800
600	950	900

Table C401.1 - Minimum Trench Widths

2. Where the Drawings provide for a trench to be excavated across a paved surface, the width of the trench shall be kept to a minimum. Bitumen and concrete surfaces shall be carefully cut, by sawcutting or other means approved by the Superintendent, so as to provide a neat straight line free from broken ragged edges. ***Minimum Disturbances***

3. The Contractor shall widen the trench where necessary for the installation of valves and fittings and protective coating systems. ***Widen For Fittings***

C401.24 EXCAVATION DEPTH

1. The Contractor shall excavate trenches to 75mm below the underside of the pipe barrel and socket or coupling except for mains to be laid on other than rock foundations or as otherwise shown on the Drawings. ***75mm Below***

2. The excavation shall be carried out such as to ensure solid and uniform support for each pipe over the whole length of barrel with chases provided for joints and wrapping. ***Pipe Support***

C401.25 SUPPORT OF EXCAVATION

1. The Contractor shall adequately support all excavations to Statutory requirements as the Works proceed. When withdrawing supports, the Contractor shall exercise every precaution against slips or falls. (WSAA 03 Part 3, section 13.6) ***Precautions Against Slips or Falls***

2. The Contractor shall ensure that timber is left in place where its removal may endanger structures in the vicinity of the excavation. ***Timber Left in Place***

C401.26 PIPE BEDDING

1. When excavation of the trench has been completed the Contractor shall obtain the Superintendent's approval prior to commencing pipe laying, jointing and bedding. This action constitutes a **HOLD POINT**. The Superintendent's approval of the excavated trench is required prior to the release of the hold point. ***Approval***

HP

2. Crusher screenings shall only be used for pipe bedding where sand or other non- ***Crusher***

cohesive material is not readily available locally or where the Contractor can demonstrate that its use will not impede repair operations. (WSAA 03 Part 3, section 14). ***Screenings***

3. Pipes (excluding PVC/PE pipes) may be laid directly on other than rock foundation. The Contractor shall provide non-cohesive granular bedding, having a minimum thickness of 75mm below the barrel and socket of the pipe, where rock or other hard material occurs in the bottom of the trench. The bedding material shall conform to the sands classification described in WSAA 03 Part 4 WAT-1200 Soil Classification Guidelines, either loose clean sand and /or medium dense clean sand. ***Pipes other than PVC/PE***

4. For PVC/PE pipes, irrespective of foundation, the material to be used for pipe bedding (underlay a minimum of 75mm below the underside of the pipe barrel and socket, side support and overlay to a depth of 150mm above the top of the pipe) as shown in Figure 5.1 in AS 2032 shall be in sand or other non-cohesive granular material, either crushed, natural or blended, and its grading shall fall within the limits in Table C401.2, except that where the materials cannot be reasonably sourced from within the vicinity, the Contractor may use materials satisfying the classification in paragraph 2 above provided also that the material meets the requirements for passing sieve sizes 9.5mm and 6.7mm shown in Table C401.2 : ***PVC/PE Pipes***

Sieve Size Aperture Width (AS1152)	Equivalent BS Sieve Size (BS410)	Percentage Passing
9.5 mm	$^3/_8$ inch	100
6.7 mm	¼ inch	90 - 100
425 μm	No. 36	40 - 90
150 μm	No. 100	0 - 10

Table C401.2 - Grading of Bedding Material for PVC and PE Pipes

5. All mains laid on grades steeper than 50 per cent shall be encased in concrete as detailed on the Drawings. ***Grades Greater Than 50%***

C401.27 LAYING AND JOINTING OF PIPES

1. Unless detailed otherwise in this Specification, the Contractor shall install pipes in accordance with AS 2032, AS 2033, AS/NZS 2566 or AS 3690 as appropriate. (WSAA 03 Part 4, sections 15, WAT-1102 to 1105). ***Installation***

2. Before being laid, all pipes, fittings, valves, and materials to be used shall be cleaned and examined by the Contractor and, if required by the Superintendent, the Contractor shall suspend each one in a sling to enable the Superintendent to inspect it. If directed by the Superintendent, the Contractor shall oil valves and repack valve glands. ***Examination***

3. The Contractor shall ensure that the interior of the pipeline is clean and free from obstructions. Plugs shall be used to prevent foreign matter entering sections of pipeline which are left uncompleted overnight. ***Cleaning***

4. The Contractor shall take all necessary precautions to prevent flotation of pipes during laying, backfilling and initial testing. Any temporary supports shall be removed prior to completion of backfilling. ***Flotation***

5. Except where solvent cement joints are needed to make up or install fittings, joints in pipelines shall be flexible, rubber ring (elastomeric) joints, either roll-on or skid type or, where shown on the Drawings, mechanical joints, either fixed flange or bolted gland type. ***Joint Type***

6. For pipes with rubber ring (elastomeric) joints, only the lubricant specified in writing by the manufacturer shall be applied in making the joint. The Contractor shall make the joint such that the witness mark shall, at no point, be more than 1mm from the end of the socket. ***Rubber Ring***

7. Pipes may be cut as needed or directed by the Superintendent to suit closing lengths, to remove damaged pipe or fittings or to remove sockets if necessary when jointing a socketed fitting. ***Cut Pipes***

8. For field cuts, a mechanical pipe cutter shall be used, except that PVC/PE pipes may be cut using a power saw or a fine toothed hand saw and mitre box. For field cuts of ductile iron or steel, the Contractor shall ensure that fire fighting equipment, in working order, is on the site prior to the field cuts being made. If the Contractor proposes to use a petrol engined pipe cutter in an excavation, the Contractor shall ensure that a safe atmosphere is maintained in the excavation at all times. ***Pipe Cutting***

9. The Contractor shall prepare the ends of any pipes cut in the field to the manufacturer's written instructions, or as directed by the Superintendent. ***End Preparation***

10. Where pipes are cut in the field, the Contractor shall make a witness mark on the pipe using a felt-tip marking pen at the length specified by the manufacturer from the end of the pipe. The Contractor shall not use PVC/PE pipes with scored witness marks. Where the same manufacturer does not make spigots and sockets, the Contractor shall refer to the socket manufacturer for the correct marking depth. ***Witness Mark***

11. Where PVC/PE pipes are to be joined to ductile iron pipes, the joints shall be made by inserting a PVC/PE spigot into a ductile iron socket. Ductile iron spigots shall not be joined to PVC/PE sockets. Alternatively, multi-fit mechanical couplings or flanged adaptor couplings may be used to join pipes of different materials. ***Different Joints***

12. The Contractor shall conform with the relevant Statutory and OH&S requirements when cutting and disposing of asbestos cement pipes. ***Existing AC Pipe***

13. Flexibly jointed pipelines with gradual changes in alignment or grade shall be laid with the joint being deflected after it has been made. The Contractor shall comply with the manufacturer's written recommendations in respect of maximum deflection for each joint provided that no joint shall be deflected to such an extent as to impair its effectiveness. ***Joint Deflection***

14. The maximum angle of deflection between adjacent pipes shall be limited to 2^{o} or 0.035 radian in areas subject to mine subsidence or slippage. ***Limit of Joint Deflection***

15. Unless otherwise directed by the Superintendent, the Contractor shall lay pipes on continuously rising grades from scour valve to air release valve, notwithstanding any minor irregularities in the ground surface. ***Grade***

16. Detectable identification tape shall be laid along the line of non-metallic mains within 150mm of the finished surface. (WSAA 03 Part 3, section 15.10). ***Detectable Tape***

C401.28 TRENCH STOPS

1. Where a pipe is laid on bedding at a grade of 5 per cent to 14 per cent, the Contractor shall construct, as below, trench stops consisting of bags filled with clay, or sand or cement stabilised sand and sealed: (WSAA 03 Part 4 WAT-1209 and Part 3, sections 15.7, 15.8)

Grade 5% to 14%

   (a) At the socket side of the joint nearest to the position of a stop required in accordance with the formula hereinafter, a recess 100mm deep to suit the width of bag shall be excavated into the bottom of the trench across its full width and into both sidewalls and extend to within 150mm below finished surface level.

   (b) The bags shall be placed around and above the pipe, as in (a) above, so as to give close contact with the pipe and to fill the entire space between the excavated recess and the pipe. Bags shall not be placed onto sand bedding.

2. The distance between trench stops shall be determined by the following formula:

Spacing

$$D = \frac{100}{G}, \text{ whereby}$$

D = Distance between stops in m,
G = Grade of pipe expressed in percentum.

C401.29 CONCRETE BULKHEADS

1. Where a pipe is installed at a grade of 15 per cent to 29 per cent, the Contractor shall construct concrete bulkheads. Where a pipe is installed at a grade 30 per cent to 50 per cent, the Contractor shall construct concrete bulkheads integral with concrete encasement. Bulkheads shall be of 20MPa concrete complying with the Specification for MINOR CONCRETE WORKS, 150mm minimum thickness as follows: (WSAA 03 Part 4 WAT-1209 and Part 3, sections 15.7, 15.8)

Grade 15% to 29% and 30% to 50%

   (a) Where concrete bedding or encasement to pipe is required, the 150mm thick bulkhead shall be cast integral with the concrete bedding or encasement across the width of trench and shall be keyed into both sidewalls a minimum of 150mm. The bulkhead shall extend to 150mm below finished surface level or such other level as directed by the Superintendent.

   (b) Where other bedding, or no bedding, is applicable, the bulkhead shall also be keyed into the bottom of the trench 150mm for the full width of trench.

   (c) A 75mm nominal diameter drain hole shall be provided in the concrete bulkhead immediately above the top of the encasement bedding or foundation and crushed rock or gravel shall be placed in and at the upstream end of the drain hole to act as a filter. The gravel shall be 10 to 20mm in size within 150mm in all directions upstream and above the invert of the drain hole beyond which another 150mm thick surround of gravel 2 to 10mm in size shall be placed.

2. The distance between concrete bulkheads shall be determined by the following formula: ***Spacing***

Concrete bulkhead

$$D = \frac{L}{G}$$

Concrete encasement (continuous) and concrete bulhead

$$D = \frac{100}{G}, \text{ whereby}$$

L = 80 X Pipe length, m
= 450 m max
if L> 100 m use intermediate trenchstops at spacing < 100/G
D = Distance between bulkheads in m
G = Grade of pipe expressed in percentum

C401.30 VALVE AND HYDRANT CHAMBERS

1. The Contractor shall construct around each valve and hydrant a chamber of the type and to the details shown on the Drawings. (WSAA 03 Part 3, section 15.11.12). ***Type***

2. The concrete shall comply with the Specification for MINOR CONCRETE WORKS. ***Concrete***

3. Valve chamber covers shall be painted with white pavement marking paint while hydrant chamber covers shall be painted with yellow pavement marking paint. ***Colour Designation***

4. Where the type of valve chamber is such that the body, or part of the body, of the valve is to be backfilled before the valve chamber is constructed, the Contractor shall either wrap the valve using a tape consisting of synthetic fibre open weave cloth impregnated with saturated hydro-carbons, applied in accordance with the valve manufacturer's written instructions, or apply at least one coat of corrosion preventing material to the valve body after the valve has been installed but before backfilling. The coating material shall be compatible with the coating material which has been applied to the valve prior to delivery. ***Corrosion Protection***

C401.31 CHAMBER COVERS AND FRAMES

1. Covers and frames shall not be warped or twisted. Surfaces shall be finished such that there are no abrupt irregularities and gradual irregularities shall not exceed 3mm. Unformed surfaces shall be finished to produce a surface that is dense, uniform and free from blemishes. Exposed edges shall have a minimum 4mm radius. ***Finish***

2. Tolerances for the dimensions on the COVER shall be - 3mm + NIL. ***Cover Tolerance***

3. Tolerances for the dimensions on the FRAME shall be - 3mm + 3mm. ***Frame Tolerance***

4. Covers shall be seated as shown on the Drawings or as directed by the Superintendent. ***Cover Seating***

5. Covers shall be finished flush with the surface in road pavements, footpaths and other paved surfaces. Elsewhere, covers shall be finished 25mm above the surface of the ground, or such other level as directed by the Superintendent, in a manner designed to avoid as far as possible, the entry of surface water. ***Cover Levels***

6. Cast iron covers and frames shall be manufactured in accordance with AS 3996 and shall be installed and filled with concrete, as necessary, in accordance with the manufacturer's written requirements. ***Installation***

7. The Contractor shall take care to avoid lateral movement, cracking and subsidence when installing plastic covers and frames. ***Plastic Covers***

C401.32

C401.33 THRUST AND ANCHOR BLOCKS

1. Thrust and anchor blocks shall be constructed where shown on the Drawings to the dimensions depicted therein or as otherwise directed by the Superintendent. The blocks shall be provided at valves, flexibly jointed bends, tees, enlargers and reducers or any other point where unbalanced forces resulting from internal pressures will occur. (WSAA 03 Part 4 WAT –1208 and Part 3, section 15.5). ***Location***

2. The Contractor shall provide permanent thrust blocks of 20MPa concrete, complying with the Specification for MINOR CONCRETE WORKS, such that the thrust blocks bear against undisturbed material normal to the direction of thrust resulting from internal pressures over the bearing area not less than that directed by the Superintendent. ***Thrust Blocks***

3. The Contractor shall provide permanent anchor blocks of 20MPa concrete, complying with the Specification for MINOR CONCRETE WORKS, of a volume not less than that directed by the Superintendent. ***Anchor Blocks***

4. The Contractor shall provide temporary anchorages adequate to restrain the pipe when under test. The cost of providing such anchorages shall be deemed to be included in the rates tendered for laying and jointing rising mains. ***Temporary Anchorage***

5. The Contractor shall obtain the consent of the Water Authority for the type and use of restrained joints, as an alternative to thrust blocks, in the case of congested service corridors and urgent commissioning. ***Restrained Joints***

C401.34 CONCRETE ENCASEMENT

1. Where pipes have less than 450mm of cover above the top of the pipe barrel, or where directed by the Superintendent, they shall be encased in concrete. Concrete shall be 20MPa complying with the Specification for MINOR CONCRETE WORKS and have the following minimum dimensions: (WSAA 03 Part 4 WAT –1203, WAT –1204 and Part 3, sections 12.5.5.1, 14.4) ***Location***

   (a) For trenches in other than rock: 150mm minimum under, on both sides and on top of the pipe barrel.

   (b) For trenches in rock: 75mm minimum under the pipe barrel, 150mm on top of the pipe barrel and for the full width of trench excavated.

2. In trenches of other than rock or fissured rock, a contraction joint consisting of a layer of bituminous felt 12mm thick shall be formed in the concrete encasement at the face of each socket or at one face of each coupling. ***Contraction Joint***

3. Reinforcement in concrete encasement shall be as shown on the Drawings. ***Reinforcement***

C401.35 WRAPPING OF PIPELINES

1. Where shown on the Drawings, the Contractor shall enclose a pipeline or a section thereof, in layflat polyethylene sleeving. (WSAA 03 Part 3, section 15.9).

2. The materials to be used shall be high impact resistance polyethylene sleeving, of minimum thickness 0.2mm polyethylene film approved by the Superintendent and 50mm wide plastic adhesive tape. ***Material***

3. The width of the sleeving when flat shall be in accordance with the manufacturer's written recommendations for the size and type of the pipeline which is to be encased. Precautions shall be taken so that exposure to direct sunlight does not exceed 48 hours. ***Width***

4. For dual trenching, pipelines shall be identified by colour sleeving, blue stripe for potable water and lilac for recycled water, or an appropriate identification tape. ***Colour***

5. Application of the polyethylene sleeving and plastic adhesive tape shall be in accordance with the pipe manufacturer's written instructions or as directed by the Superintendent. The Contractor shall take due care not to damage the sleeving during its application or during the backfilling of the trench. Each pipe shall be encased in a length of sleeving overlapped for a minimum of 250mm at each field joint, and the ends of each length of sleeving shall be held in position with at least three circumferential turns of adhesive tape. As the polyethylene sleeving material covering the pipe will be loose, excess material shall be neatly drawn up around the pipe barrel, folded into an overlap on top of the pipe and held in place by means of strips of plastic tape at approximately one-metre intervals. Bends, tapers and similar fittings shall be covered by polyethylene sleeving as specified for the pipes. The Contractor shall hand wrap valves, hydrants and irregular shaped fittings and joints using flat polyethylene sheets secured with plastic adhesive tape, or other suitable material, to provide an adequate seal. The flat polyethylene sheets may be obtained by splitting suitable lengths of sleeving. ***Application***

6. The Contractor shall rectify any damage done to the polyethylene sleeving before, during or after backfilling of the trench. ***Damage***

C401.36 CORROSION PROTECTION OF STEEL BOLTS AND NUTS

1. The Contractor shall wrap all galvanised steel bolts and nuts, used for installation below ground, of flanges, bolted gland joints, mechanical joints, tapping bands using a tape, approved by the Superintendent, consisting of synthetic fibre open weave cloth impregnated with saturated hydrocarbons applied in accordance with the manufacturer's recommendations or as directed by the Superintendent. Bolts and nuts shall be dry, clean and free from rust immediately before wrapping. ***Wrapping***

PIPELINE TESTING AND RESTORATION

C401.37 TESTING OF PIPELINES

1. The Contractor shall pressure test mains to detect leakage and defects in the pipeline including joints, thrust and anchor blocks. This action constitutes a **WP**

WITNESS POINT. The Superintendent shall advise at the time of notification by the Contractor whether the option to inspect the testing is required.

2. Pipelines shall be tested in sections approved by the Superintendent as soon as practicable after each section has been laid, jointed and backfilled, provided that:

   (a) If so specified, or if the Contractor so desires, some or all of the pipe joints shall be left uncovered until the whole of the section has been successfully pressure tested to the satisfaction of the Superintendent; and

   (b) The pressure testing shall not be commenced earlier than seven days after the last concrete thrust or anchor block in the section has been cast. ***Timing***

3. For the purpose of this clause, a section shall be defined as a length of pipeline which can be effectively isolated for testing, eg by means of main stop valves. ***Section Definition***

4. Pressure testing shall not be carried out during wet weather unless otherwise approved by the Superintendent. ***Wet Weather***

5. During pressure testing, all field joints, which have not been backfilled, shall be clean, dry and accessible for inspection. ***Field Joints***

6. During the pressure testing of a pipeline, each stop valve shall sustain at least once, the full test pressure on one side of the valve in closed position with no pressure on the other side for at least 15 minutes. ***Stop Valves***

7. Before testing a pipeline section, the Contractor shall clean it to the satisfaction of the Superintendent and fill it slowly with water, taking care that all air is expelled. Purging of air from rising mains shall be promoted by opening air valves. In order to achieve conditions as stable as possible for testing by allowing for absorption, movement of the pipeline and escape of entrapped air, the section shall be kept full of water for a period of not less than 24 hours prior to the commencement of the pressure testing. ***Filling with Water***

8. The hydrostatic test pressure, which shall be applied to each section of the pipeline, shall be equivalent to the pressure rating of the pipe specified. ***Test Pressure***

9. The Contractor shall maintain the specified test pressure as long as required by the Superintendent while the Contractor examines the whole section. In any case, the specified test pressure shall be maintained for not less than 8 hours. For the purpose of determining the actual leakage losses, the Contractor shall carefully measure and record the quantity of water added in order to maintain the pressure during the period of testing. ***Duration of Test***

10. The pressure testing of a section shall be considered to be satisfactory if:

    (a) There is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component;

    (b) There is no visible leakage; and

    (c) The measured leakage rate does not exceed the permissible leakage rate as determined by the following formula:

    $Q_1 = 0.0105\ D.L.\ (H)^{0.5}$

    where:

    Q_1 = permissible leakage rate (litres per hour)

D = nominal diameter of pipe (mm)
L = length of section tested (km)
H = average test head (m)

11. Any failure, defect, or visible leakage which is detected during the pressure testing of the pipeline or during the Defects Liability Period shall be made good by the Contractor at the Contractor's expense, provided that where a thrust block or an anchor block fails, and such thrust block or anchor block has been constructed in accordance with the Drawings, and the failure is not, in the opinion of the Superintendent, the fault of the Contractor, the cost of strengthening or reconstruction of such thrust block or anchor block and the cost of retesting shall be paid as a Variation to the Contract at such rates as are determined in accordance with the provisions of the General Conditions of Contract.

Rectification

12. Alternatively, the main may be tested by the use of compressed air. In this case, the Contractor shall provide details of the alternative method proposed, for approval by the Superintendent, prior to its use.

Alternative Test

C401.38 CONNECTION TO EXISTING PIPES

1. Connections to existing pipes carrying water shall be made at such times as will cause the least interference with the supply. The Contractor shall make arrangements with the Water Authority or other Authority concerned for the timing of the work including the need to isolate the existing mains and notification of affected dwelling occupants. The Superintendent shall be given five (5) working days notice of such arrangements. (WSAA 03 Part 3, section 22).

Time of Least Interference

C401.39 DISINFECTION OF PIPELINES

1. The Contractor shall disinfect all water mains after satisfactory testing in accordance with this Specification. (WSAA 03 Part 3, section 20).

After Testing

2. The Contractor shall adopt procedures for the disinfection of the mains with the concurrence of the Water Authority.

Procedures

C401.40 BACKFILL AND COMPACTION

1. After laying and jointing of a pipeline has been completed the Contractor shall present the laid and jointed pipes for inspection by the Superintendent prior to the commencement of trench backfilling. (WSAA 03 Part 3, section 17). This action constitutes a **HOLD POINT**. The Superintendent's approval to the laid and jointed pipes is required prior to the release of the hold point.

Notification

HP

2. Backfill shall not be placed until the Superintendent has given approval.

Approval

3. Material for the side support and overlay of the pipe shall comply with the requirements for pipe bedding specified in Clause C401.26. The material shall be compacted in layers of not more than 150mm to 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289.5.7.1.

Side Support and Overlay

4. The Contractor shall backfill the remainder of the excavation and compact the backfill in layers of not more than 150mm thick as follows: .

Remainder of Trench

(a) Where the trench is within a roadway, proposed roadway, or footpath area, the remainder of the trench shall be:

Roadway Area

(i) Backfilled with a non-cohesive granular material, with a grading falling generally within the limits detailed herein for pipe bedding and compacted to Density Index of 70 when determined in accordance

Backfill to Subgrade Level with Non-Cohesive

with AS1289.5.4.1 for cohesionless materials ***Granular***

1. Below 0.5m of the road surface

2. In the road reserve, but excluding the road pavement

(ii) Backfilled with excavated material, and compacted to 100 per cent of the standard maximum dry density of the material when determined in accordance with AS1289.5.7.1, when within 0.5m of the road surface, but excluding the road pavement layers. ***Backfill to Subgrade Level with Excavated Material***

(iii) Backfilled with road base and sub-base material as per existing or proposed pavement layers and compacted to 100 per cent of the standard maximum dry density of the material when determined in accordance with AS1289.5.7.1 ***Backfill of Pavement Layers***

(b) Elsewhere, unless stated otherwise, the remainder of the trench shall be backfilled with ordinary excavated backfill material. Where suitable material is not available, granular material may be used for the full depth of backfilling. The material shall be compacted to a density Index of 70 when determined in accordance with AS1289.5.4.1 for cohesionless materials or 98 per cent of the standard maximum dry density of the material when determined in accordance with AS1289.5.7.1 for cohesive materials.

5. The Contractor shall carry out backfilling and compaction without damaging the pipe or its external coating or wrapping or producing any movement of the pipe. ***Care***

6. The contractor shall carry out compaction tests 75mm to 100mm below the level being tested. ***Compaction Tests***

7. The Contractor may compact backfill by trench flooding only where ***Flood Compaction***

(a) The ground and backfill material is cohesionless sand.

(b) Water for flooding has been sourced at the site.

(c) The process will not create mud which would be moved off site by vehicles or construction plant.

(d) Additives are not used.

C401.41 MARKING PLATES

1. The Contractor shall clearly mark the position of each stop valve, scour valve, air valve and hydrant on completion of backfilling in a manner and position as approved by the Superintendent. The marking shall be made by one of the following methods but the location of the mark or peg shall be consistent with the method(s) in use by the Water Authority. (WSAA 03 Part 3, section 15.16). ***Valve and Hydrant***

2. Where, in the opinion of the Superintendent, a valve or hydrant is at too great a distance from any existing wall, fence, kerb face, or post, the Contractor shall provide and set in the ground a post with the relevant marking plate fixed at the top of the post, facing the fitting. The distance to the valve or hydrant in metres, to an accuracy of 0.1m, shall be permanently marked on the plate with legible numbers a minimum 80 mm high. Wooden posts are not to be used where there is evidence, by rotting or termite activity, that the integrity of the posts will be affected. ***Plates on Posts***

3. The post shall conform to the following requirements: ***Post Details***

   (a) The post shall be of sufficient length to be set firmly in place under saturated ground conditions.

