

COONAMBLE

SHIRE COUNCIL

COONAMBLE DEVELOPMENT CONSTRUCTION SPECIFICATION



AUS-SPEC #1

DEVELOPMENT SPECIFICATION SERIES

CONSTRUCTION

RECOMMENDED FOR ISSUE

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Coonamble Development Construction Specifications

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COONAMBLE SHIRE COUNCIL

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
VERSION 3.1	Version 3.1 referenced	C101.06	A	KD	10/03/10
	Version 3.1 referenced	C101.12	A		
	Additional legislation added to text	C101.14	A		
	Version 3.1 referenced	C101.16	A		
	Work outside of the hours specified.	C101.17.	A		
	Utilities and Authorities - General	C101.19	A		
	Relations with Utility Authorities and other agencies	C101.20	A		
	Location and Protection of Services and Utilities	C101.21	A		
	Utility Adjustments	C101.22	A		
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	Electrical Service	C101.27	A		
	Telephone	C101.28	A		
	First Aid	C101.29	A		
	Chain Wire Fence at Site Facilities	C101.30	A		
	Special Requirements	C101.31	A		
	Special Requirements	C101.32	A		

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	Deductions for Nonconforming Work	C101.33	A		
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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.
- The excluded work will be the responsibility of the Principal and Utility Authorities. Attention is drawn to the Conditions of Contract regarding the obligation of the Contractor to co-ordinate the works with any simultaneous and/or adjacent work by others. The Contractor shall liaise with these Contractors and Authorities to avoid disruption, delays and possible conflict.

C101.03 SUBSURFACE CONDITIONS

EXAMPLE (TO BE COMPLETED BY COMPILER)

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

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

Contractor to Inform Itself

GENERAL REQUIREMENTS

C101.04 DRAWINGS

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

C101.05 STANDARDS AND TEST METHODS

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

Australian Standards

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

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

Overseas Standards

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

Copies to be kept on Site

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

Other Test Methods

C101.06 TESTING AND SURVEY

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

Contractor's Cost

2. The minimum frequency of testing and survey shall be in accordance with either the Specification for QUALITY SYSTEM REQUIREMENTS – VERSION 3.1 or QUALITY CONTROL REQUIREMENTS – VERSION 3.1 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

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

Notice for Relocation

Contractor's Cost

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. **Representation**
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 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 C101-A, shall be completed by an appropriate qualified Engineer or Surveyor commissioned by the Contractor. **Submission**
2. Work-as-Executed Drawings for Roadworks shall show in red ink all changes to the Contract Drawings and actual values of all levels shown on the Drawings. The Drawings shall be signed by a Surveyor and certified by the Contractor. **Roadworks**
3. Work-as-Executed Drawings for Bridgeworks shall show in red ink all changes to the Contract Drawings, including variations to levels, dimensions, concrete, reinforcement, prestressing and other materials, all non-conformances accepted without rectification, suppliers and model numbers of bearings and proprietary joints and type of barrier railings installed where both steel and aluminium alternatives are detailed. The Drawings shall be certified by the Contractor. **Bridgeworks**

C101.12 ITEMS TO BE SUPPLIED BY THE PRINCIPAL

1. Items listed in the Schedule of Items to be supplied by the Principal (TBS Items) will be supplied, delivered and unloaded by the Principal free of cost to the Contractor at points to be nominated. The Contractor shall give the Superintendent notice of the time delivery of TBS Items are required in accordance with the Requirements of the Technical Specification or as specified below. **Delivery**
2. If any TBS Item is found to be damaged or defective the Contractor shall so inform the Superintendent within 2 days of taking delivery of such item. If the Contractor does not report damage or defect, it shall be deemed that the TBS Item was free from damage or defect when received. The Contractor shall then be responsible for any replacement or making good as may be directed by the Superintendent in the case of a Quality Control Contract or in accordance with the Disposition of Nonconformance requirements in the Specification for QUALITY SYSTEM REQUIREMENTS – VERSION 3.1 in the case of a Quality Assured Contract.
3. The Contractor shall be responsible for the storage, protection and insurance of **Contractor's**

all TBS Items received.

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 any Environmental Impact Statement and Assessment Report or Review of Environmental Factors for the project, the conditions of approval imposed by the development consent, the Environmental Planning and Assessment Act 1979, the Protection of the Environment Operations Act 1997, the Rural Fires Act 1997, the Roads Act 1993, the Local Government Act 1993 and any other Council requirements and environmental legislation. No variation in costs or extensions of time will be considered due to these requirements.

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 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.

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 – VERSION 3.1.

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_{MAX}) 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 6pm Monday to Friday, 7am to 1pm on 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 Queanbeyan City Council.

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 Authority's publication Environment Noise Control Manual, 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 affect 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

Contractor's

payments as a result of non-observance of the above requirements. No claim by the Contractor will be considered by the Principal.

Responsibility

UTILITIES AND AUTHORITIES

C101.19 GENERAL

1. This section includes the location and protection of utilities and services, programming of the work by other Authorities and the Contractor, and an outline of utility adjustments required during the construction of the Works.

General

C101.20 RELATIONS WITH UTILITY AUTHORITIES AND OTHER AGENCIES

1. The Superintendent will arrange for all necessary adjustments to utilities required to conform to the Drawings unless specified otherwise or noted on the Drawings. The Superintendent will make every endeavour to arrange for such adjustments to be performed expeditiously and with a minimum of inconvenience to the Contractor. The 'Dial Before You Dig' Service, telephone 1100, may be contacted to obtain presence of gas, electricity and telephone services and some cables and pipes of companies and other organisations.

Principal to arrange adjustments to utilities

2. Where the Contractor's method of working results in additional adjustments to their plant being deemed necessary by any other Authority the Contractor will arrange for and bear all costs relevant to those additional adjustments. This applies regardless of any approval to the method of working by the Superintendent.

Additional Adjustments

3. The Contractor shall conduct the operations so as to interfere as little as possible with the operations of other Authorities or their contractors on or near the site of the works. The Principal reserves the right to permit other Authorities and others to work on or near the Works being constructed under the Contract.

Minimum Interference

4. The Contractor will not be responsible for the maintenance of any facilities installed or constructed by the various Authorities or structures and other facilities constructed by others (except where such structures and facilities form part of the Contract), but will be responsible for the protection of such facilities and structures during the Contract period.

Responsibility for Maintenance

5. In certain instances the Contractor may be required to provide the various Authorities the opportunity to remove, relocate, or work on their facilities before the Contractor proceeds with succeeding construction operations.

Delays due to works by Authorities

Should the Contractor suffer any delay in excess of the times set out in this worksection owing to the moving of any such services, or the operations of any Authority controlling such services, the Contractor may apply to the Superintendent for an extension of time in accordance with the Conditions of Contract.

The Contractor shall have no right to monetary compensation or to any claim for damages because of any loss owing to such delays, nor shall the Contractor stop the Works without the express permission in writing of the Superintendent because of any operation by other Authorities.

C101.21 LOCATION AND PROTECTION OF SERVICES AND UTILITIES

1. Prior to the commencement of any excavation the Contractor shall verify the location and depth of all Public Utility Mains and Consumer Services and shall be responsible for any damage caused, the repair of the damage, and payment of all charges associated therewith.

Contractor to verify locations

Contact: DIAL 1100 BEFORE YOU DIG is a free service, from anywhere in Australia, of locating underground pipe and cables (possible within two working days). See www.dialbeforeyoudig.com.au.

2. During the excavation of Works, the Contractor shall take every precaution that is necessary, in the opinion of the Superintendent, to secure existing gas, water or drainage pipes, sewers, electric conduits or other existing works, wherever met with both underground and overhead, or that are adjacent to these Works, from injury and shall maintain the same until in the opinion of the Superintendent, the backfilling of excavation and the general progress of the

Precautions

GENERAL

Works render further precautions unnecessary.

The Contractor shall comply with the Statutory Requirements for maintaining safe working clearance to overhead electrical services.

3. Damage to existing water, gas or drainage pipes, sewers, electric conduit or other existing works or services, shall be repaired by the Contractor to the satisfaction of the Superintendent and the relevant Authority at the Contractor's cost.

**Repairs to
damage
caused by
Contractor**

4. Where it is found necessary to remove, divert or cut into any existing sewer, drainage pipe, gas or water main, service pipes, electric conduits or other existing works, the Contractor shall give at least 3 days notice of the Contractor's requirements to the Superintendent, who will advise what arrangements should be made for the alteration of such existing works.

**Notice to
divert Services**

5. Where the installation of service mains, pits and consumer service connections is to be carried out by the various Utility Authorities the Contractor shall liaise and co-ordinate with the relevant Authorities for the installation to coincide with the construction work of this Contract. The Contractor shall be responsible to programme the installation such that all work is completed by the relevant Authorities so as not to hinder or delay the progress of the construction work of this Contract.

Liaison

6. Attention is directed to the possible existence of vibration and other working limitations in the vicinity of underground and overhead facilities. The extent of these limitations are liable to the absolute discretion of the Authority concerned.

The Contractor shall be deemed to have included consideration of these potential limitations in the method of construction as proposed for approval by the Superintendent in accordance with the provisions of this worksection.

The cost of such limitations on working methods shall be determined in accordance with the Conditions of Contract.

**Limitations on
Work Methods**

7. Information shown on the Drawings concerning utility services has been compiled from information obtained from various Utility Authorities and is not guaranteed correct or complete. Services may exist which are not shown on the Drawings, or which are at locations or elevations different than those shown on the Drawings.

Disclaimer

C101.22 PROGRAMMING AND DURATION OF UTILITY ADJUSTMENTS

1. The Contractor shall give the Superintendent 21 days' notice in writing of the expected date of completion of each of the necessary parts of the Works required before each of the utility services listed in this worksection can be relocated.

No final trimming or subsequent parts of the Work shall proceed in any area of the Work until the adjustment of all utilities within that area is complete.

**Notice of Date
of Completion
of parts of the
Works**

2. The Contractor shall allow in the programming of the Works for the utility adjustments specified in the following clauses. The finish dates given are approximate only. The Contractor shall be entitled to extensions of time if the utilities have not been relocated by these dates and this causes delay to the Contract.

The Contractor shall have no right to monetary compensation or to any claim for damages because of any loss attributable to such delays.

**Allowance for
Utility
Adjustments**

SITE FACILITIES

C101.23 GENERAL

1. This section includes the provision, maintenance and removal or restoration on completion of the Work of temporary site facilities for personnel, including the office for the Superintendent, and the necessary temporary utility services required on the site.

**Workers'
Facilities**

2. The Contractor shall provide, equip and maintain temporary ablution facilities, dressing rooms, tool houses and the like required by any Industrial Ordinance, Award or Agreement for use of workers employed by the Contractor, or the Contractor's sub-contractors,

**Facilities
required**

and shall remove them on completion of the Contract.

3. The Contractor shall provide temporary latrine accommodation for use of the workers which shall be suitably enclosed and screened and in accordance with the requirements of the Local Authority, making a temporary connection to an existing sewer where one is available. The Contractor shall maintain such accommodation in a clean condition, pay all relevant fees and remove it on completion of the Work, capping off any temporary sewer connection

Latrines

C.101.24 OFFICE FOR SUPERINTENDENT

1. The Contractor shall provide, equip, maintain and remove at the completion of the Works an office, including toilet facilities, for the sole use of the Superintendent and Superintendent's staff.

The office shall be comprised of:

- Building:
 - . A structure of prefabricated construction with minimum inside dimensions of 6 m x 3 m x 2.4 m high exclusive of toilet facilities, weatherproof, adequately insulated and well ventilated.
 - . The office shall contain 2 opening type windows fitted with insect-proof screens and an external door fitted with a cylinder night lock with 2 keys.
 - . The floor area shall be covered with an approved vinyl flooring and the walls and ceiling painted to the approval of the Superintendent.
- Furniture and fittings
 - . The office shall contain:
 - . One reference table of minimum size 1.5 m x 0.9 m.
 - . One desk, with lockable drawers, of minimum size 1.5 m x 0.9 m.
 - . Three office chairs and one stool all with padded seats, swivel base and adjustable height.
 - . Two 1.2 m square pin boards fixed to the walls.
 - . One 0.75 kW reverse cycle air conditioner.
- Toilet facilities
 - . The toilet facilities shall consist of a prefabricated structure, weatherproof and well ventilated, and connected to the temporary sewerage system and containing:
 - . One, minimum, partitioned w.c. cubicle with door and latch.
 - . Separate wash area with one, minimum, wash basin connected with hot and cold running water.
 - . Lockable external door with 2 keys.
- Electricity
 - . The office, including toilet facilities, shall be supplied with adequate electric lighting and the office with 2 double power points.
- Telephone
 - . Two telephone lines shall be connected to the office with one line fitted with a telephone hand set. The second line shall be for a facsimile machine supplied by the Superintendent.
- Charges
 - . The Contractor shall pay all charges resulting from the supply, erection, installation, maintenance, cleaning and removal of the office, toilet facilities, electricity and telephone services.