   (b) When installed, the post shall project 1000mm above the ground, provided that where tall grass or crops are likely to obscure the post, its height above the ground shall be increased to 1500mm.

   (c) The post shall be painted with 2 coats of white enamel for exterior use.

4. The Contractor shall fix marking plates as soon as practicable after each valve or hydrant is installed. However, the Contractor shall temporarily cover marking plates for hydrants using masking tape or other approved cover which the Contractor shall remove on satisfactory completion of the pressure testing of the pipeline. ***Fixed After Installation***

6. In addition to the marking plates, the Contractor shall affix two-way reflective raised pavement markers to the road pavement and kerb, where available, in accordance with the WATER RETICULATION CODE (WSAA 03 Part 4 WAT –1300, WAT –1106 and WAT –1107). ***Pavement Markers***

C401.42 RESTORATION OF SURFACES

1. The Contractor shall clean pavements, lawns and other improved areas and leave them in the same order as they were at the commencement of the Works. The Contractor shall restore any fencing removed during construction and shall restore lawns with turf cut and set aside from the original surface and with turf imported from a source approved by the Superintendent. (WSAA 03 Part 3, section 23). ***Original Condition***

2. The Contractor shall maintain all restored surfaces in the condition to which they are restored until the expiry of the Defects Liability Period applicable to those surfaces, notwithstanding that any deterioration of the restored surfaces, and the need for their maintenance may or may not be due to defects which become apparent or arise from events which occur during the Defects Liability Period. The Contractor shall maintain pavements with crushed igneous rock, gravel or other suitable material allowing for consolidation and shall then restore them to a condition equivalent to that of the original pavement. ***Maintenance***

3. The Contractor shall maintain all restored surfaces in the condition to which they are restored until the expiry of the Defects Liability Period applicable to those surfaces, notwithstanding that any deterioration of the restored surfaces, and the need for their maintenance may or may not be due to defects which become apparent or arise from events which occur during the Defects Liability Period. The Contractor shall maintain pavements with crushed igneous rock, gravel, asphaltic concrete or other suitable material allowing for consolidation and shall then restore them to a condition equivalent to that of the original pavement. Final restoration may include, if required by the Superintendent, the removal of temporary restoration. ***Temporary Pavement Restoration***

4. In other than roadways, the Contractor shall place the backfill sufficiently high to compensate for expected settlement and further backfilling shall be carried out or the original backfill trimmed at the end of the defects liability period in order that the surface of the completed trench may then conform to the adjacent surface. Surplus material shall be removed and disposed of to areas arranged by the Contractor. Where dry weather conditions have persisted after the original backfilling, including during the defects liability period, the Contractor shall take all necessary steps to consolidate the trench before removing surplus materials from the site. ***Backfill***

5. In locations where, in the opinion of the Superintendent, surplus material left in the vicinity of the trench would not be objectionable, the surplus material may be disposed by spreading neatly in the vicinity of the trench to the satisfaction of the Superintendent in such a way as to avoid future erosion of the backfill and adjacent ground surfaces. The Contractor shall maintain the backfill and adjacent ground until the expiry of the Defects Liability Period. ***Disposal of Surplus Material***

6. Where, within public or private property, the reasonable convenience of persons will require such, the Contractor shall level trenches at the time of backfilling or otherwise as directed by the Superintendent. The Contractor shall make good any subsequent settlement, as required by placing additional fill. ***Settlement***

7. The Contractor shall immediately restore any damaged or disturbed private property and services. ***Restoration***

8. Should the Contractor elect to tunnel under paving, kerb and gutter or other improved surfaces in lieu of trenching, backfilling shall be so carried out as to restore full support to those surfaces, and payment shall be made for the restoration of the surfaces as though they had been removed and replaced. The Contractor shall remain responsible for the repair of the improved surfaces, if subsequently damaged due to subsidence of the backfill, until the end of the Defects Liability Period. ***Tunnelling***

9. The Contractor shall provide notice to affected property owners of any pending works. ***Property Owner Advice***

PUMP STATIONS

C401.43 PUMPS

1. Pump construction materials for centrifugal end suction pumps shall comply with the following: ***Materials***

DESCRIPTION	MATERIAL
PUMP	
Casing and suction bend	Cast iron AS 1830 Gr T200
Wear rings	Cast iron AS 1830 Gr T200
Impeller	316 Stainless steel AS 1449
Impeller nut	Gunmetal AS 1565-905C
Shaft	316 Stainless steel AS 2837
Shaft sleeve	Phosphor bronze AS 1565-9060/316
Neck bush, lantern ring	Phosphor bronze AS1565-9060
Gland	Cast Iron AS1830 Gr T200
Gland studs	316 Stainless steel AS 2837
Gland nuts	316 Stainless steel AS 2837
Fixing nuts and bolts handhole	316 Stainless steel AS 2837
Covers	316 Stainless steel AS 1449
Fitted bolts and nuts, casing and dowels	316 Stainless steel AS 2837
Forcing screws	316 Stainless steel AS 2837
Water thrower and drip tray	316 Stainless steel AS 1449
Pump set base plate	Cast iron AS 1830 Gr T200/Fabricated steel
MOTOR	
Motor frame and end shield	Cast iron/Mild steel
Motor terminal box	Cast iron/Mild steel
Motor fan cover	Mild steel
Motor fan	Metal
HOLDING DOWN BOLTS	316 Stainless steel AS 2837
MECHANICAL SEALS	
Seal faces	Tungsten carbide or equal
Springs	Nickel chrome steel
Secondary seal	Fluoro carbon or nitrile rubber

2. The Contractor shall provide a written warranty from the Manufacturer of the equipment. This action constitutes a **HOLD POINT**. The Superintendent's approval of the warranty is required prior to the release of the hold point. ***HP***

3. The Manufacturer's warranty shall require the Manufacturer to accept liability for any defect in materials or workmanship which becomes apparent at any time within two (2) years after the date of delivery of any piece of equipment used in Work under the Contract. ***Manufacturer's Liability***

4. All nuts and bolts shall be manufactured in accordance with AS/NZS 1111 and AS/NZS 1112 150 metric series and fitted with washers beneath bolts heads and nuts. ***Nuts and Bolts***

   (a) All bolts, nuts and washers shall be stainless steel to AS 1449 and AS 2837, minimum grade 316. All bolts, nuts and washers are to be of the same grade and supplied passivated.

   (b) All threads are to be rolled.

   (c) All bolt heads and nuts shall be hexagonal.

   (d) All bolts, studs, set screws and nuts for bolting flanges and other pressure containing purposes shall conform to AS 2528.

   (e) All nuts and bolts subjected to vibration shall be fitted with lock washers or lock nuts.

   (f) All concrete anchor bolts, nuts, locking nuts and large series washers required for the bolting down of pump set discharge bends shall be provided. These anchor bolts shall be as recommended by the equipment designer with a minimum diameter of 16mm.

   (g) Concrete anchor bolts shall be chemical masonry anchor type, set to their full depth, suitable for the required duty.

5. Bolts on all flanges will protrude no more than 10mm past the nut when tightened. ***Bolts and Flanges***

6. The Contractor shall apply sufficient anti-seize/anti-galling material to the threads of all stainless steel fasteners. The material shall be Polytetrafluroethylene (PTFE), either tape to AS 1272, dipped or sprayed, or molybdenum disulphide. ***Anti-Galling, Anti-Seize***

C401.44 PRESSURE GAUGES

1. The Contractor shall install one (1) diaphragm protected, glycerine oil filled, direct mounting, bottom connection pressure gauge complying with AS 1349 per centrifugal pump installation. Cases shall be fabricated from stainless steel complying with AS 1449 or bronze. The protective diaphragm shall be suitable for dismantling for cleaning without affecting the accuracy of the gauge. ***Compliance***

2. The gauge face shall be 100mm in diameter and calibrated in metres head of water. The gauge shall accurately indicate the pump operating head and the pump no-flow head. ***Calibration***

3. Each gauge shall be supplied with the nominally sized metric equivalent of three of the following bronze fittings: gate valve, union, nipple and reducing nipple. ***Inclusions***

4. Gauges and fittings shall be screwed into the pipe wall of ductile iron pipes, or pipe fittings, 150mm and larger. In pipework less than 150mm, gauges and fittings shall be screwed into a tapping band. Where shown on the Drawings, the Contractor shall install a ball valve to allow removal of the gauge. ***Installation***

5. The pressure gauge range for single or parallel pumps duty shall be 0 to 1.7 times the closed valve head of the pumps. ***Gauge Range***

C401.45 ELECTRICAL COMPLIANCE

1. The Works shall be in accordance with the Electrical Services Minimum Requirements contained in MEW E101 except where this Specification or the Drawings indicate otherwise. The technical requirements detailed on the Drawings shall take precedence over the requirements of this Specification should clauses be in disagreement. ***Standards***

2. MEW E101 covers the general requirements for materials, workmanship, and methods of installation as follows: ***DPWS Requirements***

   (a) General
   (b) Reticulation and wiring
   (c) Switchboards and Associated Equipment
   (d) Accessories
   (e) Luminaries – Supply and Installation
   (f) Electric Motors
   (g) Painting, Colour Coding and Labelling

3. Except where MEW E101 requires a higher standard, Works shall be carried out in accordance with AS/NZS 3000, the Service Rules of the Supply Authority and all relevant Statutory Authorities. ***Compliance***

4. The Contractor shall supply proof of compliance with a standard or specified test. Such proof shall comprise a test certificate from an approved independent testing authority. ***Proof of Compliance***

5. The Contractor shall submit all designs and material to each Authority having jurisdiction for approval. The Contractor shall arrange for each Authority having jurisdiction to inspect the Works. The Superintendent shall be advised a minimum of 7 working days in advance of the date of any inspection by an Authority. This action constitutes a **WITNESS POINT**. The Superintendent shall advise at the time of notification by the Contractor whether the option to attend the inspections is to be exercised. ***Approval***

WP

C401.46 SWITCHGEAR AND CONTROL GEAR ASSEMBLY (SCA)

1. The Contractor shall supply and install the SCA designed and assembled by a manufacturer approved by the Superintendent. ***Approved Manufacturer***

2. The SCA shall be of outdoor, stationary, free standing, metal-enclosed, cubicle type series with a minimum degree of protection of IP56D as specified in AS 1939. ***Type***

3. All equipment shall be securely mounted on suitable mounting panels and comprise individual compartments. A steel galvanised channel base shall be provided. ***Construction***

4. Starter contactors shall have the appropriate rating for the proposed pumps to AC3. ***Starter Contactors***

5. All necessary terminals with terminal and cable numbers shall be supplied and installed in accordance with the Drawings. ***Terminals***

6. The Contractor shall liaise with the electricity supply authority to supply a lock barrel for the metering equipment, at the Contractor's expense. The Superintendent shall supply standard lock barrels for use on the SCA at no cost to the Contractor. ***Lock Barrels***

7. The electrical characteristics of the SCA shall be: ***Characteristics***

   Main Circuit: 415/240 V, 50 Hz, 3-phase, 4-wire.
   Motor Control Circuit: 240 V, 50 Hz.
   Common Control Circuit: 240 & 24 V, A.C.
   Prospective short-circuit current:
   14kA for 1 second.
   Peak Factor: 2.2
   Power Factor Correction (Determined in consultation with the Water Authority)
   Earthing (M.E.N. system)

8. All cables shall enter the SCA from below. ***Cable Entry***

9. The Contractor shall supply data from the switchgear supplier confirming Type "2" co-ordination between contactors, motor protection relays and corresponding circuit breakers, to the Superintendent. ***Switchgear Data***

10. The "AUTO" mode shall be capable of being overridden by turning the starter selector switch to the "ON" position. Manual operation would normally be used in the event of failure of the telemetry system or for function testing. A warning label (R/W/R) advising selector switches to be left in the "AUTO" mode shall be fitted to common control cover. ***Operation***

11. The Contractor shall carry out factory tests in the presence of the Superintendent's Representative and in accordance with Schedule MEW E101 and the results shall comprise all routine Tests specified in AS 3439. ***Factory Tests***

12. Functional tests referred to in Schedule MEW E101 shall include electrical function tests as defined in AS3439. ***Functional Tests***

13. The Contractor shall ensure, after approval has been given by the Superintendent, that any relays, programmable logic controllers, and fittings likely to be adversely affected during delivery shall be adequately protected or shall be removed and packed separately in protected containers. Where equipment has been removed, cover plates shall be provided. ***Packing***

14. The Contractor shall be responsible for any damage that may occur during transit and unloading at site. ***Damage***

15. The Contractor shall ensure that spare parts, tools etc, are packed separately from the main plant and shall be marked "Spare Parts", "Tools" etc, as applicable. ***Tools***

16. The Contractor shall supply spare parts in accordance with the schedule supplied by the Superintendent. ***Spare Parts***

17. The Contractor shall supply and install control equipment that is compatible with the existing equipment. ***Pump Control***

C401.47 ELECTRICAL INSTALLATION

1. The Contractor shall liaise with the Supply Authority for the electricity supply to the pump station site. ***Liaison***

2. The Contractor shall be responsible for all facilities required by the Supply Authority for revenue metering equipment and the payment of all associated connection, inspection fees and capacity charges. ***Contractor's Responsibility***

3. The Contractor shall supply and install all cabling including consumer mains, ***Cabling***

motor, control and flow meter cables, conduits and electrical pits.

4. The Contractor shall install all wiring in HD-PVC underground conduits laid in accordance with the Supply Authority's requirements, with a minimum 500mm below the finished ground level in non-trafficable areas and 600mm below the finished ground level in trafficable areas. The trench and backfill material shall be free of rocks and other foreign matter likely to damage the conduits. ***Conduits***

5. The Contractor shall run electrical marker tape 150mm below the finished ground level directly above the conduits for the entire length of the conduits. Marker tape shall be orange in colour, 150mm wide and stamped with the words "DANGER – ELECTRIC CABLES BELOW" or similar. ***Marker Tape***

6. The Contractor shall route all underground cabling with the approval of the Superintendent. Brass marking plates shall be positioned on any concrete surround clearly showing the direction of the incoming consumer mains. Wording and markings shall read "Danger – Electrical Cables Below". This action constitutes a **HOLD POINT**. The Superintendent's approval of the route of all underground cabling is required prior to the release of the hold point. ***Route***

HP

7. The Contractor shall determine the Points of Attachment on site and the Contractor shall supply and install any consumer's connection poles for the consumer mains required by the Supply Authority. ***Point of Attachment***

8. The consumer mains shall be generally run underground and commence at the Point of Attachment on a steel consumers pole (if applicable), installed near the property boundary and run in conduit to the switchboard. ***Consumer Mains***

9. The minimum size of the consumers mains shall be sized to satisfy the following requirements: ***Size***

   (a) Current carrying capacity to suit the maximum demand with an excess current carrying capacity of 30 per cent minimum.

   (b) Be sized for a voltage drop less than 1.5 per cent to the maximum demand as calculated.

   (c) Be single core PVC/PVC cables. XLPE insulated cable may also be used.

   (d) Comply with the requirements of the Supply Authority.

   (e) Pole termination method shall be as shown on the Drawings.

   (f) AS/NZS 3000 and AS/NZS 3008

10. In addition to the requirements of the Supply Authority and MEW E101 the main earthing conductor shall be run in conduit to the main earthing electrode. The main earthing connection shall be contained in an earthing electrode connection box similar to ALM type ERB-1 up to 50mm^2 cable and a Type 4 pit for larger cable. ***Earthing Conductor***

11. The Contractor shall provide a separate earthing conductor and electrode for the surge diverters. Each electrode shall be bonded and suitably labelled with an engraved brass label l. ***Surge Diverters***

12. The Contractor shall bond the pump station metallic pipework to the main earth. ***Pipework***

13. The Contractor shall install metering facilities within the SCA. The metering facilities and panel shall be Energy Authority approved and suitable for the installation of the metering equipment required by the Supply Authority. ***Meters***

14. The Contractor shall supply and install the following metering equipment: ***Metering Equipment***

(a) Plug-in meter bases or all electricity meters (tariffs) supplied by the Supply Authority, as may be required by the Supply Authority.

(b) Service potential fuses.

(c) Current transformers metering equipment (if required).

(d) All necessary wiring and other accessories as required by the Supply Authority.

(e) Key locking facilities for Supply Authority access.

15. The Contractor shall gland cables entering the outdoor SCA compartment using non-ferrous metallic or plastic glands with neoprene compression seals and connect the on-flow switch and pump motor cables to the appropriate terminals. Cables shall not be jointed. ***Cable Entry***

16. The Contractor shall seal, at the completion of commissioning tests, all conduits into the outdoor SCA with a non-setting sealing compound to prevent the ingress of vermin. ***Sealing***

C401.48 TESTING AND COMMISSIONING OF PUMP STATION

1. The Contractor shall test and/or inspect all materials, equipment, installation and workmanship to prove compliance with the Specification requirements. The submission to the Superintendent of satisfactory test results constitutes a **HOLD POINT**. The approval of the Superintendent is required prior to the release of the hold point. ***Compliance*** ***HP***

2. Tests and inspections shall comply with relevant Australian Standards. ***Standards***

3. Testing shall include pre-commissioning, field testing and performance testing of each part of the whole installation. ***Testing***

4. Pre-commissioning is the preparation of plant or equipment so that it is in a safe and proper condition and ready for commissioning and operation. It includes all aspects of plant operation such as safety, electrical, mechanical and instrumentation. ***Pre-Commissioning***

5. The Contractor shall conduct pre-commissioning in a logical sequence in accordance with the programme prepared by the Contractor and approved by the Superintendent. ***Sequence***

6. The Contractor shall prepare pre-commissioning record sheets for each item of equipment to ensure results of tests are satisfactorily recorded and that all necessary checks or tests have been performed. ***Record Sheets***

7. Specific requirements for pre-commissioning shall include, but are not limited to: ***Requirements***

(a) Initial charges of lubricant in addition to any special lubricant requirements for initial flushing or treatment of the system or for “running in”.

(b) Physical checks and tests such as completeness of assembly, rotational tests (including checking that the rotation of electrical motors is in the correct direction), alignment checks, balancing and vibration checks, temperature, pressure and flow measurements, clearances, belt alignment and tension, etc, depending on the type of equipment.

(c) Electrical and instrument installation tests, including motor insulation tests and checking instruments against certified instruments and correcting as

necessary.

(d) Tests of the correct functioning of automatic and manual control and protection equipment, including simulating danger conditions, mal-operations or failures, to check that all instruments and controls function correctly. These tests shall also include adjusting instrument set points and alarm settings and proving correct operation of alarms.

(e) Equipment and system operating tests. The Contractor shall certify compliance of each item and submit a signed copy to the Superintendent prior to commissioning.

8. The Contractor shall carry out pre-commissioning tests to the satisfaction of the Superintendent and shall record the results of the tests on the appropriate Pre-commissioning Record Sheet. ***Recording***

9. The Contractor shall furnish the Superintendent with one signed copy of each completed Pre-commissioning Record Sheet countersigned by the Superintendent's Representative who witnessed the test. ***Submission***

10. Commissioning is the running of the plant and equipment to ensure flow through the pumping system, carrying out any necessary testing and adjustments until it is ready and suitable for normal starting and running under service conditions. ***Commissioning***

11. The Contractor shall give five (5) working days notice of the Contractor's intention to undertake commissioning and supply to the Superintendent the copies of each of the pre-commissioning record sheets and three copies of the operational and maintenance manuals at the time that notice of commissioning is given. This action constitutes a **WITNESS POINT**. The Superintendent shall advise at the time of notification by the Contractor whether the option to attend the commissioning is to be exercised. ***Notification*** ***WP***

12. The Contractor shall conduct commissioning in a logical sequence in accordance with a programme prepared by the Contractor and approved by the Superintendent. ***Sequence***

13. Throughout commissioning the Contractor shall be responsible for the test programme. ***Responsibility***

14. The Contractor shall provide continuous supervision by personnel experienced in the operation of the equipment and shall have qualified personnel in attendance to carry out all necessary adjustments and/or remedial work during the commissioning tests. ***Supervision***

15. The Contractor shall prepare, schedules, test record sheets and programmes for approval by the Superintendent prior to each stage of the overall commissioning. ***Documentation***

16. The Contractor shall carry out final testing and commissioning (min 1 day duration) of the electrical services in conjunction with the mechanical equipment (e.g. pump, etc) including setting and adjustment of equipment in accordance with MEW E101. ***Final Testing***

17. The Contractor shall arrange for all testing, commissioning and any adjustments to be carried out by qualified personnel. ***Qualified Personnel***

C401.49 PRACTICAL COMPLETION OF PUMP STATION

1. The Contractor shall fulfil the following requirements before the Certificate of Practical Completion is issued: ***Certificate***

   (a) Receipt by the Superintendent of a certificate of approval from the relevant statutory authorities.

   (b) Pump station is in working order as demonstrated by the testing and commissioning.

   (c) Approval by the Superintendent of Operating and maintenance manuals.

   (d) Receipt by the Superintendent of as-built drawings of the pump station.

C401.50 TELEMETRY

1. The Contractor shall make provision for equipment to link the pump station to the existing telemetry network to be provided by the Water Authority at the Contractor's expense. ***Contractor's Cost***

2. The pump station shall operate automatically by control signals from the telemetry system. In addition, either one or any combination of pumps may operate at any one time by control signals from the telemetry system. ***Operation***

C401.51 OPERATION AND MAINTENANCE MANUALS

1. Manuals shall contain the following information: ***Information***

   a) Contractor's name, address and telephone number.

   (b) Client's Contract number, job name.

   (c) Pump station general arrangement drawing showing pumps, motors, valves, pipework, switchboard and electrical installation.

2. Manuals for pumps shall contain the following information: ***Pumps***

   (a) Manufacture.

   (b) Type and model number.

   (c) Serial number.

   (d) Dimensioned general arrangement drawing of pump and motor.

   (e) Sectional arrangement drawing with parts and list.

   (f) Dimensioned sectional arrangements detailing:

      (i) Maximum and minimum shaft/bearing clearance (radial)

      (ii) Maximum and minimum impeller/bowl clearance (radial)

      (iii) Maximum and minimum impeller/bowl clearance (axial)

      (iv) Impeller/bowl wear rings.

      (v) Motor/pump coupling - type, make and model number.

      (vi) Mechanical seals where applicable.

3. Manual for motors shall contain the following information: ***Motors***

   (a) Manufacture.

   (b) Type and model number.

   (c) Serial number.

   (d) Dimensioned general arrangement drawing.

   (e) Sectional arrangement drawing for submersible motor power cabling where applicable.

   (f) Gland sealing arrangement drawing for submersible motor power cabling where applicable.

   (g) Cables where applicable.

   (h) Terminal block arrangement drawing where applicable.

4. Manuals for valves shall contain a dimensioned sectional arrangement drawing with parts and material list for all valves. ***Valves***

5. Manuals shall contain the following test curves:- ***Test Curves***

   (a) Pump witnessed test curves.

   (b) Motor test curves.

   (c) Motor torque/speed/efficiency characteristic curves.

6. The operating and maintenance manual shall include: ***Operation and Maintenance***

   (a) Safe working procedures: For switching and isolating the supply and distribution system;

   (b) Description of Operation;

   (c) Maintenance procedures: Recommended maintenance periods and procedures;

   (d) Tools: Particulars of maintenance equipment and tools provided, with instructions for their use.

   (e) Equipment: A technical description of the equipment supplied, with diagrams and illustrations where appropriate;

   (f) Dismantling: Where necessary, procedures for dismantling and reassembling equipment;

   (g) Spare parts: A list of the spare parts provided.

7. Trouble shooting instructions shall be included for pumps, motors, valves and SCA. ***Trouble Shooting***

8. Step by step procedures for dismantling and reassembly of pumps, motors and valves using any special tools shall be detailed together with step by step procedures for replacement of wearing parts such as bearing, seals, wear rings, etc. ***Replacement Procedures***

CONSTRUCTION COMPLIANCE

C401.52 WORK-AS-EXECUTED DETAILS

1. The Contractor shall submit to the Superintendent work-as-executed Drawings showing the actual location and alignment of pipelines, and all pump station details together with operating and maintenance manuals. (WSAA 03 Part 3, section 24). ***Main Requirements***

2. Details shall include the size, type, levels of pipelines, valve and hydrant chamber types and cover details, easement requirements for maintenance, pump details, switchboard equipment details and station structural details. ***Additional Detailed Requirements***

3. The Contractor shall ensure that a Registered Surveyor certifies the plans showing location and alignment. ***Survey***

4. The Contractor shall provide records, for the Water Authority's Asset Register, to the Superintendent at the time of practical completion of the Contract. The records are to be in a form consistent for inputting into the Asset Register as directed by the Superintendent. ***Asset Register***

SPECIAL REQUIREMENTS

C401.53 RESERVED

C401.54 RESERVED

C401.55 RESERVED

MEASUREMENT AND PAYMENT

C401.56 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification in accordance with Pay Items C401(a) to C401(k) inclusive.

2. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

3. Concrete for valve chambers, bulkheads, thrust and anchor blocks, concrete encasement and pump stations is measured and paid in accordance with this Specification and not the Specification for MINOR CONCRETE WORKS.

4. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.

Pay Item C401(a) EXCAVATION AND BACKFILL FOR WATER RETICULATION

1. The unit of measurement shall be cubic metre.

2. The schedule rate for this Pay Item shall be an average rate to cover all types of material encountered during excavation. Separate rates shall not be included for earth and rock.

3. The rate is deemed to include:

   - Setting out and associated survey
   - Excavation, including excavation and replacement of unsuitable material.
   - Backfilling and compaction, other than selected backfill, of pipes
   - Restoration of surface
   - Replacement for over-excavation for any reason
   - Control of stormwater runoff, temporary drainage and erosion and sedimentation control.

4. The volumes of excavation for payment shall be computed as follows:

   Trench Width: Minimum width in Table C401.1 + 200mm.

   Trench Depth: Average actual depth to underside of specified bedding.

   Trench Length: Actual excavation length.

Pay Item C401(b) SUPPLY AND LAY PIPE AND FITTINGS

1. The unit of measurement shall be the linear metre measured along the centreline of each particular type of pipe installed.

2. The schedule rate shall include:

   - Supply of pipe and fittings
   - Wrapping pipeline
   - Survey and setting out
   - Bedding
   - Bulkheads
   - Thrust and anchor blocks
   - Jointing (including connections)
   - Temporary bracing and strutting of excavation
   - Selected backfilling
   - Quality compliance

Pay Item C401(c) SUPPLY AND INSTALL VALVES

1. The unit of measurement shall be per "each" stop, air or scour valve and associated chamber or box installed.

2. The schedule of rate for supply and install valves shall include for setting out, excavation, formwork, supply and placing concrete, supply and installation of valves, supply and installation of covers and frames, supply and installation of marker plates, backfilling and disposal of spoil off site. It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.

3. A separate unit rate shall be included in the Schedule of Rates for each type and size of valve.

Pay Item C401(d) SUPPLY AND INSTALL HYDRANTS

1. The unit of measurement shall be per "each" hydrant and associated box installed.

2. The schedule of rate for supply and install hydrants shall include for setting out, excavation, formwork, supply and placing concrete, supply and installation of hydrants, supply and installation of covers and frames, supply and installation of marker plates, backfilling and disposal of spoil off site. It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.

3. A separate unit rate shall be included in the Schedule of Rates for each type and size of hydrant.

Pay Item C401(e) CONNECTION TO EXISTING

1. The unit of measurement shall be per "each" connection to existing pipe.

2. The schedule rate for connection to existing shall include for all the necessary works to arrange and liaise with the appropriate Authority, cut into or otherwise modify and finish the system as shown on the Drawings.

Pay Item C401(f) TRENCH TIMBERING LEFT IN PLACE

1. The unit of measurement shall be a lump sum for timber directed to be left in place by the Superintendent.

2. No extra payment shall be made where the Contractor uses more timber than anticipated or the timber used exceeds the size of timber required as determined by the Superintendent.

Pay Item C401(g) CONCRETE ENCASEMENT

1. The unit of measurement shall be the linear metre measured along the centreline of each particular type of concrete encasement.

2. The schedule rate shall include for additional excavation, formwork, reinforcement, concrete and contraction joints.

Pay Item C401(h) PUMP STATION

1. The item shall be a Lump Sum for each pump station.

2. The Lump Sum shall include for the setting out, excavation, preparation of foundation, formwork, reinforcement, concreting, curing concrete, backfilling, disposal of spoil off site, supply and installation of pipework, valves, fittings, access cover, ladder and cleaning up. It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.

Pay Item C401(i) WATER PUMPS

1. The item shall be a Lump Sum for each water pump.

2. The Lump Sum shall include for the supply and installation of the system as specified and as detailed on the Drawings including suction and discharge pipework, valves, fittings, control panel and cabinet, power and control wiring and testing.

Pay Item C401(j) COMMISSIONING

1. The item shall be a Lump Sum.

2. The Lump Sum for Commissioning shall include for all labour, test equipment and consumables to undertake and record the full commissioning procedure for all equipment and systems, and to carry out all necessary modifications and adjustments to the system so that it operates in accordance with the Specification requirements.

Pay Item C401(k) MANUALS

1. The item shall be a Lump Sum.

2. The Lump Sum for Manuals shall include for the preparation and printing of the operating and maintenance manuals in accordance with the Specification. Necessary and appropriate "work-as-executed" drawings shall be included.

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C402

SEWERAGE SYSTEM

AUS-SPEC appreciates the role of the Water Directorate in comprehensively updating the design and construction specifications for water and sewer works.

Comment on this Specification:

DELETE THIS PAGE FROM THE CONTRACT DOCUMENTS

This is a construction Specification suitable for use in a *Sequential* Design and Construction (not Design/Construct) delivery of work method, with separate contracts for Design, then Construction, where:

(a) A development subdivision is likely to be certified.

(b) State Government subsidises a small town sewerage scheme where the Project Director elects not to use performance based contracts for the Service Providers where the work is likely to be supervised by a designated person appointed by the Principal with defined authority.

(c) Where the augmentation is small and relates to a component or sub-component of a larger facility where the work is likely to be supervised by a designated person appointed by the Principal with defined authority.

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Update of Layout				02/06
2	Clauses 52, 53, 54, 57, 58, 59, replaced. Well Washer and Flow Metering and Generator (as required) added.				02/06
3	Adopted by Burnett Shire Council		M	RT	10/05/2006

SPECIFICATION C402 - SEWERAGE SYSTEM

CLAUSE **CONTENTS** **PAGE**

SPECIFICATION C402: SEWERAGE SYSTEM

GENERAL

C402.01 SCOPE

1. The Work to be constructed under this Specification consists of the construction of: ***Suitable Works***

   (a) Gravitation sewers up to DN600 nominal size;

   (b) Common Effluent sewers, both gravity and pressurised;

   (c) Vacuum Sewerage Systems;

   (d) Rising mains up to DN600 nominal size;

   (e) Standard appurtenances such as maintenance holes, maintenance shafts and property connection sewers;

   (f) Small pump stations, usually limited to single wells with submersible pumps.

2. This Specification excludes the construction activities for: ***Exclusions***

   (a) Treatment plants;

   (b) Headworks;

   (c) Dosing plant;

   (d) Larger pump stations;

   (e) Works controlled by others, including overflow management

3. The Contractor shall carry out the work, and supply materials meeting the requirements of the reference documents and, in particular, in accordance with the requirements of SEWERAGE CODE OF AUSTRALIA, except as otherwise specified herein. ***Compliance with Standards***

4. For the purposes of this Specification, ‘access chambers’ are referred to as ‘maintenance holes’. ***Terminology***

C402.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed below whilst being cited in the text in the abbreviated form or code indicated. The Contractor shall possess, or have access to, the documents required to comply with this Specification. ***Documents, Standards, Test Methods***

2. References to the SEWERAGE CODE OF AUSTRALIA are made where there are parallel sections or equivalent clauses to those in this Specification. Where not called up as part of this Specification, these references are identified by part and section numbers and enclosed in brackets thus (WSAA Part, Section). ***Sewerage Code***

(a) Council Specifications

C271	-	Minor Concrete Works
C201	-	Control of Traffic
C211	-	Control of Erosion and Sedimentation

(b) Australian Standards

Australian Standards

References in this Specification or on the Drawings to Australian Standards are noted by their prefix AS or AS/NZS.

Currency

Where not otherwise specified in this Specification or the Drawings, the Contractor shall use the latest Australian Standard, including amendments and supplements, available within two weeks of close of tenders.

AS/NZS 1111	-	ISO metric hexagon commercial bolts and screws
AS/NZS 1112	-	ISO metric hexagon nuts, including thin nuts, slotted nuts, and castle nuts
AS 1152	-	Specification for test sieves
AS/NZS 1260	-	PVC pipes and fittings for drain, waste and vent applications
AS 1272	-	Unsintered PTFE tape for thread sealing applications
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 1349	-	Bourdon tube pressure and vacuum gauges
AS 1359	-	Rotating Electrical Machines - General Requirements
AS 1444	-	Wrought alloy steels – Standard, hardenability (H) series and hardened and tempered to designated mechanical properties
AS/NZS 1477	-	PVC pipes and fittings for pressure applications
AS 1565	-	Copper and copper alloys – Ingots and castings
AS 1579	-	Arc welded steel pipes and fittings for water and wastewater
AS/NZS 1594	-	Hot-rolled steel flat products
AS 1627.4	-	Metal finishing – Preparation and pre-treatment of surfaces-Abrasive blast cleaning
AS 1646	-	Elastomeric seals for waterworks purposes
AS 1657	-	Fixed Platforms, walkways, stairways and ladders – Design, construction and installation
AS 1675	-	Current Transformers - Measurement and protection.
AS 1741	-	Vitrified clay pipes and fittings with flexible joints – sewer quality
AS 1830	-	Grey cast iron
AS 1939	-	Degrees of protection provided by enclosures for electrical equipment
AS 2032	-	Code of practice for installation of uPVC pipe systems.
AS 2033	-	Installation of polyethylene pipe systems
AS 2074	-	Steel Castings.
AS 2129	-	Flanges for pipes, valves and fittings
AS/NZS 2280	-	Ductile iron pressure pipes and fittings
AS 2528	-	Bolts, studbolts and nuts for flanges and other high and low temperature applications
AS/NZS 2566	-	Buried flexible pipelines
AS 2768	-	Electrical Insulating Materials - Evaluation and classification based on thermal endurance.
AS 2837	-	Wrought alloy steels – Stainless steel bars and semi-finished products
AS/NZS 3000	-	Electrical installations (Wiring Rules)
AS/NZS 3008	-	Electrical installations –Selection of cables
AS3010	-	Electrical Installations - Supply by generating set – Internal combustion engine driven sets.
AS/NZS 3439	-	Low voltage switchgear and controlgear assemblies

AS 3518	-	Acrylonitrile butadiene styrene (ABS) pipes and fittings for pressure applications
AS 3571	-	Glass filament reinforced thermosetting plastics (GRP) pipes – Polyester based – Water supply, sewerage and drainage applications
AS 3578	-	Cast iron non-return valves for general purposes
AS 3681	-	Guidelines for the application of polyethylene sleeving to ductile iron pipelines and fittings
AS3679	-	Structural Steel - Hot-rolled bars and sections.
AS 3690	-	Installation of ABS pipe systems
AS 3947	-	Low-voltage Switchgear and Control Gear - Contactors and motor starters- Electromechanical contactors and motor-starters.
AS 3972	-	Portland and blended cements
AS 3996	-	Metal access covers, road grates and frames
AS 4058	-	Precast concrete pipes (pressure and non-pressure)
AS 4060	-	Loads on buried vitrified clay pipes
AS/NZS 4129(Int)		Fittings for polyethylene (PE) pipes for pressure applications
AS/NZS 4130	-	Polyethylene (PE) pipes for pressure applications
AS 4198	-	Precast concrete access chambers for sewerage applications (Read 'maintenance hole' for 'access chamber')
AS/NZS 4321	-	Fusion-bonded medium-density polyethylene coating and lining for pipes and fittings
AS/NZS 4680	-	Hot-dip galvanised (zinc) coatings on fabricated ferrous articles
AS/NZS 4765(Int)		Modified PVC (PVC-M) pipes for pressure applications
AS 4794	-	Non return valves – Swing check and tilting disc

(c) Other

Institute of Public Works Engineering Australia (IPWEA)

- Streets Opening Conference Information Bulletin on Codes and Practices (Sections 3 and 4 detailing locations and depths of other services and preferred location for water reticulation pipes)

NSW Department of Public Works and Services (DPWS)

MEW E101	-	Electrical Services Minimum Requirements
WS-SPEC	-	Technical Requirements (TRs) and Strategic products Specifications

Water Services Association of Australia (WSAAA)

WSAA 01	-	Polyethylene Pipeline Code
WSAA 02	-	Sewerage Code of Australia
WSAA 04	-	Sewerage Pumping Station Code
WSAA 05	-	Sewer inspection Reporting Code

Standard Drawings

- SEWERAGE CODE OF AUSTRALIA drawings (WSAA 03

Part 4)

British Standard
BS 410 - Specification for test sieves

Where any standard drawing used in conjunction with this Specification includes technical requirements that conflict with this Specification, the requirements of this Specification shall take precedence. ***Precedence***

MATERIALS

C402.03 GENERAL

1. The Contractor shall comply with the requirements of the manufacturer's recommendations regarding the handling, transport and storage of materials and as further specified in this Specification. ***Due Diligence***

2. The Contractor shall not use damaged or defective materials, including coatings and linings, outside the manufacturer's recommended limits. ***Rejection***

3. All gravity reticulation pipes shall be rubber ring (elastomeric), complying with AS 1646, jointed to the type, size and class as shown on the Drawings. ***Pipes***

C402.04 UNPLASTICISED AND MODIFIED PVC (uPVC and PVC-M) PIPE AND FITTINGS

1. Unplasticised PVC (uPVC) pipes and fittings for gravity systems shall comply with AS/NZS 1260, shall be suitable for rubber rings (elastomeric) joints and shall be of the class and size as shown on the Drawings. (WSAA 02 Part 40, sections iii, iv). ***Non-pressure Pipe PVC***

2. Unplasticised PVC (uPVC) pipes and fittings for rising mains and suction pipes shall comply with AS/NZS 1477 and AS/NZS 4765, shall be suitable for rubber ring (elastomeric) joints shall be of the class and size as shown on the Drawings. Modified PVC (PVC-M) pipes and fittings shall comply with AS/NZS 4765, shall be suitable for rubber ring (elastomeric) joints and shall be of the class and size as shown on the Drawings. ***Pressure Pipe PVC***

3. PVC pipes and fittings for mains and suction pipes shall be installed in accordance with AS 2032 and AS/NZS 2566.1. ***Installation***

4. Pipes and fittings are to be handled and stored protected from sunlight. The Contractor shall provide protection for the pipes and fittings from ultra violet light and damage. The Contractor shall take account of the time for storage and type of shelter. ***Protection***

C402.05 POLYETHYLENE (PE) PIPE AND FITTINGS

1. Polyethylene pipe shall comply with AS/NZS 4129 and AS/NZS 4130 and shall be of the class and size shown on the Drawings and installed in accordance with AS 2033. (WSAA 02 Part 40, section iii, iv). ***Standard***

2. Jointing shall be by butt thermal fusion or by electrofusion couplings, or with compression fittings. ***Jointing***

3. The Contractor shall provide pipe of the appropriate external diameter consistent with the required internal diameter shown on the Drawings. ***Internal Diameter***

C402.06 GLASS REINFORCED PLASTIC (GRP) PIPE AND FITTINGS

1. Glass filament reinforced thermosetting plastics (GRP) pipes shall comply with AS 3571 and shall be of the class and size as shown on the Drawings and installed in accordance with AS/NZS 2566.1. (WSAA 02 Part 402, sections iii, iv). ***Standard***

2. Pipes and fittings are to be handled and stored protected from sunlight. The Contractor shall provide protection for the pipes and fittings from ultra violet light and damage. The Contractor shall take account of the time for storage and type of cover. ***Protection***

C402.07 DUCTILE IRON (DI) PIPE AND FITTINGS

1. Ductile iron (DI) pipes and fittings shall comply with AS/NZS 2280 and shall be of the class, size and lining, as shown on the Drawings, and installed in accordance with AS/NZS 2566.1. Jointing shall be with rubber rings (elastomeric) to the class and type as shown on the Drawings. ***Standard***

2. Flanges shall be to the table shown on the Drawings. Bolts and nuts for flanged joints shall be galvanised, or stainless steel as for the pumps specified herein, unless shown otherwise on the Drawings. ***Flanges***

3. All pipework shall be sleeved externally with polyethylene sleeving in accordance with the requirements of AS 3681 unless specified otherwise to be coated and lined. All fittings shall be fusion-bonded coated, in accordance with AS/NZS 4321, or wrapped. The Contractor shall wrap all unprotected joints in the trench with a petrolatum tape system approved by the Superintendent. ***Corrosion Protection***

C402.08 STEEL PIPELINE

1. Steel pipelines and fittings shall comply with AS 1579 and AS/NZS 1594 and shall be of the class, size, lining and coating as shown on the Drawings. (WSAA 02 Part 40, sections iii, iv). ***Standard***

2 The Contractor shall wrap all unprotected joints in the trench with a petrolatum tape system approved by the Superintendent. ***Corrosion Protection***

3. The jointing system shall be rubber ring (elastomeric) unless shown otherwise on the Drawings. ***Joints***

C402.09 VITRIFIED CLAY

1. Vitrified clay (VC) pipes and fittings shall comply with AS 1741 and shall be of the class of pipe, complying with the loading requirements of AS 4060, and size as shown on the Drawings and suitable for rubber ring (elastomeric) joints (WSAA 02 Part 40, sections iii, iv). ***Standard***

C402.10 PREFORMED MAINTENANCE HOLES (MH)

1. Preformed maintenance hole components shall comply with AS/NZS 1477 for PVC, AS 2033 for PE, AS 3518 for ABS, AS 3571 for GRP and AS 4198 for concrete (WSAA 02 Part 40, sections iii, iv and Part 3, Section 18). ***Standard***

C402.11 PREFORMED MAINTENANCE SHAFTS (MS) AND TERMINAL MAINTENANCE SHAFTS (TMS) INCLUDING COVER

1. Preformed maintenance shaft and terminal maintenance shaft components shall ***Standard***

comply with AS/NZS 1477 for PVC, AS 2033 for PE, AS 3518 for ABS, AS 3571 for GRP and AS 4198 for concrete (WSAA 02 Part 40, sections iiii, iv, Part 3 Section 19, SEW 1314, 1316).

C402.12 MAINTENANCE HOLE COVERS AND FRAMES

1. Cast iron maintenance hole covers and frames shall comply with AS 3996 and shall be suitable for concrete filling. The size and class shall be as shown on the Drawings. ***Cast Iron***

2. Concrete covers and frames shall comply with AS 4198 and shall be of the size and, either Heavy or Light, class as shown on the Drawings. ***Concrete***

C402.13 STEELWORK

1. Structural steelwork, including ladders, brackets and covers, complying with AS 1657, shall be abrasive blast cleaned to AS 1627.4, Class 2.5 and hot dip galvanised to AS/NZS 4680. ***Corrosion Protection***

2. The Contractor shall supply and install step irons as shown on the Drawings or plastic encapsulated step irons (WSAA 02 Part 40, sections iii, iv). ***Step Irons***

PIPELINE CONSTRUCTION

C402.14 GENERAL

1. The Contractor, employees, or subcontractors, engaged in excavations, including tunnelling, are to be accredited for the work. Proof of accreditation constitutes a **HOLD POINT**. The approval of the Superintendent, to the supplied documentation, shall be required prior to the release of the hold point. ***Accreditation*** ***HP***

2. The Contractor shall not change the pipeline alignment without the prior concurrence of the Sewer Authority. The Contractor shall provide full details, of any proposed changes to the pipeline alignment, to the Superintendent for submission to the Sewer Authority. This action constitutes a **HOLD POINT**. The Superintendent shall obtain the decision of the Sewer Authority prior to the release of the hold point. ***Alignment Changes*** ***HP***

C402.15 LOCATION

1. The location of the sewers, maintenance holes, rising mains and pump stations, sizes and grades of sewers and rising mains, the types of maintenance holes and maintenance hole covers and the classes of pipes shall be as shown on the Drawings. The Contractor shall commence laying of pipelines at the lower end of the line unless directed otherwise by the Superintendent. The Contractor shall lay pipelines to grades and locations shown on the Drawings unless directed otherwise by the Superintendent (WSAA 02 Part 4, section 13.1, 13.2). ***Pipe Laying Method***

C402.16 COVER OVER PIPELINES

1. The minimum depth of cover to be provided over pipelines shall be as follows: (WSAA 02 Part 43, section 15.2). ***Minimum Cover***

LOCATION	MINIMUM COVER (mm)
Private property non vehicular New Developments	600
Private property non vehicular Existing Developments	450
Private property vehicular	750
Footpaths, sealed roads (non Arterial)	900
Unsealed roads	1200
Arterial roads	1200

2. Lesser covers may be permitted where special protection of the pipelines has been shown on the Drawings or directed by the Superintendent. ***Special Protection***

C402.17 CROSSINGS

1. Where a pipeline crosses a Main or State road, creek or involves features shown on the Drawings, under the control of any Authority, the Contractor shall carry out the work in accordance with the requirements of that Authority. The Contractor shall provide written notification to the Authority of the intention to carry out the work, and pay the appropriate fees. (WSAA 02 Part 43, section 17.13 - aqueducts). The Contractor shall obtain the written approval from the Authority prior to commencement of work. Such written approval shall be supplied to the Superintendent if requested. This action constitutes a **WITNESS POINT**. The Superintendent shall advise at the time of notification by the Contractor whether the option to request the written approval is to be exercised. ***Contractor's Responsibility*** ***WP***

2. Where shown on the Drawings, the Contractor shall use trenchless methods for the installation of the sewer mains. The installation of the sewer main by open trenching shall not be permitted over the lengths designated for trenchless installation. (WSAA 02 Part 43, Section 13.5.4.1). ***Existing Road Crossings***

3. The Contractor shall address, in its Method Statement for trenchless conduit installation, the following: ***Trenchless Installation Methodology***

   (a) General description of method and sequence of operation.

   (b) Size, depth and position of temporary pits required.

   (c) Use of specialist subcontractors.

   (d) Specialist equipment to be used.

   (e) Grout type and method of injection.

4. The encasement pipe shall be as detailed on the Drawings. The encasement pipe shall extend 1.0m behind the back of the kerb on either side of the carriageway. ***Encasement Pipe***

5. The carrier pipe shall be positioned on support cradles and the carrier pipe shall be centrally located within the encasement pipe. ***Support Cradles***

6. After installation and pressure testing of the carrier pipe, the Contractor shall fill the annular space between the carrier pipe and the encasement pipe with suitable grout or cementitious grout filler (WSAA 02 Part 43, section 17.12). ***Grouting***

7. Where the carrier pipe is ductile iron cement lined (DICL), any length of pipe

which is enclosed within the encasement pipe need not be wrapped in polyethylene tubing.

C402.18 EARTHWORKS

1. The Contractor shall carry out all excavations for structures and pipelines to the lines, grades and forms shown on the Drawings, or as directed by the Superintendent, within the specified tolerances. The Contractor shall comply with all requirements of the appropriate Authority including having regard for drainage, dewatering, silt control, noise abatement, proximity to existing buildings and generally for the amenity of adjacent owners (WSAA 02 Part 43, section 15). ***Contractor's Responsibility***

2. The Contractor shall leave a clear space of 600mm minimum between the edge of any excavation and the inner toe of stockpiles. No excavated materials shall be stockpiled against the walls of any building or fence without the written permission of the owner of such building or fence. Topsoil from excavations shall be stockpiled separately and utilised to restore the surface after backfilling (WSAA 02 Part 43, sections 14.7, 15.9). ***Excavated Material***

3. At the completion of work each day, the Contractor shall install safety fencing to Statutory requirements along the edges of open excavations to isolate them from the public. The Contractor shall provide fenced walkways and vehicular crossways across trenches to maintain access at all times from carriageway to individual properties or within individual properties and advise beforehand all affected residents. All such installations shall be of adequate size and strength and shall be illuminated to prevent accidents (WSAA 02 Part 43, sections 13.6, 15.1). ***Public Safety*** ***Access to Property***

4. The Contractor shall locate, protect and repair, as necessary, all services affected by the Works at the Contractor's expense (WSAA 02 Part 43, section 13.7). ***Existing Services***

5. The Contractor shall carry out erosion and sedimentation control at all construction sites in accordance with Specification for CONTROL OF EROSION AND SEDIMENTATION. ***Erosion Control***

6. The Contractor shall take account of safety issues and possible wet weather effects to limit the extent of excavation left open (WSAA 02 Part 43, section 15.2). ***Limiting Excavations***

C402.19 MINIMUM TRENCH WIDTH FOR PIPELINES

1. The minimum clear width of trench (inside internal faces of timbering or sheet piling, if used) to a height of 150mm above the top of the pipe shall be as shown in Table C402.1 (WSAA 02 Part 43, section 15.2).