C101.25 ALTERNATIVE SITE FACILITIES

1. The Contractor may propose alternative site facilities in existing buildings adjacent to, or in close proximity to, the site of the Works. Full details of such alternative facilities shall be

GENERAL

submitted for consideration by the Superintendent, however, the requirements detailed in Office for Superintendent shall be taken as the minimum acceptable.

C101.26 WATER SUPPLY

1. The Contractor shall provide any temporary water supply required for site facilities and for carrying out the Work under the Contract.

**Temporary
Water Supply**

2. The Contractor shall pay all fees and obtain all approvals in respect of the temporary service and shall pay any charges for the water used. On completion of the Contract the temporary water supply service, except that to the Superintendent's office, shall be removed by the Contractor.

**Fees and
Charges**

C101.27 ELECTRICAL SERVICE

1. The Contractor shall provide any temporary electricity supply required for site facilities and for carrying out the Work under the Contract.

**Temporary
Electricity
Supply**

2. The Contractor shall pay all fees and charges and shall obtain all approvals in respect of the temporary electricity supply. The temporary electrical installation and the electrical reticulation shall fully comply with and conform to the Service Rules, Regulations and Requirements of the Statutory Authority having jurisdiction. The Contractor shall pay for all electricity consumed.

**Fees and
Charges**

3. The temporary electricity service, reticulation and lighting, except that to the Superintendent's office, shall be removed by the Contractor on completion of the Contract.

Removal

C101.28 TELEPHONE

1. The Contractor shall arrange for installation of a temporary site telephone for the Contractor's and Sub-contractor's use and shall maintain the installation for the period of the Contract.

Provision

2. All charges for installation, rental, calls and removal on completion shall be borne by the Contractor.

Charges

C101.29 FIRST AID

1. The Contractor shall provide, equip and maintain an adequate First Aid Treatment Centre on the site and shall have an experienced First Aid person available at all times when work is in progress.

2. The First Aid facilities shall be clearly marked and readily accessible to all personnel at all times. The minimum provisions under this Clause shall satisfy the current statutory requirements.

C101.30 CHAIN WIRE FENCE

1. The Contractor shall provide a 1.80 m high galvanised chain wire mesh perimeter fence, in accordance with the requirements of 1195 *Boundary fences for road reserves*, together with a galvanised tubular steel vehicular access gate, for the temporary site facilities as shown on the Drawings or as directed by the Superintendent.

Standard

2. The mesh fence shall be covered with a suitable hessian or shade cloth screen for its full height.

**Hessian
Covering**

3. The galvanised fence, screen material and gate shall be removed by the Contractor on completion of the Contract.

Removal

4. If a fence, in accordance with Chain Wire Fence is not required, the Working area including the site facilities shall be fenced off from the public to the satisfaction of the Superintendent and in accordance with any relevant regulations.

Other Fencing

SPECIAL REQUIREMENTS

C101.31 RESERVED

C101.32 RESERVED

MEASUREMENT AND PAYMENT

C101.33 DEDUCTIONS FOR NONCONFORMING WORK

1. Where deductions for nonconforming work are given in the worksections, the nominated deductions shall be applied to the rates given in the Pay Items for that item of work.

C101.34 PAY ITEMS

1. No separate measurement and payment shall be made for compliance with the requirements of this worksection except as specified in the pay item below.

Office for Superintendent

The unit of measurement shall be lump sum and shall include provision of all facilities detailed in Office for Superintendent.

AUS-SPEC #1

ANNEXURE C101-A**COONAMBLE SHIRE COUNCIL
WORK-AS-EXECUTED CERTIFICATION REPORT****Project Title:** _____**DA/BA No:** _____**Design Consultant's Drawing No:** _____**Name of Consultant:** _____**Name and Address of Developer:** _____

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

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

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

Contact Phone: __________
Consulting Engineer/Surveyor **Date****Contact Postal Address:** _____

Qualifications**AUS-SPEC #1**



COONAMBLE SHIRE COUNCIL

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.

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
VERSION 3.1	Inspection requirements added	C201.01.5	A	KD	14/04/10
	Standards updated	C201.02.1	M		
	Hold Point added	C201.03.3	A		
	Hold Point added	C201.04.1	A		
	Witness Point added	C201.05.1	A		
	Requirements for safety clothing	C201.06	A		
	Hold Point added	C201.09.1	A		
	Version 3.2 referenced	C101.12.1	A		
	Specification Version 3.2 referenced	C101.13.1	A		
	Version 3.2 referenced	C101.14.3	A		
	C267 & Version 3.2 referenced	C101.15.2	A		
	Hold Point added	C201.16.1	A		
	Hold Point added	C201.18.1	A		
	Hold Point added	C201.19.3	A		
	Hold Point added	C201.20.1	A		
	Hold Point added	C201.22.2	A		
	Retro reflective sheeting added	C201.28	A		
	Hold Point added	C201.35.3	A		
	Annexure added	C201-B	A		

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SPECIFICATION C201 : CONTROL OF TRAFFIC

GENERAL

C201.01 SCOPE

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

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

**Works
Included**

3. Control of traffic shall be in accordance with AS1742.3, SAA HB81, this Specification, and the Drawings.

Standards

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

**Contractor's
Responsibility**

5. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C201-B. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority to be obtained, where stipulated in Annexure C201-B.

Inspections

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 1742	-	Manual of Uniform Traffic Control Devices
AS 1742.3: 2009	-	Traffic Control for Works on Roads
AS 1742.14:1996	-	Traffic signals
AS 1743 : 2001	-	Road Signs Specifications
AS 1744 : 1975	-	Forms of letters and numerals for road signs (known as Standard Alphabets for Road Signs)
AS/NZS 1906	-	Retroreflective Materials & Devices for Road Traffic Control Purposes
AS/NZS 1906.1 : 2007	-	Retroreflective sheeting
AS 4191:1994	-	Portable traffic signal systems
AS/NZS 4192:2006	-	Illuminated flashing arrow signs
AS/NZS 4602: 1999	-	High visibility safety garments
SAA HB81	-	Field Guides for Traffic Control at Works on Roads
SAA HB 43:2004	-	Risk management guidelines companion to AS/NZS 4360:2004