NOMINAL SIZE OF PIPE (DN)	MINIMUM CLEAR WIDTH OF TRENCH (mm) (inside timbering or sheet piling, if any)	
	PIPE OTHER THAN PVC/PE	PVC/PE PIPE
80	400	350
100	400	350
150	450	400
200	500	450
225	550	500
250	550	500
300	600	550
375	700	650
400	700	650
450	750	700
500	850	800
525	850	800
600	950	900

Table C402.1 - Minimum Trench Widths

2. Where the Drawings provide for a trench to be excavated across a paved surface, the width of the trench shall be kept to a minimum. Bitumen and concrete surfaces shall be carefully cut, by sawcutting, or other means approved by the Superintendent, so as to provide a neat straight line free from broken ragged edges (WSAA 02 Part 43, section 15.3). ***Minimum Disturbance***

3. The Contractor shall widen the trench where necessary for the installation of valves and fittings and protective coating systems. ***Widen For Fittings***

C402.20 MAXIMUM TRENCH WIDTH

1. For gravitation sewers or rising mains of pipe materials other than PVC or PE, no restriction shall be placed on the maximum width of trench due to the structural strength of the pipe provided the depth to invert of the pipe does not exceed the depths shown in column (ii) of Table C402.2. ***Pipes other than PVC/PE***

2. The Superintendent may, however, restrict the width of trench due to local conditions. The Superintendent shall not restrict the width of trench to less than as shown in column (iii) of Table C402.2. ***Width Restrictions***

3. Where the depth to invert exceeds that shown in column (ii) of Table C402.2, the maximum width of trench (outside timbering or sheet piling, if used) to a height of 150mm above the top of the pipe shall be as shown in column (iii) of Table C402.2. ***Depth***

Nominal Size of Pipe (mm) (i)	Maximum Depth to Invert, Unlimited Width Trench (m) (ii)	Maximum Trench Width, Depths Greater than in Column (ii) (mm) (iii)
150	8.0	750
225	6.5	825
300	5.5	900
375	4.5	975
400	4.5	975
450	4.5	1050
525	4.0	1125
600	4.0	1200

Table C402.2 - Maximum Trench Widths

4. For gravitation sewers or rising mains of PVC/PE pipe the maximum width of trench from the trench base to a height of 150mm above the top of the pipe shall be the outside diameter of the pipe barrel plus 400mm. However, in timbered or travelling box excavated trenches, the width of trench when measured to the outside of the support used may be increased to a maximum of 580mm plus the outside diameter of the pipe barrel. ***PVC/PE Pipe***

5. The Contractor shall supply a method statement of any special construction control, where shown on the Drawings, to the Superintendent's approval. ***Special Controls***

C402.21 EXCAVATION DEPTH

1. The Contractor shall excavate trenches to 75mm below the underside of the pipe barrel and socket or coupling except for rising mains to be laid on other than rock foundations or as otherwise shown on the Drawings (WSAA 02 Part 43, section 15.8, , SEW-101). ***75mm Below***

2. The excavation shall be carried out such as to ensure solid and uniform support for each pipe over the whole length of the barrel with chases provided for joints and wrapping. ***Pipe Support***

C402.22 SUPPORT OF EXCAVATION

1. The Contractor shall adequately support all excavations to Statutory requirements as the Works proceed. When withdrawing supports, the Contractor shall exercise every precaution against slips or falls. (WSAA 02 Part 43, section 15.6). ***Precaution Against Slips or Falls***

2. The Contractor shall ensure that timber is left in place where its removal may endanger structures in the vicinity of the excavation. ***Timber Left in Place***

C402.23 PIPE BEDDING

1. When excavation of the trench has been completed the Contractor shall obtain the Superintendent's approval prior to commencing pipe laying, jointing and bedding. This action constitutes a **HOLD POINT**. The Superintendent's approval of the excavated trench is required prior to the release of the hold point (WSAA 2 Part 3, section 16). ***Approval*** ***HP***

2. Crusher screenings may only be used for pipe bedding where sand or other non-cohesive material is not readily available locally or where the Contractor can demonstrate that its use will not impede repair operations. ***Crusher Screenings***

3. Pipes for gravitation sewers (excluding PVC/PE pipes), shall be bedded on sand or other non-cohesive material. Pipe bedding shall consist of a non-cohesive granular material, having a minimum thickness of 75mm below the barrel and socket of the pipe, and its grading shall generally fall within the following limits shown in Table C402.3. (WSAA 02 Part 43, section 14.1). ***Gravity Sewers Pipes other than PVC/PE***

Sieve Size Aperture Width (AS 1152)	Equivalent BS Sieve Size (BS 410)	Percentage Passing
22.4 mm	1 inch	100
6.7 mm	¼ inch	90 - 100
425 μm	No. 36	40 - 90
75 μm	No. 200	0 - 10

Table C402.3 - Grading of Bedding Material for Pipes Other Than PVC and PE

4. Pipes for rising mains (excluding PVC/PE pipes) may be laid directly on other than rock foundation. The Contractor shall provide non-cohesive granular bedding, having a minimum thickness of 75mm below the barrel and socket of the pipe, where rock or other hard material occurs in the bottom of the trench or where specified or directed by the Superintendent. The bedding material shall be either loose clean sand and /or medium dense clean sand or as directed by the Superintendent. ***Rising Mains Pipes other than PVC/PE***

5. For PVC/PE pipes, irrespective of foundation, the material to be used for pipe bedding (underlay a minimum of 75mm below the underside of the pipe barrel and socket, side support and overlay to a depth of 150mm above the top of the pipe) as shown in Figure 5.1 in AS 2032 shall be in sand or other non-cohesive granular material, either crushed, natural or blended, and its grading shall fall within limits shown in Table C402.4, except that where the materials cannot be reasonably sourced from within the vicinity, the Contractor may use materials satisfying the classification in paragraph 2 above provided also that the material meets the requirements for passing sieve sizes 9.5mm and 6.7mm as shown in Table C402.4. ***PVC/PE Pipes***

Sieve Size Aperture Width (AS 1152)	Equivalent BS Sieve Size (BS 410)	Percentage Passing
9.5 mm	$^3/_8$ inch	100
6.7 mm	¼ inch	90 - 100
425 μm	No. 36	40 - 90
150 μm	No. 100	0 - 10

Table C402.4 - Grading of Bedding Material for PVC and PE Pipes

6. The Contractor shall bed all gravitation sewers laid on grades of 15 per cent to 50 per cent on 20MPa concrete complying with the Specification for MINOR CONCRETE WORKS. Such concrete bedding shall have a thickness of at least 75mm below the underside of the barrel and socket of the pipe and shall extend to a level above the bottom of the pipe of one quarter of the external diameter of the pipe and a width across the trench not less than the minimum width shown in Table C402.1. ***15-50% Grades***

7. The Contractor shall encase all gravitation pipelines and rising mains, laid on grades steeper than 50 per cent, in concrete as detailed on the Drawings. ***Grades Greater Than 50%***

C402.24 LAYING AND JOINTING OF PIPES

1. Unless detailed otherwise in this Specification, the Contractor shall install pipes in accordance with AS 2032, AS 2033, AS/NZS 2566.1 or AS 3690 as appropriate. (WSAA 02 Part 43, section 17). ***Installation***

2. Before being laid, all pipes, fittings, valves, and materials to be used shall be cleaned and examined by the Contractor and, if required by the Superintendent, the Contractor shall suspend each one in a sling to enable the Superintendent to inspect it. If directed by the Superintendent, the Contractor shall oil valves and repack valve glands. ***Examination***

3. The Contractor shall ensure that the interior of the pipeline is clean and free from obstructions. Plugs shall be used to prevent foreign matter entering sections of pipeline which are left uncompleted overnight. ***Cleaning***

4. The Contractor shall take all necessary precautions to prevent flotation of pipes during laying, backfilling and initial testing. The Contractor shall remove any temporary supports prior to completion of backfilling. ***Flotation***

5. Except where solvent cement joints are needed to make up or install fittings, joints in pipelines shall be flexible, rubber ring (elastomeric) joints (either roll-on rubber ring (elastomeric) or skid type) or, where shown on the Drawings, mechanical joints (either fixed flange or bolted gland type). (WSAA 02 Part 43, section 17.1.2) ***Joint Type***

6. For pipes with roll-on rubber ring (elastomeric) joints, spigots and sockets shall be clean and dry. The Contractor, after making the joint, shall check that the rubber ring (elastomeric) has rolled in evenly, and, if not, the Contractor shall withdraw the pipe and remake the joint. ***Roll-on Rubber Ring***

7. For pipes with skid type rubber ring (elastomeric) joints, only the lubricant specified in writing by the manufacturer shall be applied in making the joint. The Contractor shall make the joint such that the witness mark shall, at no point, be more than 1mm from the end of the socket. ***Skid Rubber Ring***

8. Pipes may be cut as needed, or directed by the Superintendent, to suit closing lengths, to remove damaged pipe or fittings or to remove sockets if necessary when jointing a socketed fitting. ***Cut Pipes***

9. For field cuts, a mechanical pipe cutter shall be used, except that PVC/PE pipes may be cut using a power saw or a fine toothed handsaw and mitre box. For field cuts of ductile iron or steel, the Contractor shall ensure that fire fighting equipment, in working order, is on the site prior to the field cuts being made. If the Contractor proposes to use a petrol-engine pipe cutter in an excavation, the Contractor shall ensure that a safe atmosphere is maintained in the excavation at all times. ***Pipe Cutting***

10. The Contractor shall prepare the ends of any pipes cut in the field to the manufacturer's written instructions, or as directed by the Superintendent. ***End Preparation***

11. Where pipes are cut in the field, the Contractor shall make a witness mark on the pipe at the length specified by the manufacturer from the end of the pipe. The Contractor shall not use PVC/PE pipes with scored witness marks. Where the same manufacturer does not make spigots and sockets, the Contractor shall refer to the socket manufacturer for the correct marking depth. ***Witness Mark***

12. Where PVC pipes are to be joined to pipes of another material, the joints shall be made as follows: ***Different Joints***

    (a) For jointing PVC/PE spigot to VC socket or PVC/PE socket to VC spigot, the Contractor shall use a PVC/PE adaptor shall be used. The joints in both instances shall be made using a ring conforming to AS 1646.

    (b) For jointing PVC/PE to ductile iron, the Contractor shall use a rubber ring (elastomeric) joint with an adaptor coupling.

13. The Contractor shall conform with the relevant Statutory and OH&S requirements when cutting and disposing of asbestos cement pipes. ***Existing AC Pipe***

14. Gravitation pipelines shall be constructed to the following tolerances (WSAA 02 Part 3, Section 23): ***Tolerances***

    (a) The maximum horizontal deviations to either side from the design axis of a pipeline shall be 20mm for all sizes of pipes.

    (b) The invert level shall not deviate from the design grade line by more than 10mm.

15. Flexibly jointed pipelines with gradual changes in alignment or grade shall be laid with the joint being deflected after it has been made. The Contractor shall comply with the manufacturer's written recommendations in respect of maximum deflection for each joint provided that no joint shall be deflected to such an extent as to impair its effectiveness. ***Joint Deflection***

16. The maximum angle of deflection between adjacent pipes shall be limited to 2^{o} or 0.035 radian in areas subject to mine subsidence or slippage. ***Limit of Joint Deflection***

17. Unless otherwise directed by the Superintendent, the Contractor shall lay pipes for rising mains on continuously rising grades from scour valve to air release valve, notwithstanding any minor irregularities in the ground surface. ***Rising Main Grade***

18. Detectable identification tape to AS/NZS 2648.1 shall be laid along the line of the rising main within 150mm of the finished surface or as otherwise directed by the Superintendent (WSAA 02 Part 43, section 17.11). ***Rising Main Identification***

19. Prior to backfilling and compaction operations, the Contractor shall undertake ovality tests of all pipelines for any abnormalities in pipe shape and rectify any unsatisfactory sections found to the satisfaction of the Superintendent. The test results of such tests shall be made available to the Superintendent. This action constitutes a **WITNESS POINT**. The Superintendent shall advise at the time of notification by the Contractor whether the option to inspect the test results is required. ***Ovality Testing***

WP

C402.25 CONNECTIONS TO MAINTENANCE HOLES AND STRUCTURES

Flexible Joints

1. The Contractor shall connect pipelines to maintenance holes, structures or embedded concrete by means of 600mm long pipes such that two flexible joints are provided, the first joint being at or within 150mm of the face of the structure. Where flexible joints cannot be made with cut pipes, the Contractor shall select pipes from the various lengths provided in order to make the second joint within 300mm of the position shown on the drawings (WSAA 02 Part 4, section 9.5, 9.6).

Maintenance Hole Location

2. The Contractor may vary slightly the positions of maintenance holes shown on the Drawings, subject to final approval by the Superintendent immediately prior to construction, to suit changes, such as erection of structures, growth of flora and installation of services. The positioning of a maintenance hole shall be such as to comply with occupational health and safety requirements for access by maintenance staff, providing a proper working area around the top and access into the hole. Once the final position of a maintenance hole has been established, construction shall be subject to the following requirements:

Tolerances

(a) For deviations from the design levels of maintenance holes as shown on the Drawings or as directed by the Superintendent during construction, the following tolerances shall apply: (WSAA 02 Part 43, section 23).

(i) Where the difference in levels between the inlet pipe and the outlet pipe in a maintenance hole is 100mm or less:

Pipe	**Tolerance**
Inlet	- nil; + 10mm
Outlet	- 10mm; + nil

(ii) Where the difference in levels, as above, is greater than 100mm:

Pipe	**Tolerance**
Inlet	- 10mm; + 10mm
Outlet	- 10mm; + 10mm

(b) Allowable lateral deviations from the final design position of maintenance holes shall be +/- 300 mm.

Work on Live Maintenance Holes

3. The Auhtority shall complete all necessary Works on “live” maintenance holes (that is, accesses to sewer system that is currently in service). All Works undertaken by the Authority at “live” maintenance holes in delivering the Works under the Contract shall be a cost to the Contractor. (WSAA 02 Part 43, section 24).

C402.26 JUNCTIONS AND PROPERTY CONNECTION SEWERS

Location

1. The Contractor shall provide junctions for dead ends and property connection sewers or risers to properties to serve existing and future dwellings in accordance with this Specification and the Drawings. Such junctions shall be inserted along pipelines in locations shown on the Drawings or directed by the Superintendent, with the service connection, where not shown on the Drawings, provided at a depth no deeper than 1.5m provided the property still has service to the sewer, as follows: (WSAA 02 Part 43, section 17.7)

(a) For existing dwellings, at the most practical point not outside the property boundary to facilitate the connection, considering existing sewage outlets. Separate connections shall be provided for dual occupancies.

(b) For vacant blocks, at the most practical point not outside the property boundary to facilitate the connection, considering topography and likely positioning of sewage outlets.

2. Where the sewer is intended to serve a large block and/or where the sewer line is located more than 75m from the premises, the Contractor shall extend the property connection sewer onto that block such that the maximum horizontal measurement in a straight line between the sewer connection point and the premises on the block is not more than 75m. ***Long Property Connection Sewers***

3. Junctions for risers shall be encased in 20MPa concrete complying with the Specification for MINOR CONCRETE WORKS. ***Concrete Encasement***

4. Except where concrete encasement is ordered by the Superintendent, the Contractor shall sand compact backfill around risers to the top of the socket or coupling on the highest branch off the riser, for the full width of trench and for a minimum distance of 500mm upstream and downstream of the riser. Compaction density shall be as for the requirements for the trench pipeline. ***Backfill***

5. All property connection sewers and junctions shall have a minimum diameter of 150mm and have a screwed access cap. Property connection sewers shall have a maximum length of 10m (WSAA 02 Part 43, sections 17.7, 17.8). ***Property Connection Sewer Caps***

C402.27 MARKING OF JUNCTIONS AND PROPERTY CONNECTION SEWERS

1. The Contractor shall clearly mark the position of each riser, junction or end of a property connection sewer on completion of backfilling. The marking shall be made by one of the following methods but the location of the mark or peg shall be consistent with the method(s) in use by the Sewer Authority and to the approval of the Superintendent (WSAA 02 Part 43, section 17.9). ***Location***

2. Where the position of a riser, junction or the end of a property connection sewer is at a substantial boundary fence or structure located on the boundary, a neatly stencilled letter "J" 50mm high shall be painted thereon. An underground identification tape, as specified hereafter, shall finish flush with the existing ground surface as close to the boundary fence or structure as possible. ***Adjacent to Fence***

3. Elsewhere, the Contractor shall drive into the ground, a peg, 75mm x 50mm x 600mm long at that position, and left flush with the surface of the surrounding ground. The Contractor shall connect the peg to an underground identification tape as specified hereafter. ***Peg***

4. The Contractor shall tie the identification tape to the junction or end of the property connection sewer and hold the tape in a vertical position during backfilling. The Contractor shall spike the top end of the tape by the junction peg immediately upon completion of backfilling (WSAA 02 Part 43, section 17.11). ***Tape Position***

5. The identification tape shall be 75mm wide red coloured polyethylene tape with the inscription "Caution - buried sewer line", printed in heavy black letters every 200mm. ***Identification Tape***

C402.28 TRENCH STOPS

1. Where a sewer or rising main is laid on bedding at a grade of 5 per cent to 14 per cent, the Contractor shall construct, as below, trench stops consisting of bags filled with clay, or sand or cement stabilised sand and sealed: (WSAA 02 Part 3, section 17.5, SEW-1206, SEW-1207) ***Grade 5% to 14%***

   (a) At the socket side of the joint nearest to the position of a stop required in accordance with the formula hereinafter, a recess 100mm deep to suit the width of bag shall be excavated into the bottom of the trench across its full width and into both sidewalls and extend to within 150mm below finished surface level.

   (b) The bags shall be placed around and above the pipe, as in (a) above, so as to give close contact with the pipe and to fill the entire space between the excavated recess and the pipe. Bags shall not be placed onto sand bedding.

2. The distance between trench stops shall be determined by the following formula: ***Spacing***

$$D = \frac{100}{G}$$, whereby

D = Distance between stops in m,
G = Grade of pipe expressed in percentum.

C402.29 CONCRETE BULKHEADS

1. Where a gravitation sewer or rising main is installed at a grade of 15 per cent to 29 per cent, the Contractor shall construct concrete bulkheads. Where a gravitation sewer or rising main is installed at a grade 30 per cent to 50 per cent, the Contractor shall construct concrete bulkheads integral with concrete encasement. Bulkheads shall be of 20MPa concrete complying with the Specification for MINOR CONCRETE WORKS, 150mm minimum thickness as follows: (WSAA 02 Part 3, section 17.5, SEW 1206, SEW 1207) ***Grade 15% to 29% and 30% to 50%***

   (a) Where concrete bedding or encasement to pipe is required, the 150mm thick bulkhead shall be cast integral with the concrete bedding or encasement across the width of trench and shall be keyed into both sidewalls a minimum of 150mm. The bulkhead shall extend to 150mm below finished surface level or such other level as directed by the Superintendent.

   (b) Where other bedding, or no bedding, is applicable, the bulkhead shall also be keyed into the bottom of the trench 150mm for the full width of trench.

   (c) A 75mm nominal diameter drain hole shall be provided in the concrete bulkhead immediately above the top of the encasement bedding or foundation and crushed rock or gravel shall be placed in and at the upstream end of the drain hole to act as a filter. The gravel shall be 10 to 20mm in size within 150mm in all directions upstream and above the invert of the drain hole beyond which another 150mm thick surround of gravel 2 to 10mm in size shall be placed.

2. The distance between concrete bulkheads shall be determined by the following formula: (WSAA 02 Part 1, Table 1) ***Spacing***

Concrete bulkhead

$$D = \frac{L}{G}$$

Concrete encasement (continuous) and concrete bulhead

$$D = \frac{100}{G}, \text{ whereby}$$

L = 80 X Pipe length, m
= 450 m max
if L> 100 m use intermediate trenchstops at spacing < 100/G
D = Distance between bulkheads in m
G = Grade of pipe expressed in percentum

C402.30 THRUST AND ANCHOR BLOCKS FOR RISING MAINS

1. The Contractor shall construct thrust and anchor blocks where shown on the Drawings to the dimensions depicted therein or as otherwise directed by the Superintendent. The blocks shall be provided at valves, flexibly jointed bends, tees, enlargers and reducers or any other point where unbalanced forces resulting from internal pressures will occur. ***Location***

2. The Contractor shall provide permanent thrust blocks of 20MPa concrete, complying with the Specification for MINOR CONCRETE WORKS, such that the thrust blocks bear against undisturbed material normal to the direction of thrust resulting from internal pressures over the bearing area not less than that directed by the Superintendent. ***Thrust Blocks***

3. The Contractor shall provide permanent anchor blocks of 20MPa concrete, complying with the Specification for MINOR CONCRETE WORKS, of a volume not less than that directed by the Superintendent. ***Anchor Blocks***

4. The Contractor shall provide temporary anchorages adequate to restrain the pipe when under test. The cost of providing such anchorages shall be deemed to be included in the rates tendered for laying and jointing rising mains. ***Temporary Anchorage***

5. The Contractor shall obtain the consent of the Sewer Authority for the type and use of restrained joints, as an alternative to thrust blocks, in the case of congested service corridors and urgent commissioning. ***Restrained Joints***

C402.31 RISING MAIN FITTINGS

1. The Contractor shall install rising mains, air release valves and inspection pipes where shown on the Drawings or directed by the Superintendent. All rising mains shall be topped with an appropriate identification tape. ***Location***

2. The Contractor shall provide marking plates bearing the letters "DAV" for double air valves, "SCOUR" for scour pipes and "SRM" for sewage rising main at changes of direction and at such chainages that the location of the main is marked, at least once each 100 metres, as specified hereinafter. In urban areas, the kerb adjacent to each fitting is to be painted with two (2) coats of non-slip paint coloured black. ***Marking Plates***

3. Where, in the opinion of the Superintendent, a valve or fitting is at too great a distance from any existing wall, fence or post to which the notice plate could be conveniently fixed, the Contractor shall provide and set in the ground a post with the relevant marking plate fixed at the top of the post, facing the fitting. The distance to the fitting in metres, to an accuracy of 0.1m, shall be permanently marked on the plate with legible numbers a minimum 80mm high. Wooden posts are not to be used where there is evidence, by rotting or termite activity, that the integrity of the posts will be affected. ***Marking Posts***

4. The post shall conform to the following requirements: ***Post Details***

   (a) The post shall be of sufficient length to be set firmly in place under saturated ground conditions.

   (b) When installed, the post shall project 1000mm above the ground, provided that where tall grass or crops are likely to obscure the post, or where directed by the Superintendent, its height above the ground shall be increased to 1500mm.

   (c) The post shall be painted with 2 coats of white enamel for exterior use.

C402.32 CONCRETE ENCASEMENT

1. The Contractor shall encase in concrete pipes in gravity sewers or rising mains, as shown on the Drawings, with less than the specified cover above the top of the pipe barrel, or where directed by the Superintendent. Concrete shall be 20MPa complying with the Specification for MINOR CONCRETE WORKS and have the following minimum dimensions: (WSAA 02 Part 43, section 16, SEW-1205). ***Location***

   (a) For trenches in other than rock: 150mm minimum under, on both sides and on top of the pipe barrel.

   (b) For trenches in rock: 100mm minimum under the pipe barrel, 150mm on top of the pipe barrel and for the full width of trench excavated.

2. In trenches of other than rock or fissured rock, a contraction joint consisting of a layer of bituminous felt 12mm thick shall be formed in the concrete encasement at the face of each socket or at one face of each coupling. ***Contraction Joint***

3. Reinforcement in concrete encasement shall be as shown on the Drawings. ***Reinforcement***

C402.33 WRAPPING OF PIPELINES

1. Where shown on the Drawings or directed by the Superintendent, the Contractor shall enclose a pipeline or a section thereof, in layflat polyethylene sleeving (WSAA 02 Part 43, section 17.10).