(b) Other Publications

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

C201.03 TRAFFIC GUIDANCE 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 Guidance Scheme in accordance with AS 1742.3. This is a **HOLD POINT**. **Traffic Guidance Scheme (HP)**
4. The Traffic Guidance Scheme shall include:- **Control Plan Contents**
 - (a) design drawings for any temporary roadways and detours in accordance with Clause C201.11 showing pavement, wearing surface and drainage details,
 - (b) details of arrangements for construction under traffic in accordance with SAA HB81, and
 - (c) a signpost layout plan showing:
 - (i) location, size and legend of all temporary signs
 - (ii) temporary regulatory signs and temporary speed zones, and
 - (iii) all traffic control devices such as temporary traffic signals, linemarking, pavement reflectors, guideposts, guardfence and barrier boards.
 - (d) working times when traffic control measures are in place to minimise disruption to traffic during periods of peak flows.
5. Where the Traffic Guidance 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 will be sought and obtained. In such cases the period of notice shall be increased to five weeks in accordance with Clause C201.24. **Notice**
6. The Traffic Guidance 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. This is a **HOLD POINT**. **Access (HP)**
2. With the prior approval of the Superintendent, vehicular access may need to be denied due to particular construction activities. The Contractor is to keep these interruptions to an absolute minimum and must advise the property owners of such occurrences by way of letter drop at least 24 hours prior to such an interruption. The Contractor shall repeat this advice verbally to the property owner in a courteous manner. **Notice to Property Owners**

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 AS 1742.3 and SAA HB81. This is a **WITNESS POINT**.

**Trained Traffic
Controllers
(WP)**

C201.06 APPROVED CLOTHING FOR WORK PERSONNEL

1. All personnel shall wear high visibility clothing to the requirements of AS 1742.3 and AS/NZS 4602.
2. All personnel shall wear a garment or garments of the classification appropriate for the time of work execution in accordance with AS/NZS 4602 as follows:
 - (a) Class D - garments for daytime use only
 - (b) Class N - garments for night-time use only
 - (c) Class D/N - garments for both day and night use.
3. For Class D and D/N garments, the colour of the material shall be either red-orange or yellow or as otherwise approved by the Superintendent.
4. For Class N garments, the colour of the background material is unspecified, however, the retroreflective strips shall be white or yellow or as otherwise approved by the Superintendent.

**Safety
Clothing**

C201.07 TEMPORARY SPEED ZONING

1. Where a temporary speed limit has been approved by the Road Authority, 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.
2. All costs associated with temporary speed zoning signposting shall be borne by the Contractor.

**Speed Zone
Signs**

**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.
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.
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.

**Plant
Delineation**

**Night Time
Clearance**

**Warning
Lamps**

TEMPORARY ROADWAYS AND DETOURS

C201.09 APPROVAL

1. The Contractor shall submit for the Superintendent's approval the design of all proposed temporary roadways and detours. This is a **HOLD POINT**.

**Temporary
Roads (HP)**

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

**Alignment &
Grading**

Intersections

**Standards &
Pavement**

C201.11 DESIGN DRAWINGS

1. Design drawings submitted for approval shall show:
 - (a) Alignment and grading at a horizontal scale of 1:2000 for rural roads and 1:500 for urban roads. Where the temporary road rejoins the existing road, levels showing the full cross section shall be extended along the existing road for a minimum length of 200m.
 - (b) A sight distance diagram if opposing traffic is to use a single carriageway.
 - (c) Intersections, and any other locations where traffic may be required to make turning, merging or diverging movements, at a scale of 1:500.
 - (d) Pavement marking details.
 - (e) 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.

Contents

C201.12 DRAINAGE

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

Standard

C220	-	Stormwater Drainage – General Version 3.1
C221	-	Pipe Drainage Version 3.1
C223	-	Drainage Structures Version 3.1
C224	-	Open Drains, including Kerb and Gutter – Version 3.1

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 – Version 3.1 |
| C212 | - | Clearing And Grubbing – Version 3.1 |
| C213 | - | Earthworks – Version 3.1 |
| C242 | - | Flexible Pavements – Version 3.1 |

C201.14 SURFACING

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

**Wearing
Surface**

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

**Tie-in to
existing work**

3. Surfacing shall be constructed in accordance with:

Standards

- | | | |
|------|---|--|
| C244 | - | Sprayed Bituminous Surfacing – Version 3.1
and/or |
| C245 | - | Asphaltic Concrete – Version 3.1 |

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) –
Version 3.1 |
| C267 | - | Rigid Concrete Road Safety Barrier Systems (Public
Domain) – Version 3.1 |

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. This is a **HOLD POINT**.

**Approval to
Use (HP)**

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

Signposting

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

**Existing
Roadway
Retained**

CONTROL OF TRAFFIC

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. This is a **HOLD POINT**.

**Restoration
(HP)**

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 SAA HB81, are to be submitted for the Superintendent's approval at least five working days before undertaking any work which would involve construction under traffic. This is a **HOLD POINT**.

**Signs and
Markings (HP)**

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. This is a **HOLD POINT**. The procedure for opening shall be determined through consultation between the Superintendent, the Contractor and the Council.

**Written Notice
(HP)**

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**

AUS-SPEC #1

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, AS 1742.3 and SAA HB81. The arrangement diagrams illustrate the more common examples of the arrangement of traffic control devices and set out the minimum requirements.

**Arrangement
Diagrams**

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

**Unnecessary
Signs**

C201.22 MAINTENANCE OF TRAFFIC CONTROL DEVICES

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

**Contractor's
Responsibility**

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

**Out of Hours
Contact (HP)**

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 AS 1742.3, and shall require approval by the Council 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 AS 1742.3 are shown in Annexure C201A. These signs may be used in lieu of or in addition to those shown in AS 1742.3 as follows:

(a) Heavy Machinery Crossing

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

(b) Cycle Hazard Grooved Road

This temporary sign, shown as Sign ST1-10, shall 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, shall be used in addition to T3-1 for bituminous surfacing works.

(d) Changed Traffic Conditions Ahead

This temporary sign, shown as Sign ST1-6, shall be used in addition to T1-1, T1-6, T2-6 and T2-21 on long term works, sidetracks and detours.

C201.27 FLASHING ARROW SIGNS

1. Flashing arrow signs shall comply with AS 1742.3.

C201.28 BARRIER BOARDS

1. Barrier boards shall comply with AS 1742.3.
2. Retroreflective sheeting on the rails shall be minimum Class 2 in accordance with AS/NZS 1906.1.
3. 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.

Standard

**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 AS 1742.3, containment fences.
3. The mesh fencing shall be approximately 1m in height and of a red-orange coloured flexible material as approved by the Superintendent.