2. The materials to be used shall be high impact resistance polyethylene sleeving of minimum thickness 0.2mm polyethylene film, approved by the Superintendent, and 50mm wide plastic adhesive tape. ***Material Type***

3. The width of the sleeving when flat shall be in accordance with the pipe manufacturer's written recommendations for the size and type of the pipeline which is to be encased. Precautions shall be taken so that exposure to direct sunlight does not exceed 48 hours. ***Width***

4. Where necessary to distinguish pipes within close proximity, pipelines shall be identified by colour sleeving, green in colour, or an appropriate identification tape. ***Colour***

5. Application of the polyethylene sleeving and plastic adhesive tape shall be in accordance with the pipe manufacturer's written instructions or as directed by the Superintendent. The Contractor shall take due care not to damage the sleeving during its application or during the backfilling of the trench. Each pipe shall be encased in a length of sleeving overlapped for a minimum of 250mm at each field joint, and the ends of each length of sleeving shall be held in position with at least three circumferential turns of adhesive tape. As the polyethylene sleeve material covering the pipe will be loose, excess material shall be neatly drawn up around the pipe barrel, folded into an overlap on top of the pipe and held in place by means of strips of plastic tape at approximately one-metre intervals. Bends, tapers and similar fittings shall be covered by polyethylene sleeving as specified for the pipes. The Contractor shall hand wrap valves, hydrants and irregular shaped fittings and joints using flat polyethylene sheets secured with plastic adhesive tape, or other suitable material, to provide an adequate seal. The flat polyethylene sheets may be obtained by splitting suitable lengths of sleeving. ***Application***

6. The Contractor shall rectify any damage done to the polyethylene tubing before, during or after backfilling of the trench. ***Damage***

C402.34 CORROSION PROTECTION OF STEEL BOLTS AND NUTS

1. The Contractor shall wrap all galvanised steel bolts and nuts, used for installation below ground, of flanges, bolted gland joints, mechanical joints, tapping bands using a tape, approved by the Superintendent consisting of synthetic fibre open weave cloth impregnated with saturated hydrocarbons applied in accordance with the manufacturer's recommendations. Bolts and nuts shall be dry, clean and free from rust immediately before wrapping. ***Wrapping***

C402.35 CAST-IN-SITU MAINTENANCE HOLES

1. For all maintenance holes concrete work, the Contractor shall comply with the Specification for MINOR CONCRETE WORKS in relation to the supply and placement of concrete and steel reinforcement, formwork, tolerances, construction joints, curing and protection except as specified below. (WSAA 02 Part 43, section 18). ***Concrete***

2. Cement used in all concrete shall be Type SR to AS 3972. The Contractor may use fly ash additive to a maximum 20 per cent. Cement used shall be no older than three months since manufacture. ***Cement Type***

3. The minimum cement content shall be 360 kg/m^3 of concrete and the water/cement ratio of the mix shall not be greater than 0.50 by mass. ***Minimum Cement Content***

C402.36 COVERS AND FRAMES

1. Covers and frames shall not be warped or twisted. Surfaces shall be finished such that there are no abrupt irregularities and gradual irregularities shall not exceed 3mm. Unformed surfaces shall be finished to produce a surface that is dense, uniform and free from blemishes. Exposed edges shall have a minimum 4mm radius. (WSAA 02 Part 43, section 18.9). Covers and frames shall not be delivered to the site before satisfactory documentary evidence has been submitted to the Superintendent that quality tests have been carried out. This action constitutes a **HOLD POINT**. The Superintendent's approval to the quality test documentation is required prior to the release of the hold point. ***Standard*** ***HP***

2. Tolerances for the dimensions on the COVER shall be - 3mm + NIL. ***Cover Tolerance***

3. Tolerances for the dimensions on the FRAME shall be -3mm +3mm. ***Frame Tolerance***

4. Maintenance hole covers shall be seated on a layer of bitumen impregnated fibre board, having a cross-section of 25 x 25mm. Alternatively another seating material of a cross-section and composition approved by the Superintendent may be used. ***Cover Seating***

5. Maintenance hole covers shall be finished flush with the surface in roadways, footpaths and paved surfaces of any type. Elsewhere, covers shall be finished 25mm above the surface of the ground where not shown otherwise on the Drawings, or such other level as directed by the Superintendent, in a manner designed to avoid as far as possible, the entry of surface water. ***Cover Levels***

6. In locations where shown on the Drawings or directed by the Superintendent, the Contractor shall install a cast iron cover and frame instead of the standard concrete maintenance hole cover. Where it is evident, or otherwise shown on the Drawings, the Contractor shall install bolt down frames and covers in areas subjected to 1 in 100 year flooding. Cast iron covers and frames shall be manufactured in accordance with AS 3996, and shall be installed and filled with concrete, as necessary, in accordance with the manufacturer's written requirements. ***Cast Iron Cover***

C402.37 STEP IRONS

1. Step irons shall be as detailed on the Drawings. The Contractor shall fix step irons in formwork prior to placing concrete, ensuring step hold, alignment and spacing is positioned for safe access. (WSAA 02 SEW 1307). ***Fixing***

C402.38 PREFORMED MAINTENANCE HOLE AND MAINTENANCE SHAFT SYSTEMS

1. If approved by the Superintendent, preformed systems, complying with the Drawings, if any, otherwise complying with AS 3518, AS 3571 or AS 4198 may be used in lieu of cast in-situ systems. (WSAA 02 Part 43, section 18.4). Preformed system components shall not be delivered to the site before satisfactory documentary evidence has been submitted to the Superintendent that quality tests have been carried out. This action constitutes a **HOLD POINT**. The Superintendent's approval to the quality test documentation is required prior to the release of the hold point. ***Approval***

HP

2. The Contractor shall supply components that make a watertight system and have a satisfactory surface finish. ***Watertight Components***

3. Generally, preformed maintenance holes shall be made up in accordance with the Drawings, with components consisting of a base section, shaft sections of section lengths such as to minimise the number of joints required, a cone section, cover and frame. Make-up Rings may be used between cone sections and frames to make up height differentials. The wall thickness of any reinforced component below the frame shall not be less than 84mm. The vertical distance from the top of the surround and the first step is to be in the range of 600mm to 900mm. ***Component Assembly***

4. Generally, preformed maintenance shafts shall be made up in accordance with the Drawings, with components consisting of a base section, shaft sections of section lengths such as to minimise the number of joints required, cover and frame. (WSAA SEW 1314). ***Maintenance Shafts***

5. The installation of all preformed components shall be in accordance with the manufacturers' recommended procedures and requirements. ***Manufacturers' Procedures***

6. Backfill for all preformed maintenance holes and maintenance shafts shall be placed and compacted evenly around the maintenance hole to a level 300mm above the top of the highest incoming pipe and for the full width of the excavation. If necessary, the Contractor shall import and compact non-cohesive granular material. ***Backfill***

PIPELINE TESTING AND RESTORATION

C402.39 GENERAL

1. The Contractor shall subject all sewers and maintenance holes to an initial test as soon as practicable after construction and before backfilling is commenced. An acceptance test shall be carried out before the issue of the Certificate of Practical Completion and not earlier than one month after completion of construction of all sewers and maintenance holes in a section. Sewers or maintenance holes failing any test, shall be repaired and the test repeated. The process of testing, repair of defects and retesting shall continue until a satisfactory test is obtained (WSAA 02 Part 43, section 22). ***Initial Test Before Backfill***

2. All lines shall be clear and free from soil, slurry, liquids and other foreign substances at the time of initial and acceptance testing. ***Cleaning***

3. Where a vacuum system has been specified, the Contractor shall test the system in accordance with the testing schedule as shown on the Drawings. ***Vacuum System***

C402.40 INITIAL TEST OF GRAVITATION SEWERS

1. The Contractor shall make the initial testing of gravitation sewers with compressed air. Before the initial test is performed, all pipelaying on the section shall be completed, and backfill shall be compacted to the level of the centre of the pipe barrel and the Superintendent notified. This action constitutes a **WITNESS POINT**. The Superintendent shall advise at the time of notification by the Contractor whether the option to inspect the initial testing is required. ***Compressed Air*** ***WP***

2. The initial test may be carried out before risers and/or property connection sewers are constructed so that the main line can be backfilled. However, the Contractor shall carry out an initial test on the risers and property connection sewers as soon as they are completed. ***Risers and Property Connection Sewers***

3. Where the Superintendent approves the construction of pipelines in other than full lengths between maintenance holes, each length of pipeline shall be tested before backfilling together with the downstream portion of the maintenance hole length under construction. ***Other Than Full Lengths***

4. The Contractor shall rectify any fault detected and obtain a satisfactory test before the remainder of backfill is placed. ***Rectification***

5. The Contractor shall undertake ovality testing as follows: ***Ovality Testing***

   (a) All sewers to DN 300 shall be tested to determine any excessive ovality using a proving tool approved by the Council. Ovality testing shall be undertaken after all earthworks on the subdivision are complete and no sooner than 28 days after backfill of trenches has been completed. Sewer pipes having excessive ovality shall be replaced and the line retested.

   (b) The proving tool shall be rigid and non-adjustable having an effective length of not less than its nominal diameter. The minimum diameter at any point along the length shall be:

NOMINAL SIZE (DN)	MINIMUM PROVER DIAMETER (mm)
	uPVC PIPE
100	99.7
150	142.6
225	222.9
300	280.8

(c) The proving tool shall be fabricated from steel and have pulling rings at each end. The prover shall be marked to indicate the nominal pipe size and the prover outside diameter.

(d) Maximum Allowable Deflection = 3% of Mean Outside Diameter.

(e) The testing shall require a "prover" to be pulled through each section of the pipeline by hand winching to demonstrate that the maximum allowable deflection is not exceeded.

C402.41 INITIAL TEST OF MAINTENANCE HOLES

1. The Contractor shall test each maintenance hole for leakage, as soon as practicable after the maintenance hole is constructed and the maintenance hole cover surround fitted. (WSAA 02 Part 43, section 22.4.4) ***Leakage***

2. The test shall be made by plugging all pipe openings in the walls and by filling the maintenance hole with water to the lowest point on the top of the maintenance hole cover surround. The plugs shall be positioned in the pipes as near as practicable to the internal face of the maintenance hole. ***Method***

3. After allowing an interval for absorption, to be determined by the Superintendent, the Contractor shall refill the maintenance hole and measure the loss of water during the following 30 minutes. The test on the maintenance hole will be considered satisfactory provided the water lost is less than 3mm depth in the top section of the maintenance hole for each 1m depth of maintenance hole. The depth of maintenance hole is to be taken from the bottom of the maintenance hole cover recess in the cover surround to the invert of the outlet from the maintenance hole. The plug of the outlet shall be fitted with a suitable release for emptying the maintenance hole on satisfactory completion of the test. ***Duration***

4. Alternatively, the maintenance hole may be tested in conjunction with the downstream section of main or undertaken using the vacuum method or use of compressed air. In either case, the Contractor shall provide details of the alternative method proposed, for approval by the Superintendent, prior to its use. ***Alternative Tests***

C402.42 ACCEPTANCE TEST OF GRAVITATION SEWERS AND MAINTENANCE HOLES

1. The Contractor shall make the acceptance test on all components in the section of the sewer in the same manner as the initial test. The submission, to the Superintendent, of satisfactory test results constitutes a **HOLD POINT**. The approval of the Superintendent is required prior to the release of the hold point. ***As for Initial Test***

HP

2. The Superintendent may permit hydrostatic testing as an alternative to compressed air testing for acceptance of gravitation pipelines. ***Alternative***

3. The Superintendent may reject any pipeline or maintenance hole in which there is visible or detectable leakage. ***Rejection***

C402.43 TESTING WITH COMPRESSED AIR

1. The Contractor shall supply and keep all necessary equipment in a condition acceptable to the Superintendent. ***Equipment***

2. The Contractor shall test pressure gauges prior to use by static water column. ***Pressure Gauges***

3. Compressed air shall be supplied by a compressor of the rotary vane type capable of supplying at least 1 m^3/minute at 35kPa. The air shall be fed through a pressure-reducing valve capable of reducing pressure from that supplied to 28kPa ± 4kPa. The air shall then pass through an airtight line fitted with a pressure gauge reading from 0 to 50kPa, a pressure relief valve that shall be set to blow off at 28kPa ± 4kPa and a gate valve to the pipeline to be tested. ***Compressed Air***

4. The method of setting up and carrying out the test shall be as follows: (WSAA 02 Part 43, section 22.4) ***Method***

   (a) Insert a blank plug at one end and a disc with air-hose connection at the other end of the line. Care shall be taken to ensure that the force due to pressure on the disc is not taken by pipe joints, but is taken by struts bearing on the disc or on the end pipe in the line.

   (b) Couple test equipment to line under test and compressor or airline.

   (c) Slowly increase the air pressure in the line from 0 to 28kPa (over one minute approximately).

   (d) Hold air pressure at 28kPa for three minutes for stabilising temperature.

   (e) Close gate valve to shut off air supply to test equipment.

   (f) Measure the time it takes for the pressure to drop from 25kPa to 18kPa. If this time is less than that permitted or if the line cannot be pressurised to 28kPa, then the test is unsatisfactory and the pipeline shall be checked for leaks.

   (g) To check pipelines for leaks:

      I. Open the gate valve from the air supply sufficiently to maintain a pressure of 14 to 23kPa in the pipeline.

      II. Move along the pipeline coating it with detergent solution. Bubbles will indicate a point of leakage. Special attention should be paid to joints, discs and horns of junctions.

   (h) If leaks are detected, they shall be repaired to the satisfaction of the Superintendent.

   (i) Re-test as above until the time taken for the pressure to drop is greater than that shown below.

C402.44 ALLOWABLE PRESSURE DROP TIMES

1. The time taken for the pressure to drop from 25 kPa and 18 kPa shall be greater than: ***Time***

   100mm pipe – 1 minute
   150mm pipe – 2 minutes
   225mm pipe – 4 minutes
   300mm pipe – 6 minutes
   375mm pipe – 8 minutes
   400mm pipe – 11 minutes
   525mm pipe – 14 minutes
   600mm pipe – 17 minutes

2. Pressure drop times which are less than these may indicate leakage or excessive air permeability through unsaturated pipe walls with some materials. Vitrified clay pipes, in particular, suffer from excessive air permeability under dry summer conditions. When this occurs, pipes shall be thoroughly saturated with water before testing or a hydrostatic test applied. ***Saturation with Water***

3. In any case, where the allowable pressure drop time cannot be attained and there are no visible leaks, the Contractor shall apply a hydrostatic test. ***Hydrostatic Test***

C402.45 HYDROSTATIC TESTING

1. The Contractor shall carry out the hydrostatic test by connecting to the pipeline or section thereof under test, a pipe or hose terminating in a 150mm diameter container not less than 100mm deep. All other open ends of the pipeline shall be plugged. ***Pipe Connection***

2. The pipeline under test, and the pipe or hose with container, shall be filled with water until the free surface is level with the top of the container, when that container is suspended in accordance with the requirements set out below. ***Water***

3. The test container shall be suspended at a level such that the test head applied to the pipeline is as follows: ***Test Container***

   (a) (i) For initial test when no property connection sewers or risers are constructed – a minimum head of 2 metres above the pipe invert at the upstream end of the line under test, or

   (ii) For initial test where property connection sewers and/or risers are constructed – a minimum head of 2 metres above the highest invert in the line under test, including its risers and property connection sewers.

   (b) For acceptance test, a minimum head of 2 metres above the highest invert in the line under test, including its risers and property connection sewers, or above the free standing level of ground-water in the vicinity whichever is the higher.

   (c) Such other lesser head as the Superintendent, at the Superintendent's discretion, may direct.

4. The Contractor shall determine, at the Contractor's expense, the free standing level of groundwater, by a method acceptable to the Superintendent. ***Ground-Water***

5. After allowing an interval for absorption, to be determined by the Superintendent, any fall of the free water surface shall be made good by adding extra water to the container. The Contractor shall measure the fall in water level during ten minutes thereafter. ***Extra Water***

6. The pipeline will be regarded as satisfactory if there are no visible leaks, and if the fall in water level is not more than 25mm for each standard test length of the pipeline under test including property connection sewers and/or risers. ***Results***

7. A standard test length in metres is defined as 1370m divided by the effective diameter of the pipeline in millimetres. Where the pipeline under test is all of the same size, the effective diameter shall be the nominal size of that pipeline. Where the pipeline under test has property connection sewers and/or risers of smaller nominal size than the main sewer line, then the effective diameter shall be calculated as the product of the length and the nominal size of the larger pipe added to the product of the length and the nominal size of the smaller pipe; this sum shall be divided by the total length of pipeline under test; the result shall be the effective diameter. ***Test Length***

C402.46 VISUAL INSPECTION AND MEASUREMENT OF INFILTRATION

1. Whenever, in the case of acceptance testing, the pipeline is subjected to a significant head of groundwater (ie 1500mm or more above the soffit of the sewer main provided that groundwater is at least 150mm above any property connection sewer included in the test), the tests previously prescribed may be dispensed with in favour of visual inspection and measurement of infiltration. ***Head of Groundwater***

2. In such circumstances, the Contractor shall propose full details of the method by which the infiltration is to be measured. ***Method***

3. If the Superintendent, at the Superintendent's discretion, approves of an inspection and infiltration test being performed for the purposes of acceptance, the Superintendent shall determine, the duration over which infiltration is to be measured. The rate of infiltration shall not exceed that determined by the following formula: ***Rate of Infiltration***

$$Q.I. = 0.65 (L_1d_1h_1 + L_2d_2h_2 + ... L_nd_nh_n) + H_a$$

Where:

Q.I.	=	rate of infiltration in litres/hour
L	=	length of pipe in metres
d	=	nominal size of pipe in metres
h	=	average head of groundwater over the invert level of the pipe in the section under test
H_a	=	head of groundwater above the invert level of the outlet pipe of the maintenance hole when the maintenance hole is included in the infiltration test.

4. The Contractor shall determine the head of groundwater, at the Contractor's expense, by a method approved by the Superintendent. ***Contractor's Cost***

C402.47 TESTING OF RISING MAINS

1. The Contractor shall pressure test rising mains to detect leakage and defects in the pipeline including joints, thrust and anchor blocks. The submission, to the Superintendent, of satisfactory test results constitutes a **HOLD POINT**. The approval of the Superintendent is required prior to the release of the hold point. ***HP***

2. Pipelines shall be tested in sections approved by the Superintendent as soon as practicable after each section has been laid, jointed and backfilled, provided that: ***Timing***

   (a) If so specified or if the Contractor so desires, some or all of the pipe joints shall be left uncovered until the whole of the section has been successfully pressure tested to the satisfaction of the Superintendent; and

   (b) The pressure testing shall not be commenced earlier than seven days after the last concrete thrust or anchor block in the section has been cast

3. For the purpose of this clause, a section shall be defined as a length of pipeline which can be effectively isolated for testing, eg by means of main stop valves. ***Section Definition***

4. Pressure testing shall not be carried out during wet weather unless otherwise approved by the Superintendent. ***Wet Weather***

5. During pressure testing, all field joints which have not been backfilled shall be clean, dry and accessible. ***Field Joints***

6. During the pressure testing of a pipeline, each stop valve shall sustain at least once, the full test pressure on one side of the valve in closed position with no pressure on the other side for at least 15 minutes. ***Stop Valves***

7. Before testing a pipeline section, the Contractor shall clean it to the satisfaction of the Superintendent and fill it slowly with water, taking care that all air is expelled. Purging of air from rising mains shall be promoted by opening air valves. In order to achieve conditions as stable as possible for testing by allowing for absorption, movement of the pipeline and escape of entrapped air, the section shall be kept full of water for a period of not less than 24 hours prior to the commencement of the pressure testing. ***Filling with Water***

8. The hydrostatic test pressure which shall be applied to each section of the pipeline shall be equivalent to the pressure rating of the pipe specified. ***Test Pressure***

9. The Contractor shall maintain the specified test pressure for as long as required by the Superintendent, while the Contractor examines the whole section. In any case, the specified test pressure shall be maintained for not less than 8 hours. For the purpose of determining the actual leakage losses, the Contractor shall carefully measure and record the quantity of water added in order to maintain the pressure during the period of testing. ***Duration of Test***

10. The pressure testing of a section shall be considered to be satisfactory if: ***Results***

    (a) There is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component;

    (b) There is no visible leakage; and

    (c) The measured leakage rate does not exceed the permissible leakage rate as determined by the following formula:

$$Q_1 = (0.000532 + \underline{C}/ L_p) D.L. (H)^{0.5}$$

    where:

    Q_1 = permissible leakage rate (litres per hour)
    C = a coefficient as specified hereunder for the particular pipe material and type of joint
    D = nominal diameter of pipe (mm)
    L = length of section tested (km)
    H = average test head (m)
    L_p = average pipe length – $\underline{L}$ (m)
    n

where "n" is the total number of pipes and fittings in the section tested.

(d) the measured leakage rate does not exceed that rate calculated by the simplified formula for the type of pipe tabulated hereunder, in which event determination of the permissible leakage rate on the basis of the formula specified in I above shall not be necessary. The simplified formulae are based on the coefficient "C" and average pipe lengths contained in that tabulation.

Pipe Type	Simplified Formula	Coefficient "C"	Average Pipe Length (m)
D.I.	$Q_1 = 0.0105$ D.L. $(H)^{0.5}$	0.0548	5.5
PVC	$Q_1 = 0.01$ D.L. $(H)^{0.5}$	0.0568	6.0

11. Any failure, defect, visible leakage and/or excessive leakage rate, which is detected during the pressure testing of the pipeline or during the Defects Liability Period shall be rectified by the Contractor at the Contractor's expense. Where a thrust block or an anchor block fails, and such thrust block or anchor block has been constructed in accordance with the Drawings, and the failure is not, in the opinion of the Superintendent, the fault of the Contractor, the thrust or anchor block shall be strengthened or reconstructed as directed by the Superintendent. The cost of strengthening or reconstruction of such thrust or anchor block and the cost of retesting shall be paid as a Variation to the Contract, at such rates as are determined in accordance with the provisions of the General Conditions of Contract.

Rectification

12. Alternatively, the rising main may be tested by the use of compressed air. In this case, the Contractor shall provide details of the alternative method proposed, for approval by the Superintendent, prior to its use.

Alternative Tests

C402.48 BACKFILL AND COMPACTION

1. After laying and jointing of a pipeline has been completed the Contractor shall present the laid and jointed pipes for inspection by the Superintendent prior to commencement of trench backfilling. (WSAA 02 Part 43, section 21). This action constitutes a **HOLD POINT**. The Superintendent's approval to the laid and jointed pipes is required prior to the release of the hold point.

Notification

HP

2. Backfill shall not be placed until the Superintendent has given approval.

Approval

3. Material for the side support and overlay of the pipe shall be as for pipe bedding specified in Clause C402.23. The material shall be compacted in layers of not more than 150mm to 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS 1289.5.7.1.

Side Support and Overlay

4. The Contractor shall backfill the remainder of the excavation and compact the backfill in layers of not more than 150mm thick as follows:

Remainder of Trench

(a) Where the trench is within a roadway, proposed roadway, or footpath area, the remainder of the trench shall be: (WSAA 02 Part 3, section 21.1.2).

Backfill to Subgrade Level With Non-Cohesive Granular

(i) Backfilled with a non-cohesive granular material, with a grading falling generally within the limits shown in Table C402.3, and compacted to Density Index of 70 when determined in accordance with AS 1289.5.4.1 for cohesionless materials

1. Below 0.5m of the road surface
2. In the road reserve, but excluding the road pavement

Backfill to Subgrade

(ii) Backfilled with excavated material, and compacted to 100 per

cent of the standard maximum dry density of the material when determined in accordance with AS 1289.5.7.1, to within 0.5m of the road surface, but excluding the pavement layers. ***Level with Excavated Material***

(iii) Backfilled with road base and sub-base material as per existing or proposed pavement layers and compacted to 100 per cent of the standard maximum dry density of the material when determined in accordance with AS 1289.5.7.1 ***Backfill of Pavement Layers***

(b) Elsewhere, unless stated otherwise, the remainder of the trench shall be backfilled with ordinary excavated backfill material. Where suitable material is not available, granular material may be used for the full depth of backfilling. The material shall be compacted to a density Index of 70 when determined in accordance with AS 1289.5.4.1 for cohesionless materials or 98 per cent of the standard maximum dry density of the material when determined in accordance with AS 1289.5.7.1 for cohesive materials.

5. The Contractor shall carry out backfilling and compaction without damaging the pipe or its external coating or wrapping or producing any movement of the pipe. ***Care***

6. The contractor shall carry out compaction tests 75mm to 100mm below the level being tested. (WSAA 02 Part 4, section 22.3) ***Compaction Tests***

7. The Contractor may compact backfill by trench flooding only where: ***Flood Compaction***

(a) The ground and backfill material is cohesionless sand.

(b) Water for flooding has been sourced at the site.

(c) The process will not create mud which would be moved off site by vehicles or construction plant.

(d) Additives are not used.