C201.30 TEMPORARY POST-MOUNTED DELINEATORS

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

C201.31 CONES AND BOLLARDS

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

Standard and Placement

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

Conditions of Use

3. Cones and bollards used under night conditions shall be reflectorised in accordance with AS 1742.3.

Reflectorised for Night Work

C201.32 TRAFFIC WARNING LAMPS

1. Traffic warning lamps shall comply with AS 1165 and shall be installed in accordance with AS 1742.3. The Contractor shall ensure that warning lamps are in good working order, correctly aligned and positioned with respect to the direction of traffic flow 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, roadmarking tape and/or raised pavement markers in accordance with the relevant Australian Standards or as otherwise approved by the Superintendent and shall be provided in accordance with AS 1742.3.

Reflectorised Markings

2. Where the adjoining roadway is edgeline, temporary roadways shall be similarly edgeline.

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. This is a **HOLD POINT**.

**Removal of
Superseded
Markers (HP)**

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 – VERSION 3.2.

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.

AUS-SPEC #1

(i)

Technical drawing of a heavy machinery crossing sign. The sign is rectangular with a white background and a black border. The text "HEAVY MACHINERY CROSSING" is written in a bold, sans-serif font, with "HEAVY" and "CROSSING" on the top and bottom lines, and "MACHINERY" in the middle. The drawing includes dimensions in millimeters (mm) for the sign and its mounting plate.

Sign Dimensions:

- Overall width: 1800 mm
- Overall height: 900 mm
- Text area width: 1556 mm
- Text area height: 500 mm
- Left margin: 144 mm
- Right margin: 100 mm
- Top margin: 25 mm
- Bottom margin: 25 mm

Mounting Plate Dimensions:

- Overall width: 1800 mm
- Overall height: 900 mm
- Text area width: 1556 mm
- Text area height: 500 mm
- Left margin: 144 mm
- Right margin: 100 mm
- Top margin: 25 mm
- Bottom margin: 25 mm

(ii)

Technical drawing of a rectangular sign with the text "CYCLE HAZARD GROOVED ROAD". The drawing includes dimensions and material specifications.

Sign Dimensions:

- Overall Width: 1200
- Overall Height: 900
- Top Margin: 247
- Bottom Margin: 247
- Left Margin: 138
- Right Margin: 137
- Text Area Width: 706
- Text Area Height: 925

Sign Content:

CYCLE
HAZARD
GROOVED
ROAD

Material Specifications:

- Top: SERIES E M, 120, 65, 140
- Right: SERIES E M, 120, 65, 140
- Bottom: SERIES E M, 120, 65, 140

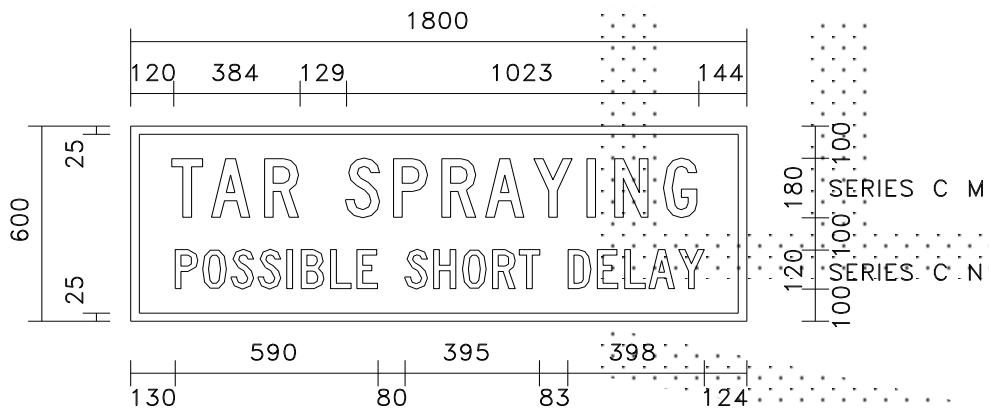
Additional Dimensions:

- Top Margin: 167
- Bottom Margin: 167
- Left Margin: 353
- Right Margin: 352
- Text Area Width: 866
- Text Area Height: 495