C402.49 RESTORATION OF SURFACES

1. The Contractor shall clean pavements, lawns and other improved areas and leave them in the same order as they were at the commencement of the Works. The Contractor shall restore any fencing removed during construction and shall restore lawns with turf cut and set aside from the original surface and with imported turf from a source approved by the Superintendent (WSAA 02 Part 43, section 25). ***Original Condition***

2. The Contractor shall maintain all restored surfaces in the condition to which they are restored until the expiry of the Defects Liability Period applicable to those surfaces, notwithstanding that any deterioration of the restored surfaces, and the need for their maintenance may or may not be due to defects which become apparent or arise from events which occur during the Defects Liability Period. The Contractor shall maintain pavements with crushed igneous rock, gravel or other suitable material allowing for consolidation and shall then restore them to a condition equivalent to that of the original pavement. ***Maintenance***

3. Immediately the backfilling of a trench excavated through a pavement has been completed, the Contractor shall temporarily restore the pavement. Where the trench crosses bitumen or concrete pavement, the surface is to be protected from deterioration. A pre-mixed asphaltic material may be used for such temporary restoration. The Contractor shall maintain the temporary restoration until final restoration is carried out. Final restoration of the pavement shall be carried out to restore the pavement and its sub-base to no less than the original condition. Final restoration may include, if required by the Superintendent, the removal of temporary restoration. ***Temporary Pavement Restoration***

4. In other than roadways, the Contractor shall place the backfill sufficiently high to compensate for expected settlement and further backfilling shall be carried out or the original backfill trimmed at the end of the Defects Liability Period in order that the surface of the completed trench may then conform with the adjacent surface. Surplus material shall be removed and disposed of to areas arranged by the Contractor. Where dry weather conditions have persisted after the original backfilling, including during the Defects Liability Period, the Contractor shall take all necessary steps to consolidate the trench before removing surplus materials from the site. ***Backfill***

5. In locations where, in the opinion of the Superintendent, surplus material left in the vicinity of the trench would not be objectionable, the surplus material may be disposed by spreading neatly in the vicinity of the trench to the satisfaction of the Superintendent in such a way as to avoid future erosion of the backfill and adjacent ground surfaces. The Contractor shall maintain the backfill and adjacent ground until the expiry of the Defects Liability Period. ***Disposal of Surplus Material***

6. Where, within public or private property, the reasonable convenience of persons will require such, the Superintendent may order the Contractor to level trenches at the time of backfilling. The Contractor shall make good any subsequent settlement, as required by placing additional fill. ***Settlement***

7. The Contractor shall immediately restore any damaged or disturbed private property and services. ***Restoration***

8. Should the Contractor elect to tunnel under paving, kerb and gutter or other improved surfaces in lieu of trenching, backfilling shall be so carried out as to restore full support to those surfaces, and payment shall be made for the restoration of the surfaces as though they had been removed and replaced. The Contractor shall remain responsible for the repair of the improved surfaces, if subsequently damaged due to subsidence of the backfill, until the end of the Defects Liability Period. ***Tunnelling***

9. The Contractor shall provide notice to affected property owners of any pending works. ***Property Owner Advice***

PUMP STATIONS

C402.50 PUMPS

1. Pump construction materials for centrifugal end suction pumps shall comply with the following: ***Materials***

DESCRIPTION	MATERIAL
PUMP	
Casing and suction bend	Cast iron AS 1830 Gr T200
Wear rings	Cast iron AS 1830 Gr T200
Impeller	316 Stainless steel/AS 1449
Impeller nut	Gunmetal AS 1565-905C
Shaft	316 Stainless steel/AS 2837
Shaft sleeve	Phosphor bronze AS 1565-9060/316
Neck bush, lantern ring	Phosphor bronze AS 1565-9060
Gland	Cast Iron AS 1830 Gr T200
Gland studs	316 Stainless steel/AS 2837
Gland nuts	316 Stainless steel/AS 2837
Fixing nuts and bolts handhole	316 Stainless steel/AS 2837
Covers	316 Stainless steel/AS 1449
Fitted bolts and nuts, casing and dowels	316 Stainless steel/AS 2837
Forcing screws	316 Stainless steel/AS 2837
Water thrower and drip tray	316 Stainless steel/AS 1449
Pump set base plate	Cast iron AS 1830 Gr T2000/Fabricated steel
MOTOR	
Motor frame and end shield	Cast iron/Mild steel
Motor terminal box	Cast iron/Mild steel
Motor fan cover	Mild steel
Motor fan	Metal
HOLDING DOWN BOLTS	316 Stainless steel/AS 2837
MECHANICAL SEALS	
Seal faces	Tungsten carbide or equal
Springs	Nickel chrome steel
Secondary seal	Fluoro carbon or nitrile rubber

2. The Contractor shall provide a written warranty from the Manufacturer of the equipment. This action constitutes a **HOLD POINT**. The Superintendent's approval of the warranty is required prior to the release of the hold point. ***HP***

3. The Manufacturer's warranty shall require the Manufacturer to accept liability for any defect in materials or workmanship which becomes apparent at any time within two (2) years after the date of delivery of any piece of equipment used in Work under the Contract. ***Manufacturer's Liability***

4. All nuts and bolts shall be manufactured in accordance with AS/NZS 1111 and AS/NZS 1112, 150 metric series and fitted with washers beneath bolts heads and nuts. ***Nuts and Bolts***

   (a) All bolts, nuts and washers shall be stainless steel to AS 1449 and AS 2837, minimum grade 316. All bolts, nuts and washers are to be of the same grade and supplied passivated.

   (b) All threads are to be rolled.

   (c) All bolt heads and nuts shall be hexagonal.

   (d) All bolts, studs, set screws and nuts for bolting flanges and other pressure containing purposes shall conform to AS 2528.

   (e) All nuts and bolts subjected to vibration shall be fitted with lock washers or lock nuts.

   (f) All concrete anchor bolts, nuts, locking nuts and large series washers required for the bolting down of pump set discharge bends shall be provided. These anchor bolts shall be as recommended by the equipment designer with a minimum diameter of 16mm.

   (g) Concrete anchor bolts shall be chemical masonry anchor type, set to their full depth, suitable for the required duty.

5. Bolts on all flanges will protrude no more than 10mm past the nut when tightened. ***Bolts on Flanges***

6. The Contractor shall apply sufficient anti-seize/anti-galling material to the threads of all stainless steel fasteners. The material shall be Polytetrafluroethylene (PTFE), either tape to AS 1272, dipped or sprayed, or molybdenum disulphide. ***Anti-Galling, Anti-Seize***

C402.51 PREFORMED PUMP STATIONS AND PACKAGE PUMP STATIONS

1. Preformed components or systems, complying with the Drawings, if any, otherwise complying with AS 3518, AS 3571 or AS 4198 may be used in lieu of in-situ construction provided: ***Alternate Wet Well***

   (a) Preformed concrete wall units are to be manufactured to AS 4058 except as modified as for the requirements for precast maintenance hole units.

   (b) Joints shall be internal flush

   (c) The Contractor shall supply components that make a watertight system and have a satisfactory surface finish ***Component Quality***

2. Package pump stations may be supplied and installed provided:

   (a) All components comply with the requirements of this Specification

   (b) The units are at least equivalent to the requirements of this Specification

and the Drawings.

Package Units

C402.52 ELECTRICAL COMPLIANCE

1. The Contractor must ensure that all employees, sub-contractors and agents comply with, but not limited to the following relevant documents: ***Standards***

   - Acts;
   - Regulations
   - Local laws and by-laws;
   - Codes of Practice;
   - Australian Standards; and
   - Policy and procedures which are in any way applicable to this Contract or the performance of the works under the Contract.

2. The Contractor must be aware of and comply with all specifications associated with the works. ***Requirements***

   All works shall be in accordance with, but not be limited to, relevant:

   - Acts
   - Technical Specifications in this Contract
   - Australian Standards
   - Manufacturers Specifications
   - Industry best practice

Proof of Compliance

3. Proof of compliance with a standard or specified test may be required. Where required by the superintendent, such proof shall comprise a test certificate from an approved independent testing authority;

4. Approval of works; ***Approval***

The Contractor shall supply to the Superintendent for approval prior to construction of the works

For the complete electrical works

- 1 A3 size prints of wiring diagrams
- CAD drawings (compatible with AutoCAD 2006) with associated files ie Font, X-Ref, VBA, Plot, and other scripts used to produce the drawing. *(The use of E-transmit or similar "pack and go" processes will provide all associated files and scripts.)*

and

- A written control method detailing the complete schematic
- PDF of all documents

As well as the requested hard copies of documents the Council has need of copies of documents in electronic form.

THEY ARE TO BE COMPATIBLE WITH SOFTWARE AND VERSIONS CURRENTLY USED BY COUNCIL.

EG. MICROSOFT WORD, EXCEL, AUTOCAD AND MS PROJECT, MAPINFO

All documents are also required in pdf format to enable consistent document reproduction

Current BSC software versions are:

Microsoft Office	*2000*
AutoCAD	*2006*
MsProject	*2000*
MapInfo	*7.8*
Adobe Acrobat	*7*

At the completion of the project "As Constructed" details on all drawings, documentation and relevant manuals are to be provided in electronic format as indicated above.

MINIMUM DRAFTING REQUIREMENTS

1. All drawing shall be prepared in accordance with AS 1100-101 *(Technical drawing - General principles)* and associated standards.

2. Drawings shall be definitive and clearly set out so as to present the design concepts in such a way that the project can be understood, specified for construction and satisfactorily built.

3. All design drawings should be clearly numbered by the designer with separate sheets numbered as part of a set. All drawing sheets shall have an allocated space in the bottom right hand corner for Council registration (18 characters).

4. The information shown on the drawings shall be logically collected on discrete sheets to avoid illogical and onerous effort in cross referencing between sheets in order to find information.

5. Digital drawings are to be organized into separate layers for each asset type.

6. Drawings should not be overcrowded with information and should not rely on colour printing or colour wash to impart information. Drawings should be on A1, A2 or A3 size sheets and be suitable for black and white copying and photo reduction to A3 paper size without loss of clarity.

SURVEY DATA - GEO-REFERENCED

The Project Officer is to arrange for a registered surveyor or a qualified engineering surveyor to undertake progressive field surveys of "as constructed" information throughout construction, timed to collect prior to and critical to continuation of the next stage of the particular construction.

1. "As constructed" details with levels to AHD (m),

2. the data is to be orientated on true geographical co-ordinates, mapping grid of Australia (MGA94) zone 56.

C402.53 SWITCHGEAR AND CONTROL GEAR ASSEMBLY (SCA), CONTROLS

1. The switchboard shall be designed and assembled by a manufacturer approved by the Superintendent; ***Approved Manufacturer***

2. SCA located within a building shall be stationary, free standing, marine grade 3.15mm aluminium cubicle, a channel base with a minimum degree of protection of IP31 specified in AS 1939. The doors of the SCA shall be utilized for the mounting of control equipment, indicating and selector devices. The exterior of ***Type***

the SCA shall be powder coated "Electrical Orange". The SCA shall include a fully automatic mains-generator transfer switch gear to facilitate the connection of permanently installed generator at this site

3. SCA located outdoors shall be, stationary, free standing, marine grade 3.15mm aluminium cubicle, a channel base shall be provided. The SCA shall include a manual operated switch gear to facilitate the connection of portable generator to an inlet socket at this site. All joints in the SCA and doors shall be continuously welded and ground smooth, free from crevices. The inside of all doors and the interior of the SCA shall be powder coated white in colour. No fastenings shall pass through the exterior of the SCA except for locking devices

Construction

4. The Contractor shall provide an effective barrier to prevent gases from the wet well entering the SCA. All cables shall enter the SCA from below and terminated into a terminal strip in the lower compartment. This compartment shall be fully sealed from other compartments and fitted with 2 vents.

Cable entry and barrier for Gases

5. All equipment shall be securely mounted on suitable mounting panels and comprise of minimum of 2 individual compartments. Each compartment shall be fitted with 2 vent, each door shall be fitted with a lockable latch with the top door housing the Electricity Meters fitted with a door latch capable of being locked with a standard Lockwood lock or similar at the Contractor's cost, doors with an overall dimension that exceeds 500mm shall be fitted with a three-point latch and door stiffener. All doors shall be fitted with a continuous resilient rubber gasket with a captive frame, hinged on chromed lift-off pintle hinges and secured with chromed three (3) point locking handles (Key No. 92268). A door stay shall be fitted to hold the door open allowing a minimum opening of 120mm

Layout and Doors

6. Vents shall be formed in the SCA walls and/or doors to ensure the maximum thermo siphon effect and shall be covered by stainless steel Grade 316 gauge mesh openings not greater than 2.66mm (approximately) to exclude vermin. The vents shall be constructed to avoid overheating with an air temperature of 45^{o}C and with all equipment operating continuously or intermittently.

Ventilation

7. Control Cabinet shall be fitted with a hinged equipment panel. The hinged panel shall be fitted with a shroud to IP 21 of AS 1939. The hinged panel shall form part of the control panel to house and display equipment

Hinged Equipment Panel

8. Equipment shall be mounted in the SCA with due regard to accessibility and grouped in a logical and neat order.

Workmanship

9. Electrical power, lighting and pumping circuits shall be protected from operational excess currents by approved devices conforming to TYPE "2" Co-ordination between contactors, motor protection relays and corresponding circuit breakers. Motor circuit breakers, control circuit breakers, RCD units and isolators shall be mounted in such manner as to enable their operation from the front of the control panel. Data from the switchgear supplier confirming Type "2" Co-Coordinator between contactors, motor protection relays and corresponding circuit breakers shall be submitted to the Superintendent;

Switchgear

10. Wiring within the SCA shall be in accordance with the wiring diagrams. The wiring shall be of adequate size, minimum 10A rated, multi stranded tinned copper conductors, insulated with different colours for power and control with numbered annular tags at each end to allow for easy tracing. Numbers shall be shown on the wiring diagram. All connections to external units shall be by numbered strip located in the cable connection compartment. Terminals shall be clip-on rail type with 50% spare rail capacity.

Wiring

The terminals shall be of non-ferrous metal. Terminals for connection of thermistors shall be clearly labeled "Thermistors – Do Not Test Above 2.5V". Connect only one wire to each terminal block. Wires shall be terminated in a crimp type lug throughout. All electric power and control cables shall be continuous to and from the SCA. No joins shall be permitted unless approved by

the Superintendent or his representative.

Provide sufficient slack in cable looms running to hinged panels and doors to prevent strain or fatigue damage to the insulation and conductor. Protect cables with nylon or polyethylene spiral wrapping. Mechanically fix cable looms at their point of origin and termination by clamps. Cables running to hinged panels and doors shall not exceed 2.5mm.

11. Relays and timers shall be 240volt, plug-in type. Relays shall have a minimum of 4 poles 5A contacts. ***Relays***

12. Selector switches shall be an industrial type, rotary action, 10A rated and complete with an engraved escutcheon plate ***Switches***

13. Phase failure, phase unbalanced, phase reversal and under voltage relays shall be connected to incoming supply. A 0-5 minute timer shall delay the restoration of power after a power failure. Incoming phases shall be selected by a selector switch and meter; ***Electrical Protection***

A 240V 10A-surge reduction filter shall be installed in the active and neutral cable of the control circuits. The unit shall have a Max Aggregate Surge rating of 50 Ka 8/20us and the units shall be Critec TDF series or equivalent.

A set of lightning arresters shall be mounted and connected to the incoming supply within the SCA. The units shall have an incorporated LED display showing status of each unit and onboard alarm contacts for an external warning if the internal surge material is below optimum condition. The unit display status shall be visual when mounted into the SCA. Each unit shall have a Max Surge rating of Min 80 Ka 8/20us and the unit shall be Critec TDS 180 series or equivalent. The units shall be mounted in the SCA. The installation shall be in accordance with AS 1768

14. The electrical characteristics of the SCA shall be: ***Characteristics***

- Main Circuit: 415/240V, 50 Hz, 3-phase, 4-wire;
- Motor Control Circuit: 240V, 50 Hz;
- Common Control Circuit: 240 & 24 V, AC
- Prospective Short-Circuit Current: 14kA for 1 second;
- Peak Factor: 2.2Earthing M.E.N. system;

15. All equipment shall be clearly identified with engraved, bi colour laminated plastic labels permanently attached. Adhesive plastic shall not be accepted ***Identification***

16. Provide spare space with the Control Cabinet to enable the installation of the telemetry module, power supply and associated equipment. Provide sensing relays and wiring for inputs to Telemetry, modules, terminate wiring in a terminal strip adjacent to the module. Obtain a standard equipment layout and wiring diagrams for telemetry from the Burnett Shire Council; ***Spare space for Telemetry***

17. The "Pumping Station" shall be operated by a Multitrode Duplex Pump Controller or equivalent. The pumps shall be variable speed controlled using the controller to monitor and control the automatic operation of the pumping station. Features required by the control and monitoring equipment are; ***Automatic Control***

- Designed for use in pumping sewage with automatic level control, pump alternation and protection, and complex efficiency functions;
- Indication of liquid level, system status, fault conditions and alarms is via the front panel. The display shall utilize high intensity LED's that always remain visible, even in the direct sunlight;
- The controller shall be equipped with EDS switches for advanced control functions;
- DIN rail mounting option and plug in terminals;
- 5 digital outputs which could be configured individually from sources of status within the Pump controller;

- 4-20mA analogue output which could be used for charting level or the advanced non-linear VFD control algorithm;
- A ball float shall be mounted in addition to the Pump Controller to sense the overflow levels within the wet well its wiring terminating in the telemetry connection terminal block. Level monitoring of the wet well shall be primarily by ultrasonic level device housed into the wet-well. A backup10 button probe shall connect to the controller as a backup device.
- Amp metering (for each pump) and hour meters could be mounted into the panel adjacent to the keypad. These items are not required are not required if a Monitor Pro or equivalent is installed.
- Phase failure detection of the incoming supply shall be wired into the Pump Station Controller
- Thermal protection;

Pump stations with pump motors rated above 6kW shall be fitted with a Multitrode Duplex Pump station controller and Monitor Pro or equivalent.

Features required are:

- Over current detection;
- Under current detection;
- Supply Voltage monitoring;
- Phase Failure detection;
- Motor Insulation testing;
- Earth Fault detection;
- Thermal protection;
- Overflow monitoring; Flow Rate calculations
- Volume Pumped calculations;
- Data Logging of all significant control events;
- Current monitoring;
- Hours run;
- Total number of starts, faults.

18. The switchboard is to be provided with lockable isolators on the power supply to each pump

Motor Isolators

19. SCA fitted with automatic transfer switches for the connection of permanently connected generators shall have indicators on the equipment panel for mains and generator status. The transfer switch shall be re settable from the control panel should the switch trip or fault during operation. A separate key switch shall enable the generator for test operations. The switch can be located on generator control panels with integrated controls. Input wiring shall be connected to the radio telemetry module for mains outage, generator online and generator fault/s. The fault relay can be a general fault relay

Automatic transfer switch

20. SCA fitted with generator inlet sockets shall be fitted with manual change- over switches within the cabinet. The switches shall be designed to enable staff to safely operate the change over between mains and generator supply. Indicator lights shall display both mains and generator status.

Generator Inlet Socket

21. Factory tests shall be carried out by the contractor. These tests shall comprise all routine Tests specified in AS 3439 and may be required to be witnessed by a Superintendent's Representative The Superintendent shall be given seven (7) days notice of the proposed date of such test. ***Factory Tests*** ***WP***

22. Functional tests shall include electrical function tests as defined in AS 3439; ***Functional Tests***

23. After satisfactory final factory inspection and tests and after approval has been given by the Superintendent, the equipment shall be packed for transport. Any relays and fittings likely to be adversely affected during delivery shall be adequately protected or shall be removed and packed separately in protected containers. Where equipment has been removed, cover plates shall be provided; The contractor shall be responsible for any damage that may occur during transit and unloading at site; ***Shipment to Site***

24. Supply spares for each item of equipment, including fuses 3 per size, contactors 1 per size, overload 1 per size, motor circuit breakers 1 per size, excluding Pump Station Controller. ***Spares***

Spare parts, tools etc, shall be packed separately from the main plant and shall be marked "Spare Parts", "Tools" etc, as applicable;

C402.54 ELECTRICAL INSTALLATION

1. The contractor shall liaise with Ergon Energy for the electricity supply to the pump station site. The consumer main shall be generally run underground and commence at the pillar box at the end of the Sewer Pump Station Access. ***Liaison***

2. This Contract includes the provision of consumers mains from Ergon Energy pillar box to site main switchboard. All facilities required by Ergon Energy for revenue metering equipment and the payment of all associated connection, inspection fees and capacity charges shall be the responsibility of the Contractor. The metering facilities and panel shall be Ergon Energy approved and suitable for the installation of the metering equipment required by Ergon Energy ***Contractor's Responsibility***

3. All cabling including consumer mains, motor, control and flow meter cables, conduits and electrical pits shall be supplied and installed by the Contractor. ***Cabling***

- The number of wires installed in any conduit or ducting system shall not exceed 75% of the maximum number recommended by the Manufacturer.
- All electrical conduits shall conform to AS 2053. All joints shall be carefully glued according to Manufacturer's recommendations.
- Where conduits are exposed to the sun, an approved paint shall be applied to prevent ultra violet damage. All underground conduits shall be installed a minimum 500mm below finished ground level in non-traffic areas and 600mm below the finished ground level in trafficable areas. The trenches and backfill materials shall be free of rocks and other deleterious matter likely to damage conduits.
- Approved electrical marker tape shall be run 150mm below finished ground level directly above conduits for the entire length of the conduit run. Prior to commencing trenching, the route of all underground cabling shall be marked out and approved by the Superintendent.
- Conduits that envelope motor and control cables shall be separated by a distance of 150mm from conduits containing instrumentation and signal cables.
- All spare conduits shall be plugged or capped and fitted with a galvanized steel draw wire for future use.
- Light duty conduits shall be grey in colour and comply with Australian Standard

2053.

- All outlet boxes in PVC conduit systems shall be PVC.
- Expansion joints shall be inserted in conduits at intervals to S.A.A. wiring rules.
- Supports shall be fastened at distances not exceeding 600mm. Conduits at ground level shall be covered with heavy-duty galvanized steel conduit covers. Covers shall extend to 300mm above ground.

4. The minimum size of the consumers mains shall be sized to satisfy the following requirements: ***Consumers Mains***

   (a) Current carrying capacity to suit the maximum demand with an excess current carrying capacity of 30% minimum;

   (b) Be sized for a voltage drop less than 1.5% to the maximum demand as calculated;

   (c) Be single core PVC/PVC cables. XLPE insulated cable may also be used;

   (d) Comply with the requirements of Ergon Energy;

   (e) Pole termination method shall be as shown on the Drawings;

5. In addition to the requirements of Ergon Energy the main earthing conductor shall be run in conduit to the main earthing electrode. The main earthing connection shall be contained in an earthing electrode connection box similar to ALM Type ERB-1 up to 50mm^2 cable and a Type 4 pit for larger cable. The pumping station pipe work shall be bonded to the main earth; ***Earthing***

6. The following types of cable shall be used in the electrical installation of all plant equipment: ***Cable Types***

   - Motor and equipment cables- Multi-core circular type colour orange.
   - Lighting and power – Stranded 2.5mm PVC/PVC –TPS.
   - VSD Units- shielded cables to IEC/AS regulations.
   - Instrumentation- Decron or similar

7. All equipment, cables, conduits and wiring shall be fixed to the supporting structures with non-corrosive metal screws and/or anchored into plastic plugs or approved equivalent. ***Fixings***

   All cable trays and ladders shall be fixed to the supporting structures using stainless steel bolts.

   All poles and mounting hardware shall be hot dipped galvanized or stainless steel;

8. At the completion of commissioning tests all conduits into the outdoor SCA shall be sealed with a non setting sealing compound to prevent the ingress of vermin and wet well gases. ***Sealing of conduit/cable entry***

9. Light switches and general power outlets installed in the building and shall be of the industrial protected type, corrosion resistant, weather proof ***Rated equipment***

10. All switches and General power outlets shall be mounted at a height of 1400mm above the floor level and positioned adjacent to each entry of the building or room. Type and locations of light switches, GPO's, lights and similar electrical appliances shall be approved by the Superintendent prior to installation. ***Switches and Outlets***

    Supply and install all lighting as shown on the drawings including all luminaries, poles, supports, stays, plinths, rag bolts, underground conduits, cables and the like. All fittings mounted to ceilings shall be fixed to the ceiling using a minimum of 4 screws, one at each corner of the fitting. Timber supports shall be placed into the ceiling to accommodate the fixings. The use of spring toggles or fixing screwing directly into ceiling sheets shall not be acceptable.