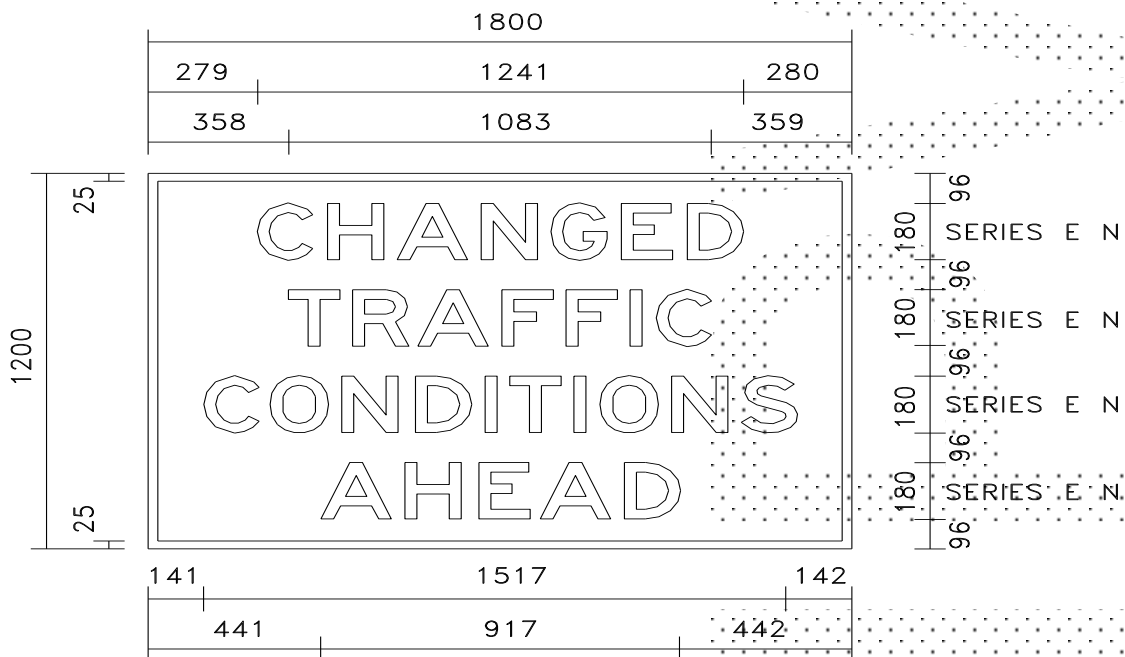
ANNEXURE C201-A
SUPPLEMENTARY TEMPORARY WARNING SIGNS TO AS 1742.3

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

(iii) ST3-1



(iv) **ST1-6**



ANNEXURE C201- B

INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title/Item	Requirement	Notice for inspection	Release by
GENERAL			
Traffic Guidance Scheme			
C201.03.3 - Traffic Guidance Scheme	Approval of Traffic Guidance Scheme	2 weeks before proposed commencement on site	Superintendent – Council concurrence required
Side Roads and Property Accesses			
C201.04.1 - Access	Submit proposed alternative access provisions for approval	2 weeks before proposed commencement on site	Superintendent – Council concurrence required
TEMPORARY ROADWAYS AND DETOURS			
Approval			
C201.09.1 – Temporary Roads	Submit design for approval	2 weeks before proposed commencement on site	Superintendent
Opening to Traffic			
C201.16.1 – Approval to Use	Inspect and approve all roadways and detours prior to opening	2 working days prior to carrying out works	Superintendent - Council concurrence required
Removal			
C201.18.1 - Restoration	Reinstate area to pre-existing conditions	2 working days	Superintendent – Council concurrence required
ARRANGEMENTS FOR TRAFFIC			
Construction under Traffic			
C201.19.3 – Signs and Markings	Submit details for approval	5 working days	Superintendent
Opening Completed Work			
C201.20.1 – Written Notice	Provide written notice advising date of opening of completed work	5 working days	Superintendent
TRAFFIC CONTROL DEVICES			
Maintenance of Traffic Control Devices			
C201.22.2 – Out of Hours Contact	Supply contact details in writing	5 working days prior to erection	Superintendent
Raised Pavement Markers			
C201.35.3 – Removal of Superseded Markers	Remove superseded markers immediately	1 working day	Superintendent

Summary of WITNESS POINTS

Clause title/subclause	Requirement	Notice for inspection
GENERAL		
Traffic Controllers		
C201.05.1 – Trained Traffic Controllers	Provide signed declaration that traffic controllers are appropriately trained	Progressive

AUS-SPEC #1

COONAMBLE SHIRE COUNCIL

COONAMBLE SHIRE COUNCIL

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
VERSION 3.1	Notice of inspections added	C211.01	A	KD	14/04/10
	Specification Version 3.2 referenced	C211.02.1	A		
	Hold Points and Witness Points added, Specification Version 3.2 referenced	C211.03	A		
	Hold Points and Witness Points added, Specification Version 3.2 referenced	C211.04	A		
	Hold Points and Witness Points added, Specification Version 3.2 referenced	C211.05	A		
	Specification Version 3.2 referenced	C211.06.1	A		
	Hold Points and Witness Points added	C211.08	A		
	Witness Points added	C211.12	A		
	Witness Points added	C211.14	A		
	Witness Points added	C211.15	A		
	Specification Version 3.2 referenced	C211.20	A		
	Annexure added	C211-A	A		

AUS-SPEC #1

SPECIFICATION C211 –

CONTROL OF EROSION AND SEDIMENTATION

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CONTROL OF EROSION AND SEDIMENTATION

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AUS-SPEC #1

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 in accordance with the approved Erosion and Sediment Control Plan (ESCP) or Soil and Water Management Plan (SWMP) included in the Drawings. These may be temporary or permanent.
2. The Contractor shall plan and carry out the whole of the Works to avoid erosion and sedimentation of the site, surrounding country, watercourses, waterbodies and wetlands.
3. All measures for erosion and sedimentation control shall be designed, installed and maintained by the Contractor in such a manner so as not to present a potential hazard to any person or property.
4. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C211-A. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority, where stipulated in Annexure C211-A.

Notice

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

(a) Council Specifications

Standards

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

Test Methods

(b) NSW State Legislation

Protection of the Environment Operations Act 1997

(c) Other

- NSW Department of Land and Water Conservation (DLWC)
 - *Urban Erosion and Sediment Control*
 NSW Department of Housing (DOH)
 - *Managing Urban Stormwater, Soils and Construction*, 3rd Ed., Aug 1998
 Institute of Public Works Engineering Australia (IPWEA)
 - *Local Government Salinity Management Handbook* (2002)

AUS-SPEC #1

C211.03 EROSION AND SEDIMENTATION CONTROL PLAN/SOIL AND WATER MANAGEMENT PLAN

1. For implementation of the ESCP/SWMP, 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 property boundaries, 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 Contractor shall submit an ESCP/SWMP 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 and consistent with the approved ESCP/SWMP. This is a **HOLD POINT**.

**Section Plan
(HP)**
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 - VERSION 3.2,
 - (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 DLWC publication Urban Erosion and Sediment Control and the DOH publication Managing Urban Stormwater, Soils and Construction provides guidance on typical permanent and temporary erosion and sedimentation control measures which may be required and guidance in the preparation of an ESCP/SWMP.

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 in each section until the ESCP/SWMP has been approved. This is a **HOLD POINT**. 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
(HP)**
7. The Contractor shall adhere to the approved ESCP/SWMP. The Contractor shall submit a revised ESCP/SWMP for approval fourteen days in advance of intended variation from the approved plan. This is a **WITNESS POINT**.

**Adherence to
Plan (WP)**

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. This is a **WITNESS POINT**. **(WP)**
- (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. This is a **WITNESS POINT**. **(WP)**
- (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 - VERSION 3.1, 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. This is a **HOLD POINT**. **(HP)**
- (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. This is a **WITNESS POINT**. **(WP)**

2. All permanent and temporary erosion and sedimentation control measures shall be constructed in accordance with the construction details in the ESCP/SWMP 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 - VERSION 3.1 and shall be stripped of topsoil and any unsuitable material under embankments removed in accordance with the Specification for EARTHWORKS - VERSION 3.1.

Site Preparation

3. The embankments shall be constructed in accordance with the Specification for EARTHWORKS - VERSION 3.1.

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 and sediment removal. This is a **HOLD POINT**.

Contractor to Provide Survey Information (HP)

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 - VERSION 3.1.

Rock Mattresses

2. A low flow outlet consisting of a 150 mm 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. This is a **WITNESS POINT**. All permanent sedimentation control structures shall be cleaned out by the Contractor prior to Practical Completion of the Works. This is a **HOLD POINT**.

Contractor's Responsibility

(WP)

(HP)

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 as defined in the Protection of the Environment Operations Act 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 ESCP/SWMP.