C402.55 PRESSURE GAUGES

1. The Contractor shall install one (1) diaphragm protected, glycerine oil filled, direct mounting, bottom connection pressure gauge complying with AS 1349 per centrifugal pump installation. Cases shall be fabricated from stainless steel complying with AS 1449 or bronze. The protective diaphragm shall be suitable for dismantling for cleaning without affecting the accuracy of the gauge. ***Compliance***

2. The gauge face shall be 100mm in diameter and calibrated in metres head of water. The gauge shall accurately indicate the pump operating head and the pump no-flow head. ***Calibration***

3. Each gauge shall be supplied with the nominally sized metric equivalent of three of the following bronze fittings: gate valve, union, nipple and reducing nipple. ***Inclusions***

4. Gauges and fittings shall be screwed into the pipe wall of ductile iron pipes, or pipe fittings, 150mm and larger. In pipework less than 150mm, gauges and fittings shall be screwed into a tapping band. On rising mains, where shown on the Drawings, the Contractor shall install a ball valve to allow removal of the gauge. ***Installation***

5. The pressure gauge range for single or parallel pumps duty shall be 0 to 1.7 times the closed valve head of the pumps. ***Gauge Range***

C402.56 VALVES

1. The Contractor shall ensure that the valves supplied are compatible with the pipework such that proper sealing is provided between the pipe flanges and the valve. The concrete lining in pipework shall not be chipped away or reduced to provide clearance from the working parts of valves. ***Compatibility with Pipework***

2. The Contractor shall ensure that valves are installed so as to facilitate maintenance. The Contractor shall take into account the manufacturer's recommendations, the requirements shown on the Drawings, the type of connection, and lubrication of connecting bolts. ***Installation***

3. Flanges shall comply with AS 2129 to the class shown on the Drawings. ***Flanges***

4. Unless shown otherwise on the Drawings, all valves shall be clockwise closing. ***Clockwise Closing***

5. The Contractor shall size "Tee" Key valve operators and hand wheels to operate the valves under all operating conditions throughout their full range with no greater than 180 Newtons applied to the ends of the key bar or the rim of the wheel. ***Valve Key Operators and Hand wheels***

6. Hand wheels shall display an embossed or engraved arrow, together with "open" and/or "close" corresponding to the valve operation.

7. One "Tee" key operator per pump station, of suitable length for operating the respective valve from the surface level, shall be provided for each size of valve installed in each pump station. ***Provision of "Tee" Key***

8. Non return valves shall be of the swing check type to AS 3578 or AS 4794 of cast iron or steel body, cover and disc with bronze body and disc seat rings. The leaf shall swing clear and provide an unobstructed waterway. ***Non Return Valves***

9. The body cover shall be located and sized to allow the valve flap to be removed and the seat to be inspected without removing the valve. ***Arrangement***

10. Each non-return valve shall have an extended spindle, minimum grade 316 stainless steel, fitted with an adjustable counterweight, together with a proximity switch to indicate a no-flow condition. **Inclusions**

11. The no flow switches shall have the following features: ***No Flow Switches***

    (a) Be of the eccentric cam operated limit switch type.

    (b) Have a minimum rating of 10 amps, 240 V AC, 50- Hz.

    (c) Be oil tight and dust proof to IP 65.

    (d) Be suitable for 25mm conduit entry.

    (e) Be mounted on rigid stainless steel complying with AS 1444 adjustable brackets. The brackets shall be free of sharp edges and exposed corners.

12. The knife gate valve shall be constructed in accordance with the following: ***Knife Gate Valve***

    (a) The design shall include an enclosed bonnet.

    (b) The spindle shall be of the non-rising type.

    (c) Valves shall be clockwise closing.

    (d) The gland around the spindle shall be adjustable or formed by a double O-ring.

    (e) Flange jointing shall be rubber O-rings.

    (f) Seating shall be achieved by flexible seats which shall be designed in a manner that will allow easy replacement. The material of the seat is to be nominated.

13. All assembly bolts and nuts shall be fitted with fibre or nylon isolating washers to prevent bimetallic corrosion where required. ***Isolating Washers***

14. Each valve spindle shall be fitted with a cast steel or forged steel spindle guard secured to the valve spindle with a gun metal set screw or a handwheel secured to the spindle with gun metal set screw and washer. ***Spindle Guard***

15. Valves shall be drilled and threaded, where required, in accordance with AS 2129. ***Drilled and Threaded***

C402.57 TESTING AND COMMISSIONING OF PUMP STATION

1. The Contractor shall test and/or inspect all materials, equipment, installation and workmanship to prove compliance with the Specification requirements. The submission to the Superintendent of satisfactory test results constitutes a **HOLD POINT**. The approval of the Superintendent is required prior to the release of the hold point. ***Compliance***

    HP

2. Tests and inspections shall comply with relevant Australian Standards. ***Standards***

3. Testing shall include pre-commissioning, field testing and performance testing of each part of the whole installation. ***Testing***

4. Pre-commissioning is the preparation of plant or equipment so that it is in a safe and proper condition and ready for commissioning and operation. It includes all aspects of plant operation such as safety, electrical, mechanical and instrumentation. ***Pre-Commissioning***

5. The Contractor shall conduct pre-commissioning in a logical sequence in accordance with the program prepared by the Contractor and approved by the Superintendent. ***Sequence***

6. The Contractor shall prepare pre-commissioning record sheets for each item of equipment to ensure results of tests are satisfactorily recorded and that all necessary checks or tests have been performed. ***Record Sheets***

7. Specific requirements for pre-commissioning shall include, but are not limited to: ***Requirements***

   (a) Initial charges of lubricant in addition to any special lubricant requirements for initial flushing or treatment of the system or for "running in".

   (b) Physical checks and tests such as completeness of assembly, rotational tests (including checking that the rotation of electrical motors is in the correct direction), alignment checks, balancing and vibration checks, temperature, pressure and flow measurements, clearances, belt alignment and tension, etc, depending on the type of equipment.

   (c) Electrical and instrument installation tests, including motor insulation tests and checking instruments against certified instruments and correcting as necessary.

   (d) Tests of the correct functioning of automatic and manual control and protection equipment, including simulating danger conditions, mal-operations or failures, to check that all instruments and controls function correctly. These tests shall also include adjusting instrument set points and alarm settings and proving correct operation of alarms.

   (e) Equipment and system operating tests. The Contractor shall certify compliance of each item and submit a signed copy to the Superintendent prior to commissioning.

8. The Contractor shall carry out pre-commissioning tests to the satisfaction of the Superintendent and shall record the results of the tests on the appropriate Pre-commissioning Record Sheet. ***Recording***

9. The Contractor shall furnish the Superintendent with one signed copy of each completed Pre-commissioning Record Sheet countersigned by the Superintendent's Representative who witnessed the test. ***Submission***

10. Commissioning is the running of the plant and equipment to ensure flow through the pumping system, carrying out any necessary testing and adjustments until it is ready and suitable for normal starting and running under service conditions. ***Commissioning***

11. The Contractor shall give the Superintendent five (5) working days notice of the Contractor's intention to undertake commissioning and supply to the Superintendent the copies of each of the pre-commissioning record sheets and three copies of the operational and maintenance manuals at the time that notice of commissioning is given. This action constitutes a **WITNESS POINT**. The Superintendent shall advise at the time of notification by the Contractor whether the option to attend the commissioning is to be exercised. ***Notification*** ***WP***

12. The Contractor shall conduct commissioning in a logical sequence in accordance with a program prepared by the Contractor and approved by the Superintendent. ***Sequence***

13. Throughout commissioning the Contractor shall be responsible for the test program. ***Responsibility***

14. The Contractor shall provide continuous supervision by personnel experienced in the operation of the equipment and shall have qualified personnel in attendance to carry out all necessary adjustments and/or remedial work during the commissioning tests. ***Supervision***

15. The Contractor shall prepare, schedules, test record sheets and programs for approval by the Superintendent prior to each stage of the overall commissioning. ***Documentation***

16. The Contractor shall carry out final testing and commissioning (min 1 day duration) of the electrical services in conjunction with the mechanical equipment (e.g. pump, etc) including setting and adjustment of equipment shall be carried out in accordance with requirements of Ergon Energy

Final Testing

17. The Contractor shall arrange for all testing, commissioning and any adjustments to be carried out by qualified personnel.

Qualified Personnel

C402.58 PRACTICAL COMPLETION OF PUMP STATION

1. The Contractor shall fulfil the following requirements before the Certificate of Practical Completion is issued:

Certificate

   (a) Certificate of Approval from the relevant statutory authorities has been received By the Superintendent

   (b) Pump station is in working order as demonstrated by the testing and commissioning.

   (c) Operating and maintenance manuals have been approved by the Superintendent:

   (d) "As-constructed" drawings of the pump station have been submitted to the Superintendent as

      a. 1 set of A3 paper copies

      b. CAD drawings (compatible with AutoCAD 2006) with associated files ie Font, X-Ref, VBA, Plot, and other scripts used to produce the drawing. *(The use of E-transmit or similar "pack and go" processes will provide all associated files and scripts.)*

      c. PDF

MINIMUM DRAFTING REQUIREMENTS

1. All drawing shall be prepared in accordance with AS 1100-101 *(Technical drawing - General principles)* and associated standards.
2. Drawings shall be definitive and clearly set out so as to present the design concepts in such a way that the project can be understood, specified for construction and satisfactorily built.
3. All design drawings should be clearly numbered by the designer with separate sheets numbered as part of a set. All drawing sheets shall have an allocated space in the bottom right hand corner for Council registration (18 characters).
4. The information shown on the drawings shall be logically collected on discrete sheets to avoid illogical and onerous effort in cross referencing between sheets in order to find information.
5. Digital drawings are to be organized into separate layers for each asset type.
6. Drawings should not be overcrowded with information and should not rely on colour printing or colour wash to impart information. Drawings should be on A1, A2 or A3 size sheets and be suitable for black and white copying and photo reduction to A3 paper size without loss of clarity.

C402.59 TELEMETRY

1. Council currently operate a radio telemetry system, providing control and monitoring of its Water and Sewerage infrastructure system. This contract requires the Contractor to liaise with Councils telemetry service provider to supply of both equipment and software to allow the pump station/s to connect into the existing telemetry. Council have 57 sites connected to the Telemetry system, operating an Elpro Technologies Citect/ Scada-C software package on 3 computers. Service agreements with Elpro Technologies are in place for the provision of both hardware/equipment servicing and the management of software support.

Existing system

2. Installation, commissioning and testing of the works shall be carried by the engaging the services of Elpro Technologies as a subcontractor to this contract. The principle Contractor shall be responsible for the expenses of engaging the services of Elpro Technologies

Responsibility

3. Installation of the telemetry equipment will includeRadio Aerial, cable and mounts ***Equipment***

   - Radio module and I/O hardware devices
   - Power supply
   - Battery 7Ah 12Volts
   - Coaxial cable surge diverter
   - Software alterations to existing operational Citect/Scada-C database
   - Configuration of existing radio pre-processors
   - Configuration of new database onto existing operational computers
   - A standard wiring diagram will be supplied for the connection of field related I/O
   - Connection of Flowmeter outputs to Telemetry Module
   - Testing of Module/s
   - Interfacing relay for Pump Controller inhibit feature
   - Overflow ball float input
   - Other equipment as specified

4. Downstream overflow control shall be configured within the existing radio telemetry software. The control shall be operator selectable within the software to allow for the monitoring of down stream pump station well status. Should the wet-well condition at a downstream pumping station be at overflow level, then the upstream pump stations automatic control shall be inhibited and the pump station be shut down until the down steam station returns to high level. This method of control shall be configurated for each new pump station ***Control of downstream pump stations***

C402.58 OPERATION AND MAINTENANCE MANUALS

1. Manuals shall contain the following information:

   (a) Contractor's name, address and telephone number.

   (b) Client's Contract number, job name.

   (c) Pump station general arrangement drawing showing pumps, motors, valves, pipework, switchboard and electrical installation.

2. Manuals for pumps shall contain the following information: ***Pumps***

   (a) Manufacture.

   (b) Type and model number.

   (c) Serial number.

   (d) Dimensioned general arrangement drawing of pump and motor.

   (e) Sectional arrangement drawing with parts and list.

   (f) Dimensioned sectional arrangements detailing:

      (i) Maximum and minimum shaft/bearing clearance (radial)

      (ii) Maximum and minimum impeller/bowl clearance (radial)

      (iii) Maximum and minimum impeller/bowl clearance (axial)

      (iv) Impeller/bowl wear rings.

      (v) Motor/pump coupling – type, make and model number.

      (vi) Mechanical seals where applicable.

3. Manual for motors shall contain the following information: ***Motors***

   (a) Manufacture.

   (b) Type and model number.

   (c) Serial number.

   (d) Dimensioned general arrangement drawing.

   (e) Sectional arrangement drawing for submersible motor power cabling

where applicable.

(f) Gland sealing arrangement drawing for submersible motor power cabling where applicable.

(g) Cables where applicable.

(h) Terminal block arrangement drawing where applicable.

4. Manuals for valves shall contain a dimensioned sectional arrangement drawing with parts and material list for all valves. ***Valves***

5. Manuals shall contain the following test curves: ***Test Curves***

(a) Pump witnessed test curves.

(b) Motor test curves.

(c) Motor torque/speed/efficiency characteristic curves.

6. The operating and maintenance manual shall include: ***Operation and Maintenance***

(a) Safe working procedures: For switching and isolating the supply and distribution system;

(b) Comprehensive description of operation, including flow charts detailing each operational activity (e.g. manual pump operation, routine test procedures);

(c) Maintenance procedures: Recommended maintenance periods and procedures;

(d) Tools: Particulars of maintenance equipment and tools provided, with instructions for their use.

(e) Equipment: A technical description of the equipment supplied, with diagrams and illustrations where appropriate;

(f) Dismantling: Where necessary, procedures for dismantling and reassembling equipment;

(g) Spare parts: A list of the spare parts provided.

7. Trouble shooting instructions shall be included for pumps, motors, valves and SCA. ***Trouble Shooting***

8. Step by step procedures for dismantling and reassembly of pumps, motors and valves using any special tools shall be detailed together with step by step procedures for replacement of wearing parts such as bearing, seals, wear rings, etc. ***Replacement Procedures***

CONSTRUCTION COMPLIANCE

C402.61 WORK-AS-EXECUTED DETAILS

1. The Contractor shall submit to the Superintendent work-as-executed Drawings showing the actual location and alignment of pipelines, maintenance holes and junctions, all pump station details together with operating and maintenance manuals. (WSAA 02 Part 43, section 26). ***Main Requirements***

2. Details shall include the size, type, levels, grade of pipelines, maintenance hole, and maintenance shaft location, types and cover details, easement requirements for maintenance, pump details, switchboard equipment details and station structural details. ***Additional Detailed Requirements***

3. The Contractor shall record on work-as-executed Drawings the area of side fill which should not be disturbed in future without special precautionary measures where side fill construction is part of the structural integrity of a constructed ***Special Precautions***

pipeline of a diameter more than 225 mm.

4. The Contractor shall ensure that a Registered Surveyor certifies the plans showing location and alignment. ***Survey***

5. The Contractor shall provide records, for the Sewer Authority's Asset Register, to the Superintendent at the time of practical completion of the Contract. The records are to be in a form consistent for inputting into the Asset Register as directed by the Superintendent. ***Asset Register***

C402.62 VIDEO RECORDS

1. Unless advised otherwise by the Superintendent, the Contractor shall provide a video recording of the internal condition of all mains. The video recording shall be undertaken at the time of practical completion of the Contract. (WSAA 02 Part 43, section 22.7). ***Internal Condition***

SPECIAL REQUIREMENTS

C402.63 WET WELL WASHER

1. The pump station wet-well/s shall be fitted with automatic wet-well washing. A low voltage solenoid valve shall be fitted to the water supply line to allow the control of water into the device. The solenoid valve shall be wired into the pump-controller circuity. ***Main Requirements***

2. Provide all necessary mounts, pipes, hoses, fitting, valves, backflow and control devices for the installation of the washer/s. ***Installation***

3. Mounting height of the well-washer shall be approved by with the Superintendent. ***Mounting height***

C402.64 ELECTRO-MAGNETIC FLOW METERING - OUTFLOW

1. Supply and install Tyco Emflux M300 or equivalent, electromagnetic flow meter sized to suit design flow rates in the mains or as specified ***Type***

2**.** The signal converter units and associated equipment shall be mounted in the SCA. The display for the units shall be mounted into the equipment door of SCA; ***Signal Converter***

3. Earthing- The flow meter shall be properly earthed in accordance with Manufactures recommended method; ***Earthing***

4. Power supply to the converter shall be 240 volts; ***Power Supply***

5. Wiring installation shall ensure that all flow meter cable is adequately segregated from motor cables. The route of all underground cabling shall be approved by the Superintendent prior to commencement of trenching; ***Wiring***

7. The flow meter digital display unit will interface to the telemetry module providing signal wiring for total flow and flow rates ***Display and interface to Telemetry***

C402.65 GENERATOR

1. The Contractor shall include within the scope of supply ; ***Scope of Works***

   An automatic start generator set, including all integral equipment (generator enclosure, electronic governing systems, voltage regulators, batteries, battery chargers instrumentation) required for the operation in its intended service,

   - • labour, materials and instruments required for the setting to work and commissioning of the generator set,

- • spare parts and tools (refer Section 7);
- • operation and maintenance manuals (refer Section 8).

The emergency generator unit shall be supplied completely assembled, with the other ancillary equipment supplied separately. Installation and commissioning of the emergency generator and ancillary equipment shall be part of supply.

The stand-by diesel control and switchgear shall be installed such that upon failure of the Supply Authority supply the pump station switchboard main contactor will open after a preset time, the engine will then start and run up to speed. When rated voltage is achieved and an engine warm up period has elapsed, the generator contactor will close, energising the load. After the Supply Authority supply has been restored for a preset time the generator contactor opens automatically and on delay the main contactor closes. The set will continue to run for a preset time on no load to facilitate cooling down.

The workmanship, equipment, accessories and materials provided in accordance with this specification shall comply in design, construction, installation and performance with the latest relevant Australian Standards or in their absence the latest relevant British Standards. The Contractor shall ensure all equipment and materials supplied are in accordance with requirements of all relevant authorities and that all required approvals are obtained.

TECHNICAL REQUIREMENTS

2. ***Engine***

(a) Engine Cooling

The engine cooling system shall be sized to allow continuous operation with ambient temperatures of 45ºC in the shade.

(b) Engine Speed Control

The engine shall be fitted with an electronic speed governor so that alternator frequency does not drop more than 3% on application of load.

(c) Engine Over Speed

The generator set shall be so constructed such that in an emergency it can withstand an over speed of 25% without mechanical damage. Governing of the generator speed shall be controlled electronically.

3. ***Alterator***

(a) Alternator Rating

The output power from the alternator shall be sufficient to supply the load specified in the Technical Data Sheets at a power factor of 0.8 for standby service in accordance with ISO3046.1.

(b) Alternator Tolerance

Tolerance to alternator parameters shall be in accordance with AS1359, Table 69.1.

(c) Alternator Voltage Variations

The alternator shall be capable of supplying its rated output at rated speed and power factor at any voltage in the range 95% to 105% of its rated voltage continuously, in accordance with AS1359, Clause 31.5.

(d) Alternator Short Circuit

The alternator shall be capable of withstanding without damage a 30-second, 3 phase, short circuit at its terminals when operating at rated kVA and power factor, at 105% rated voltage with fixed excitation.

(e) Alternator Overload Current

The alternator shall be capable of supplying an overload current of 50% of rated current for one minute with the field set at rated excitation, and shall be capable of supplying an overload current of 10% for periods of one hour in any twelve hour

period.

(f) Alternator Excitation

The rated exciter capacity shall be equal to that required to supply the field excitation when the alternator is operating at 110% of rated kVA at rated power factor and voltage.

(g) Alternator Voltage

The alternator shall be equipped with a Class A1 (1 % tolerance) automatic voltage regulator suitable for auto/manual operation.

Alternator reactance and voltage regulator performance shall be in accordance with AS1359.101. On application of loads under stand-by power the initial voltage drop shall not exceed 15% of rated voltage. Voltage regulation grade shall be VR 1 or better.

The generator shall be capable of carrying a continuous unbalanced load of 15% without damage provided the rated current is not exceeded in any phase.

General

(a) Vibration

The generator and excitor shall be statically and dynamically balanced such that when operating, the vibration of the generator set shall not exceed the limits of vibration amplitude given in AS1359.114.

(b) Noise

The engine and generator unit shall be housed within a weatherproof, acoustic enclosure designed such that the maximum noise level shall be the lesser of;

- 60dBA maximum at a distance of 6 metres from the unit or
- 42dBA maximum at the nearest window of the nearest residence.

DESIGN REQUIREMENTS

Operation

5. Generator set including diesel engine running at 1500 RPM direct coupled to a 4 pole brushless alternator. Switchgear and controls to enable automatic start up of the generator and bringing on line the stand-by power supply in the event of Supply Authority supply failure. This will include:

- generator isolating switch,
- mechanically and electrically interlocked changeover contactors and
- changeover controls.

The generator shall be rated for stand-by use in accordance with ISO 3046/1 and shall be rate for the load as described.

The diesel generator set and all other equipment supplied with this contract shall be designed in such a way that it can be operated and serviced with safety to personnel.

Emergency pushbuttons on the generator control panel and the pump station switchboard shall be provided to disable generator operation and open both the generator supply and mains contactor

Equipment

6. (a)Alternator

The alternator shall be of brush less, self-ventilating, revolving field type suitable for coupling to the diesel engine specified within this document.

(b)Insulation

Winding insulation temperature rating shall not be less than Class F to AS2768. Temperature rise shall be in accordance with AS1359.101, for the insulation class used.

All insulation, bushings and terminal supports shall be made of non-hygroscopic, anti tracking, flame retardant materials.

(c)Cooling

The method of cooling shall be IC01 to AS1359.106. Subject to Burnett Shire Council approval, other categories of cooling may be accepted.

(d)Terminal Boxes

The generator shall have both ends of each winding brought out to line and neutral terminal boxes. Terminal boxes shall be suitable for air terminations of cables and shall be fitted with removable non-ferrous gland plates.

- Voltage Waveform Deviation
- Generator voltage waveform deviation and telephone harmonic factor shall be in accordance with AS1359.101.

(e)Excitation

The generator shall be provided with an air-cooled brushless exciter direct coupled to the generator shaft, excitation voltage being selected by the manufacturer. The stator winding of the exciter shall be brought onto a terminal box mounted on the side of the exciter.

The exciter enclosure shall be of a degree of protection equal to that of the generator.

The exciter insulation class shall be to AS2768, Class B as a minimum.

(f)Anti-Condensation Heaters

The generator shall be provided with a 240V anti-condensation heater. Wiring for the heater shall be brought out in a terminal box separate from the main terminal box. The terminal box shall be fitted with removable gland plate.

Each cubicle shall be provided with anti-condensation heaters located at the base of the cubicle.

Heaters shall be thermostatically controlled, and shall be shrouded.

(g)Alternator IP Rating

The alternator casing shall be dust, moisture and vermin proof. Housings shall provide minimum degree of protection IP23 to AS1939. Required protection, if different, shall be detailed in the

Technical Data Sheets.

(h)Automatic Transfer Switch

The automatic transfer switch shall be a suitably sized, mechanical and electrical interlocked Sprecher and Schuh contactor set.

A Deep Sea Model 509 electronic manager shall preferably control the generator management and supply change over. The contractor shall provide an alternate cost and the Deep Sea option if an equivalent device of similar functionality is available.

Transfer configurations shall comply with AS 3010.1

Switchboard indications shall display mains and generator supply on load.

(I)Current Transformers

Current transformers shall be fully encapsulated and shall comply with AS 1675.

(j)Overload Protection

Generators shall be provided with bi-metal thermal overload units or programmable type protection relays.

Thermal overload relays shall be triple pole, bi-metallic, ambient compensated type with single phasing protection complying with AS3947.4.1. All relays shall include an adjustable, calibrated current setting. The relays shall be fitted with one normally closed contact and be supplied with a door mounted reset pushbutton.

(k)Control Devices

The generator control panel, degree of protection IP51 to AS1939, shall be located in a lockable steel cabinet, mounted on the generator or the generator enclosure wall, and shall include the following equipment as a minimum;

- 3 phase voltage indication,
- generator current indication for each phase,
- engine/generator system diagnostics including;
    - coolant temperature,

  - engine speed,
  - engine oil pressure and
  - DC system volts,
- generator kW indication,
- generator frequency indication,
- hours run indication,
- automatic/manual stop start controls,
- engine start and stop buttons,
- automatic shutdown for engine/generator faults,
- engine available to start indication and
- emergency generator stop button.

All control devices including indicating lamps, push buttons and selector switches shall comply with AS 3947.5.1 and the following requirements;

- all control devices shall be oil-tight and dust tight.
- all indicating lamps shall have a minimum rated life of 3,000 hours at the rated voltage.
- all indicating lamps shall include a press-to-test function.

Volt free contacts shall be supplied for remote indication purposes, to indicate;

- generator set available (also to incorporated emergency push button and generator isolator operation),
- generator set running,
- generator set fault,
- generator batteries low and
- fuel level low - to operate 1 hour prior to fuel level low engine shutdown.

The existing Mains Power Failure alarm to the telemetry system must signal Supply Authority supply loss whilst the generator is supplying stand-by power.

Cabling for remote telemetry purposes shall be run from generator set to the existing telemetry cubicle inside the building/control cubicle. Terminal allocations shall be supplied by Burnett Shire Council.

Hour run meters shall be similar in appearance to the ammeters/voltmeters used and shall register

operating hours with five (5) digit cyclometer dial, the lowest digit showing 1/10 hours.

The engine shall automatically shut-down in the case of;

- engine oil pressure low,
- engine fuel level low,
- engine coolant temperature high or
- engine over speed

Protection for the generator shall include but not be limited to the following;

- alternator over current,
- alternator over/under voltage,
- alternator earth fault or
- alternator over temperature.

(I)Internal Wiring

The switchgear and control assemblies shall be completely factory wired, in accordance with AS3439.1, AS 3000 and the following requirements;

- All wiring shall be carried out in flexible copper cables, 0.6/1 kV, V 75 grade PVC and terminated with insulated compression type lugs or connectors.
- The minimum size of flexible cable shall be as follows: -
    - Control wiring $1.5mm^2$ (30/0.25mm)
    - Protection $2.5mm^2$ (50/0.25mm)
    - Metering $2.5mm^2$ (50/0.25mm)
- Cable colour shall comply with the following requirements;
    - Phases Red, White, Blue
    - Neutral Black
    - AC Control Active Grey
    - AC Control Neutral Black

- o ELV Active Violet
- o ELV Neutral Violet
- o DC Control Positive Pink
- o DC Control Negative Brown
- o Earth Green with Yellow trace

All wiring shall be identified at each end by fully interlocking Z-type numbered ferrules. All such identification shall be in accordance with Schematic and Connection Drawings as approved by the Purchaser.

(m)Earthing Provisions

Earthing requirements shall conform in all respects with the requirements of the S.A.A. Wiring rules AS 3000, AS 3010 and Electrical Supply Authority of Victoria Wiring Regulations.

Where mounted on a hinged metallic door, equipment shall be earthed with a flexible conductor connected to the earth bar or stud, in which case the door shall also be earthed by the same conductor.

(n)Rating Plates

The generator shall be fitted with permanently affixed rating plate containing all the information specified in AS 1359.

DRIVE

(o)Engine

The engine shall be installed complete with exhaust system including muffler and in the case of non-turbocharged engines, a spark arrester conforming to AS1019. A dry type air cleaner (cyclopac or equivalent) with restriction indicator shall be fitted.

(p)Cooling System

The engine cooling system shall include a closed cycle water filled radiator with electric fan to provide air flow around the radiator core.

(q)Fuel Supply

The generator set shall incorporate a fabricated steel fuel tank of sufficient capacity for at least eight (8) hours continuous operation at 75% load. The fuel tank shall be fitted with a sight gauge

or calibrated dipstick.

The fuel system shall incorporate primary and secondary filters plus a water and sedimentation trap.

The fuel tank shall be supplied full of fuel and topped up after commissioning is complete.

A low level fuel switch shall be installed to shut the engine down when less than ½ an hour fuel supply remains.

(r)Starting System

The generator set shall include a 24V DC starter motor and sufficient battery capacity for at least ten (10) cranking cycles. The cranking cycle shall consist of ten (10) seconds cranking then ten (10) seconds rest and shall preferably be adjustable.

(s)Batteries

The batteries shall be of the sealed maintenance free lead-acid type and suitable for continuous trickle charging by a constant voltage charger.

The generator supply batteries shall be Exide N70EX, 620A cc, 150A rc, 80 A/hr or equivalent.

(t)Battery Charger

Battery charger shall be floating charge type located on the frame of the generator set. The battery charger shall be a YK1212 9 (12v 12A) or YK0824 (24V 8A) as supplied by McFarlane Generators or equivalent.

7. Generators installed in outdoor locations shall be fitted into an enclosure constructed of marine grade aluminium or stainless steel, grade 316 sheeting not less than 3-mm thickness and be securely mounted to the concrete slab and removable to allow major overhaul of the unit. ***Ancillary Equipment***

The enclosure shall be fitted with sufficient access doors to enable easy access for regular maintenance purposes.

Doors shall be fitted with latches to hold them in the fully open position whilst work is being carried out.

Door locks shall be heavy duty prestige pad bolt type clasps fitted with padlocks keyed in accordance with Burnett Shire Council requirements.

Cubicles shall be painted Rain forest Green AS2700 to colour G15 with white inside

compartments and panel doors.

8. The generator set shall be mounted on a fabricated galvanised steel base with a lifting eye at each corner. The steel base shall be fixed to the concrete foundations with approved vibration damping supports. ***Generator Base***

9. Holding down bolts shall be supplied and shall be designed to withstand the full shear force, over turning moment and resulting fatigue associated with the equipment supplied. ***Hold Downs***

10. All enclosures and equipment shall be identified with white tri-laminated phenolic nameplates and labels engraved with black lettering and complying with the following; ***Labels***

- lettering shall be of a minimum size of 5mm,
- labels shall be detachable and interchangeable,
- fixing holes shall be slotted to allow for expansion and contraction,
- minor labels within compartments may only be affixed by adhesive, to the approval of the Purchaser and
- push buttons and pilot lights shall be supplied with standard metal engraved labels.

11. Where a specific material for a component has not been stated in this document, materials for manufacture shall be as listed in the Data Sheet. ***Manufacturing***

Castings shall be close and uniform in grain, homogeneous and free from blowholes, porosity, shrinkage, cracks and other injurious defects. Filling of holes with any substance shall not be permitted. Castings shall be properly cleaned and fettled and all lumps and rough areas smoothed.

Stainless steel plate and bar subjected to welding during the manufacture of any component shall be a low carbon, and stabilized grade such as AS1449, grades 316L.

Stainless steel casings shall be a stabilized grade in accordance with AS2074, grade H6C.

Stainless steel in shafts, spindles or similar shall comply with AS1449, grade 420.

Graphite greases, graphite packing and graphite compounds shall not be used in contact with stainless steel.

Mild steel shall conform to AS3679.1, grade 250.

Machining shall be concentric, square to line and true. All sharp edges and burrs shall be removed.

Bolt holes shall be drilled and spot faced for bolt head and nut. Mating parts shall be match marked.

All components and the assembled rotating element shall be interchangeable for pumps of the same type, designation and size.

Bosses shall be provided for all tapping's. The use of setscrews in castings shall be avoided.

Dowels shall be provided between components requiring accurate locating in position.

12. (a)TYPE TESTS

Inspections and Tests

The Contractor shall provide 'Type Test Certificates' for type and size of generator supplied.

Where 'Type Test Certificates' are not available the Contractor shall perform and document type tests at the Contractors works on the first generator of each design. Type tests shall include the following minimum requirements;

- measurement of cold resistance of windings,
- measurement of no-load losses,
- temperature rise test,
- measurement of efficiency,
- momentary overload test,
- high voltage test,
- insulation resistance test,
- vibration test and
- noise level test.

(b)WORKSHOP PERFORMANCE TESTS

The generator to be supplied shall be submitted to routine tests at the Contractors works prior to delivery to Burnett Shire Council. Routine tests shall include the following as minimum;

- measurement of cold resistance of generator windings,
- measurement of generator no-load losses,
- measurement of generator controls/switchgear insulation resistance,
- generator high voltage test,
- generator Vibration test,
- testing of all control and interlock circuits to ensure satisfactory operation,
- check of wiring and terminations and
- load test at rated output for 1 hour.

All tests performed on the generator may be witnessed by a Burnett Shire Council representative and shall be in accordance with AS 1359.60. The Contractor shall give a minimum of three (3) working days notice of commencement of tests.

(c)SITE COMMISSIONING & PERFORMANCE TESTS

The generator set and associated equipment is to be commissioned on site within a time to be nominated by the contractor at the time of tendering.

All tests performed on the generator may be witnessed by a Burnett Shire Council representative and shall be in accordance with AS 1359.60. The Contractor shall give a minimum of three (3) working days notice of commencement of tests.

The generator set and changeover controls commissioning tests shall include;

- testing of all control and interlock circuits for correct operation,
- insulation resistance tests,
- check of wiring and terminations,
- load tests including a minimum of five (5) pump starts and
- noise level test.

Unless stated otherwise in the Technical Data Sheet, the Contractor shall provide all test instruments, excepting flow meters. All instruments shall be calibrated by a NATA certified testing authority within three (3) months prior to the tests.

(d)ANALYSIS & PRESENTATION OF TEST RESULTS

Comparisons between test results and guaranteed performance will be made in accordance

with AS1359.101.

(e)REJECTION OF GENERATOR SET

Burnett Shire Council may reject the generator set should the performance during performance tests;

- fall outside the specified guarantee limits,
- fail to meet the guarantees for noise,
- fail to meet the guarantees for vibration or
- indicate poor mechanical or electrical design or manufacture.

Burnett Shire Council may reject the motor should the Contractor not satisfy Burnett Shire Council during workshop or commissioning tests, that the motor meets the specified service requirements.

13. Any defects developed within a period of twelve (12) months from the date of commissioning, other than fair wear and tear, shall be rectified by the Contractor on receipt of notice from the Burnett Shire Council, and at no cost to Burnett Shire Council.

WARRANTY PERIOD

14. All items shall be individually labelled prior to packing. Labels shall include the following information;

Packing, Transport and Delivery

- Property of Burnett Shire Council
- Contact Number
- Item / Part Number

Where items are manufactured for specific mating component parts, they shall all bear individual identification numbers and reference to the mating part identification numbers.

All items shall be individually packaged for long-term storage in a tropical environment, with external labelling duplicating the information specified in Section 6.1.

Crating of items for transportation shall be designed and constructed to withstand the loads imposed during transportation. Goods received in damaged packaging or crating may be returned to the Contractor for re-manufacture and/or re-inspection and testing.

Crates shall be clearly marked in black-stencilled lettering with the following information;

- Consignee's name and delivery address as given in the Contract,
- Consignor's name and contact point and contact number.

Spare Parts and Tools

15. The Contractor shall supply and deliver one (1) complete set of any special tools required for the dismantling, service and re-assembly of the motor.

Documentation

16. The Contractor shall prepare and supply, minimum two sets, drawings, installation, operation and maintenance documentation. *All documents will also be provided electrically as per councils document standard on CD.*

The manuals and technical data sheets shall fully describe all specified equipment and clearly show its mode of operation and, as a minimum, contain the following information;

- a concise description of each motor type and ancillary equipment, together with a complete performance specification,
- a concise description of the mode of operation of each part or sub-system,
- procedures for installation and commissioning of each part or sub-system,
- procedures to be followed for testing, maintenance and fault finding. The fault finding table shall list fault indication, possible causes and remedies.
- special precautions to be taken in replacement and/or adjustment of each item,
- a comprehensive routine maintenance and testing program based on that recommended by the manufacturer,
- a spare parts list for all items plus component assembly drawings of the motor and ancillary equipment,
- a list of supplier's names and addresses to enable any parts to be ordered correctly and
- any other information or instructions necessary to fully operate and maintain the equipment in a complete and satisfactory manner.

MEASUREMENT AND PAYMENT

C402.66 PAY ITEMS

1. Payment shall be made for all the activities associated with completing the work detailed in this Specification in accordance with Pay Items C402(a) to C402(k) inclusive.

2. If any item, for which a quantity of work is listed in the Schedule of Rates, has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

3. Concrete for bedding, junctions for risers, bulkheads, thrust and anchor blocks, concrete encasement, cast-in-situ maintenance holes and pump stations is measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS.

4. Miscellaneous minor concrete work not included in the pay items in this Specification shall be in accordance with pay items described in the specification for MINOR CONCRETE WORKS.

Pay Item C402(a) EXCAVATION AND BACKFILL FOR SEWERS

1. The unit of measurement shall be cubic metre.

2. The schedule rate for this Pay Item shall be an average rate to cover all types of material encountered during excavation. Separate rates shall not be included for earth and rock.

3. The rate is deemed to include:

- Setting out and associated survey.
- Excavation, including excavation and replacement of unsuitable material.
- Backfilling and compaction, other than selected backfill, of sewers.
- Restoration of surface.
- Replacement for over-excavation for any reason.
- Control of stormwater runoff, temporary drainage and erosion and sedimentation control.

4. The volumes of excavation for payment shall be computed as follows:

Trench Width: Minimum width in Table C402.1 + 200mm.

Trench Depth: Average actual depth to underside of specified bedding.

Trench Length: Actual excavation length, centre to centre of maintenance holes or centre of maintenance holes to face of structure.

Pay Item C402(b) SEWER PIPE

1. The unit of measurement shall be the linear metre measured along the centreline of each particular type of sewer pipe and shall be the plan length between centres of maintenance hole or centre of maintenance hole to face of structure.

2. The schedule rate shall include:

- Supply of pipe and fittings
- Wrapping pipeline or other protective measures
- Survey and setting out
- Bedding (including concrete bedding)
- Junctions and property connection sewers
- Bulkheads
- Thrust and anchor blocks
- Jointing (including connections)
- Temporary bracing and strutting of excavation
- Selected backfilling
- Quality compliance

Pay Item C402(c) MAINTENANCE HOLES AND MAINTENANCE SHAFTS

1. The unit of measurement shall be per "each" installed.

2. The schedule of rate for preformed maintenance holes shall include for the supply, setting out, excavation, installation including step irons and benching, backfilling and disposal of spoil off site. It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.

3. The schedule of rate for preformed maintenance shafts shall include for the supply, setting out, excavation, installation including benching, backfilling and disposal of spoil off site. It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control

4. The schedule rate for cast in situ maintenance holes and maintenance shafts shall include for the setting out, excavation, formwork, supply and placing concrete, supply and fixing step irons, placing benching, backfilling, disposal of spoil off site and making live connections where necessary. It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.

5. A separate unit rate shall be included in the Schedule of Rates for each type and size of maintenance hole and maintenance shaft.

Pay Item C402(d) COVERS AND SURROUNDS

1. The unit of measurement shall be per "each" installed.

2. The schedule rate for covers and surrounds shall include for the supply, installation and grouting.

3. A separate unit rate shall be included in the Schedule of Rates for each size and type of surround and cover.

Pay Item C402(e) CONNECTION TO EXISTING

1. The unit of measurement shall be per "each" connection to existing maintenance hole or structure.

2. The schedule rate for connection to existing shall include for all the necessary works to blank off, sand fill, cut into or otherwise modify and finish the system as shown on the Drawings.

Pay Item C402(f) TRENCH TIMBERING LEFT IN PLACE

1. The unit of measurement shall be a lump sum for timber directed to be left in place by the Superintendent.

2. No extra payment shall be made where the Contractor uses more timber than anticipated or the timber used exceeds the size of timber required as determined by the Superintendent.

Pay Item C402(g) CONCRETE ENCASEMENT

1. The unit of measurement shall be the linear metre measured along the centreline of each particular type of concrete encasement.

2. The schedule rate shall include for additional excavation, formwork, reinforcement, concrete and contraction joints.

Pay Item C402(h) PUMP STATION

1. The item shall be a Lump Sum for each Pump Station.

2. The Lump Sum for in situ pump stations shall include for the setting out, excavation, preparation of foundation, formwork, reinforcement, concreting, curing concrete, backfilling, disposal of spoil off site, supply and installation of pipework, valves, fittings, access cover, ladder and cleaning up. It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.

3. The lump sum for preformed pump stations shall include for the, setting out, excavation, preparation of foundation, any formwork, reinforcement, concreting, and curing concrete, supply and installation of preformed sections, pipework, valves, fittings, access cover, ladder, backfilling and disposal of spoil off site and cleaning up. It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.

4. The lump sum for packaged pump stations shall include for the setting out, excavation, preparation of foundation, any formwork, reinforcement, concreting, and curing concrete, supply and installation of package pump station including pumps, suction and discharge pipework, valves, fittings, control panel and cabinet, power and control wiring and testing, backfilling and disposal of spoil off site and cleaning up. It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.

Pay Item C402(i) SEWER PUMPS

1. The item shall be a Lump Sum for each Sewer Pump, not including pumps supplied with package pump stations as costed in Pay Item C402.(h).

2. The Lump Sum shall include for the supply and installation of the system as specified and as detailed on the Drawings including suction and discharge pipework, valves, fittings, control panel and cabinet, power and control wiring and testing.

Pay Item C402(j) COMMISSIONING

1. The item shall be a Lump Sum.

2. The Lump Sum for Commissioning shall include for all labour, test equipment and consumables to undertake and record the full commissioning procedure for all equipment and systems, and to carry out all necessary modifications and adjustments to the system so that it operates in accordance with the Specification requirements.

Pay Item C402(k) MANUALS

1. The item shall be a Lump Sum.

2. The Lump Sum for Manuals shall include for the preparation and printing of the operating and maintenance manuals in accordance with the Specification. "Work-as-executed" drawings shall be included

QUEENSLAND

DEVELOPMENT CONSTRUCTION SPECIFICATION

C501

BUSHFIRE PROTECTION (Perimeter Tracks)

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
EXAMPLE 1	*Provision for acceptance of non conformance with deduction in Payment*	*XYZ.00*	*AP*	*KP*	*2/6/97*
1	Adopted by Burnett Shire Council		M	RT	10/05/2006

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CLAUSE **PAGE**

SPECIFICATION C501
BUSHFIRE PROTECTION (Perimeter Tracks)

GENERAL

C501.01 SCOPE

1. The work to be constructed under this Specification consists of perimeter tracks for fire protection. These tracks shall be constructed in accordance with the guidelines contained in the IEAQ's publication "Soil Erosion and Sediment Control - Engineering Guidelines for Queensland Construction Sites".

2. Perimeter tracks with the subdivision shall be connected by suitable intersections with existing access tracks. ***Access Tracks***

3. The track surface shall be constructed with outfall drainage and trafficable cross banks, so as to reduce erosion damage and maintenance needs. Establishing and maintaining vegetation on the tracks can further reduce erosion and may be deemed necessary in some areas. ***Construction***

4. This Specification states the requirements for constructing and maintaining tracks to minimise soil erosion. ***Principles***

C501.02 OBJECTIVE

1. The aim of this Specification is to prescribe requirements in order that bushfire protection provided by perimeter tracks is effective and is undertaken in a manner to minimise disturbance of the natural surroundings and the need for future maintenance.

C501.03 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

C220	-	Stormwater Drainage - General
C221	-	Pipe Drainage
C223	-	Drainage Structures
C273	-	Landscaping

(b) QLD State Legislation

- Water Resources Act, 1989.
- Riverine Environment Protection Regulations, 1993.

(c) Other

Institution of Engineers Australia, Queensland Division (IEAQ)
- Soil Erosion and Sediment Control - Engineering Guidelines for Queensland Construction Sites, 1996.

C501.04 DEFINITIONS

Batter

The face of an embankment or cutting, produced as a result of earthmoving operations involving cutting and filling.

Cross Bank

A hump of earth constructed across a track so that runoff is effectively diverted from it.

Cross banks are designed to handle larger flows than cross drains.

Cross Drains

Drains of various forms that baulk the flow of water down a track and divert it across the track's surface. The capacity of the drain is defined by its cross-section.

Cross drains are designed to handle smaller flows than cross banks but larger flows than can be controlled by crossfall drainage.

Crossfall Drainage

Drainage which occurs when the surface of a track has sufficient cross slope to cause water to flow across and off the surface, rather than along it. Where the water flows into the hillside, it is termed 'infall'. Where flow is away from the hillside, it is termed 'outfall'.

Culvert

A pipe or similar structure used to direct water under the track.

CONSTRUCTION

C501.05 CROSS BANKS

1. Outlet points for cross banks, shall not be blocked by a stump or rock. Outlets shall be sited so that runoff will spill into undisturbed vegetation and cannot flow back onto the track. ***Cross Bank Outer Point***

2. The roadline shall be ripped to a depth of 200 to 300mm for a distance of one or two tractor lengths back from the chosen outlet point. The loose earth shall be pushed down the roadline into a bank, commencing at the uphill side of the road and working across the outlet side. A long, shallow excavation for the cross bank shall be provided (typically 6 metres). ***Construction***

3. Sufficient loose earth shall be used to give the required dimensions after shaping and compaction. Depending on the size of the machine being used, up to eight bladefulls of earth may be required. The crest width dimensions shall be long enough to ensure comfortable vehicle access over the cross bank. The channel depth dimensions shall prevent runoff from overtopping the bank. ***Shaping and Compaction***

4. The entire length of the bank shall be track or wheel rolled to obtain maximum compaction and a smooth, even bank with batters no steeper in relation to the track surface than 1:5.

C501.06 EARTHWORKS

1. When constructing tracks, the soil and vegetation shall be disturbed as little as possible both on and adjacent to the track. The track shall be constructed to follow the contour of the land as much as possible to reduce the amount of cut and fill. For safety reasons, the maximum crossfall used shall generally not exceed 1:10. ***Minimum Disturbance***

2. To minimise the area of disturbed soil exposed, batters to 1.5m shall be cut vertically. Vertically cut batters may suffer from initial slumping but will generally stabilise with follow-up maintenance. Cut batters higher than 1.5m may require special stabilisation measures including laying back, revegetation and drainage. ***Cut Batters***

3. Fill batters on all soil classes shall be no steeper than 2:1 and flatter where possible to encourage natural revegetation and to effectively accept seed and fertiliser. Batters higher than 1.5m on Class B, C and D soils may require special stabilisation works such as drop down drains, hay mulching, etc. ***Fill Batters***

4. Vegetation debris shall not be incorporated in fill batters. ***Debris***

5. "Borrow" areas shall not be located near drainage lines or streams because of the danger of sediment polluting the stream. When necessary, "borrow" areas shall be limited in size, worked in such a way to reduce the danger of sediment leaving the borrow pit and revegetated progressively as the pit is worked out. ***Borrow Areas***

6. Wherever practicable, topsoil and litter (free of timber debris) shall be stockpiled in a recoverable position for respreading over disturbed areas. This material contains valuable seed and nutrients which will greatly assist revegetation. ***Stockpile Topsoil***

7. Timber clearing shall be limited to 0.5m on either side of the track. Where extra clearing widths may be needed such as to allow the sun in to keep the trail dry, clear by felling rather than dozing to limit the amount of soil disturbance. ***Timber Clearing***

C501.07 DRAINAGE

1. Drainage lines and streams shall be crossed with fords, culverts or bridges. Log dam crossings shall not be used as they obstruct flood flows and can create turbulent flow and erosion. ***Crossings***

2. Fords are preferable to culverts or bridges as they cost less and often can be built with little disturbance to the stream bed and banks. Fords shall not be used where the stream has a deep cross-section requiring considerable excavation to provide approaches to the crossing. ***Fords***

3. Culverts shall not be used where debris blockages are likely.

4. Where culverts and headwalls are used, they shall be constructed where shown on the Drawings or as directed by the Superintendent in accordance with the Specifications for STORMWATER DRAINAGE - GENERAL, PIPE DRAINAGE and DRAINAGE STRUCTURES. Culverts shall be constructed as close as possible to the natural alignment of the drainage line to avoid diverting the flow into the stream banks of creating scour of the drainage line. ***Culverts***

5. Soil and vegetation disturbance shall be kept to a minimum. Disturbed areas shall be seeded in accordance with the Specification for LANDSCAPING to protect them from erosion. ***Disturbance***

6. Timber, scrub, soil or debris shall not be dumped in drainage lines, but stacked well above flood levels. ***No Dumping***

7. Where trees must be destroyed or injured in the bed or within 20m of the banks, of prescribed streams the requirements of the Water Resources Act - Riverine Environment Protection Regulations must be observed. ***Trees in Prescribed Streams***

C501.08 REVEGETATION

1. Revegetation shall be in accordance with requirements of the Specification for LANDSCAPING indicated on the development/subdivision plan. ***Amount of Revegetation***

2. Where revegetation is required, it must be applied immediately following the disturbance while the soil is still loose, irrespective of the growing seasons. ***Immediate Application***

3. A maintenance dressing of appropriate fertiliser and seed shall be applied.

SPECIAL REQUIREMENTS

C501.09 RESERVED

C501.10 RESERVED

MEASUREMENT AND PAYMENT

C501.11 PAY ITEMS

1. Payment shall be made for the activities associated with completing the work detailed in this Specification in accordance with Pay Item C501(a).

2. A lump sum for this item shall not be accepted.

3. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

4. Culverts and headwalls are measured and paid in accordance with the Specifications for STORMWATER DRAINAGE - GENERAL, PIPE DRAINAGE and DRAINAGE STRUCTURES as appropriate.

5. Seeding and revegetation is measured and paid in accordance with the Specification for LANDSCAPING.

Pay Item C501(a) PERIMETER TRACKS

1. The unit of measurement shall be the linear metre measured along the centreline of track as shown on the Drawings.

2. The Schedule rate shall comprise all activities required to construct the tracks including clearing, earthworks, batters, cross drains and banks.