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 20m nor more than 50m, 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

Diversion Drains

CONTROL OF EROSION AND SEDIMENTATION

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.

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. This is a **WITNESS POINT**.

**Sediment
Traps
(WP)**

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. This is a **WITNESS POINT**.

**Access
(WP)**

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. This is a **WITNESS POINT**.

**Contractor's
Responsibility
(WP)**

SPECIAL REQUIREMENTS

C211.16 RESERVED

C211.17 RESERVED

C211.18 RESERVED

C211.19 RESERVED

AUS-SPEC #1

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 - VERSION 3.2.
5. Landscaping works are measured and paid in accordance with the Specification for LANDSCAPING - VERSION 3.2
6. Topsoil stripping and removal of unsuitable material are measured and paid in accordance with the Specification for EARTHWORKS - VERSION 3.2.

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 - VERSION 3.1.

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

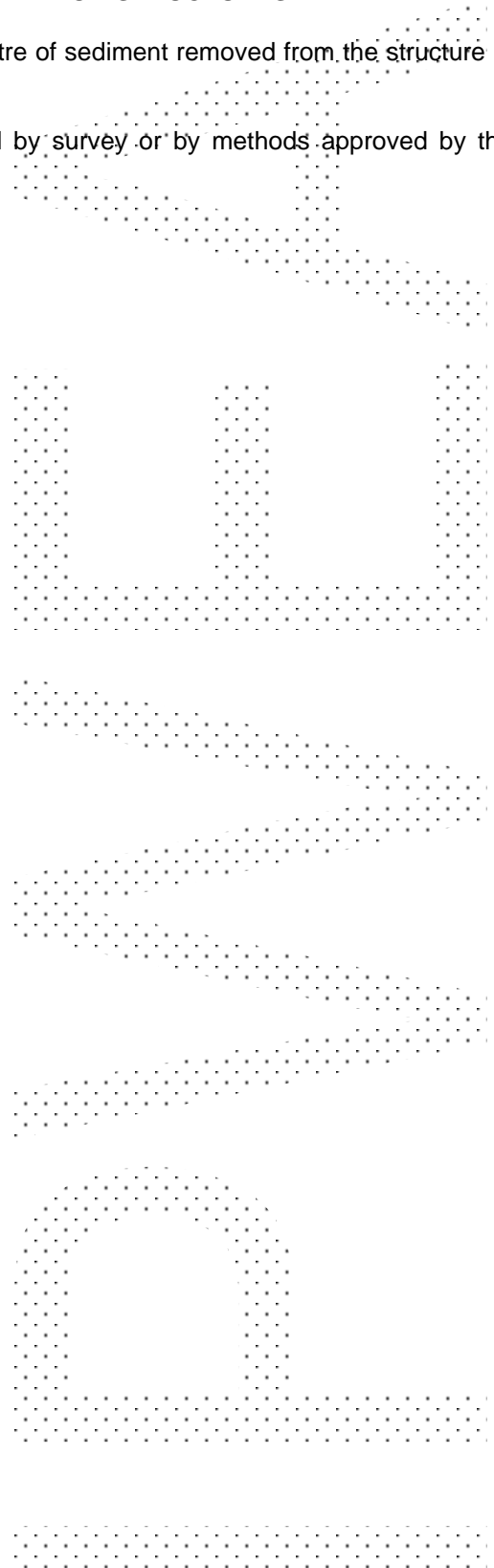
1. The unit of measurement shall be the square metre of horizontal surface area of rock filled mattress constructed in accordance with Clause C211.06 and the Drawings.

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.



AUS-SPEC #1

ANNEXURE C221-A

INSPECTIONS

Give notice so that inspection may be made of the following:

Summary of HOLD POINTS

Clause/subclause	Requirement	Notice for inspection	Release by
EROSION AND SEDIMENTATION CONTROL PLAN / SOIL AND WATER MANAGEMENT PLAN			
C211.03.2 - Section Plan	Submit ESCP/SWMP with detailed section plans for each catchment area and site section	14 days before site disturbance on each section	Superintendent
C211.03.6 - Contractors Responsibility	Obtain ESCP/SWMP approval prior to commencement		Superintendent
EROSION AND SEDIMENTATION CONTROL MEASURES			
C211.04.1(k)	Protect stockpile locations	7 days before site disturbance or material delivery	Superintendent
EARTHWORKS FOR PERMANENT EROSION AND SEDIMENTATION CONTROL BASINS			
C211.05.4 - Contractor to Provide Survey Information	Survey information for volume measurement	3 working days before embankment construction or sediment removal	Superintendent
CLEANING SEDIMENTATION CONTROL STRUCTURES			
C211.08.1 - Contractor's Responsibility	Clean out permanent sediment control structures	3 working days before Practical Completion	Superintendent

Summary of WITNESS POINTS

Clause/subclause	Requirement	Notice for inspection by the Superintendent
EROSION AND SEDIMENTATION CONTROL PLAN / SOIL AND WATER MANAGEMENT PLAN		
C.211.03.7 – Adherence to Plan	Submit proposed alterations to approved plan	14 working days before ground disturbance
EROSION AND SEDIMENTATION CONTROL MEASURES		
C211.04.1(c)	Install catch drains	2 days before site disturbance
C211.04.1(h)	Delineate areas not to be disturbed	2 days before site disturbance
C211.04.1(l)	Provide shake down measures at entry / exit points	2 days before site disturbance
CLEANING SEDIMENTATION CONTROL STRUCTURES		
C211.08.1 - Contractor's Responsibility	Clean out permanent sediment control structures	Progressive
TEMPORARY SEDIMENT TRAPS		
C211.12.1 - Sediment Traps	Provide and maintain temporary sediment control devices	Progressive
MAINTENANCE AND INSPECTION		
C211.14.2 - Access	Provide access to sediment control works	Progressive
REMOVAL		
C211.15.1 - Contractor's Responsibility	Removal of temporary erosion and sedimentation control works	3 working days before each stage of progressive removal

COONAMBLE

SHIRE COUNCIL

COONAMBLE SHIRE COUNCIL

DEVELOPMENT
CONSTRUCTION SPECIFICATION

C212

CLEARING AND GRUBBING

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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Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
VERSION 3.1	Specification Version 3.1 referenced, Inspection requirements added	C212.01.5	A	KD	12/04/10
	Hold Point added	C212.02.2	A		
	Hold Point added	C212.03.2	A		
	Hold Point added	C212.03.5	A		
	Hold Point added	C212.03.7	A		
	Specification Version 3.1 referenced	C212.05.1	A		
	Hold Point added	C212.06.2	A		
	Specification Version 3.1 referenced	C212.07.1	A		
	Annexure added	C212-A	A		

SPECIFICATION C212 - CLEARING AND GRUBBING

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C212.01 SCOPE	1
C212.02 LIMITS OF CLEARING	1
C212.03 CLEARING OPERATIONS	1
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C212.06 DISPOSAL OF MATERIALS	3
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C212.07 PAY ITEMS	3
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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 – VERSION 3.2. **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**
5. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C212-A.. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority to be obtained, where stipulated in Annexure C212-A. **Inspections**

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, plus a clearance of 2m beyond tops of cuts and toes of embankments. The Contractor shall ensure that only the absolute minimum area for construction is cleared. **Limits of Clearing**
2. The Contractor shall submit a survey plan showing the proposed area to be cleared for approval. This is a **HOLD POINT**. **Survey (HP)**
3. Before clearing commences, the limits of clearing shall be marked by pegs placed by the Contractor at 25m intervals around the area to be cleared. **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**

CLEARING & GRUBBING

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 Contractor shall arrange for an inspection by Council's Tree Preservation Officer and shall obtain Council's approval to proceed with clearing and grubbing. This is a **HOLD POINT**. 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 (HP)**
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 Council's Tree Preservation Officer. This is a **HOLD POINT**. **Disturbance to Tree Roots (HP)**
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. This is a **HOLD POINT**. **Unsound Trees in Road Reserve (HP)**
8. If directed by the Superintendent, any branch, which overhangs the road formation, shall be cut back to within 0.5m of the tree trunk and disposed of in accordance with Clause C212.05. **Overhanging branches**
9. Every precaution shall be taken to prevent timber from falling on private property and the Contractor shall dispose of any timber so fallen or produce the written consent of the owner to its remaining there. The cost of disposal of such fallen timber shall be borne by the Contractor. Prior to entering private property, the Contractor shall obtain consent from the Superintendent and the property owner. **Debris in Private Property**
10. Damage of any kind, including damage to trees, fencing, occurring during clearing operations shall be made good by the Contractor. 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 - VERSION 3.1 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 in writing, disposal of timber and other combustible materials by burning shall not be permitted. This is a **HOLD POINT**. 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 (HP)**

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 – VERSION 3.1 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.

ANNEXURE C212 - A**INSPECTIONS**

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title/subclause	Requirement	Notice for inspection	Release by
CLEARING AND GRUBBING			
Limits of Clearing			
C212.02.2 – Survey	Submit survey plan for approval	14 days before work is scheduled to commence	Superintendent – PCA concurrence required
Clearing Operations			
C212.03.2 – Trees to be Preserved	Obtain approval to commence clearing	7 working days	Superintendent – PCA concurrence required
C212.03.5 – Disturbance to Tree Roots	Obtain approval prior to root disturbance	7 working days	Superintendent – PCA concurrence required
C212.03.7 – Unsound Trees in Road Reserve	Obtain approval to remove	7 working days	Superintendent – PCA concurrence required
Disposal of Materials			
C212.06.2 – Burning not Permitted	Obtain approval to burn	14 working days before work is scheduled to commence	Superintendent – PCA concurrence required

COONAMBLE

SHIRE COUNCIL

NEW SOUTH WALES

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
VERSION 3.1	Inspection requirements added	C213.01.3	A	KD	31/03/11
	Specification Version 3.1 referenced, Standards updated	C213.02	A		
	Specification Version 3.1 referenced, salinity prevention requirements added	C213.04	A		
	Specification Version 3.1 referenced, Hold Point added	C213.06	A		
	Specification Version 3.1 referenced, Witness Point added	C213.07	A		
	Specification Version 3.1 referenced , Hold Point added	C213.09	A		
	Hold Point added	C213.11	A		
	Witness Point added	C213.12	A		
	Witness Point & Hold Points added	C213.14	A		
	Witness Point added	C213.15	A		
	Council approval for blasting added, Hold Points & Witness Points added, reporting of special requirements added	C213.16	M, A		
	Witness Point added	C213.18	A		
	Hold Point added	C213.19	A		
	Witness Point added	C213.20	A		
	Witness Point & Hold Point added	C213.21	A		
	Hold Point added	C213.24	A		

EARTHWORKS

	Witness Point added	C213.26	A		
	Hold Point added	C213.27	A		
	Hold Point added	C213.29	A		
	Hold Point added	C213.30	A		
	Specification Version 3.1 referenced, Witness Point added	C213.31	A		
	Hold Point added	C213.32	A		
	Disposal clarified	C213.34	A		
	Specification Versions 3.1 referenced	C213.35	A		
	Hold Point added	C213.38	A		
	Specification Versions 3.1 referenced,	C213.46	A		
	Supplementary information detailed	C213 – A	A		
	Annexure added	C213 - B	A		

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SPECIFICATION C213 : EARTHWORKS

GENERAL

C213.01 SCOPE

- | | |
|--|---------------------------|
| <p>1. The work to be executed under this Specification consists of:-</p> <ul style="list-style-type: none"> (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. | <p>Scope</p> |
| <p>2. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements.</p> | <p>Quality</p> |
| <p>3. The Contractor shall give notice so that inspection may be made of all HOLD POINTS and WITNESS POINTS documented in this specification and tabulated in Annexure C213-B. Release of HOLD POINTS and WITNESS POINTS shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority to be obtained, where stipulated in Annexure C213-B.</p> | <p>Inspections</p> |

C213.02 REFERENCE DOCUMENTS

- | | |
|---|--|
| <p>1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.</p> <p>(a) Council Specifications</p> <ul style="list-style-type: none"> C201 - Control of Traffic – Version 3.1 C211 - Control of Erosion and Sedimentation – Version 3.1 C212 - Clearing and Grubbing – Version 3.1 C220 - Stormwater Drainage – General – Version 3.1 C273 - Landscaping – Version 3.1 <p>(b) Australian Standards</p> <ul style="list-style-type: none"> AS 1289 Methods of testing soils for engineering purposes. AS 1289.3.3.1-2009 Soil classification tests—Calculation of the plasticity index of a soil. AS 1289.5.1.1-2003 Soil compaction and density tests—Determination of the dry density or moisture content relation of a soil using standard compactive effort. AS 1289.5.4.1-2007 Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio. AS 1289.5.7.1-2006 Soil compaction and density tests—Compaction control test—Hilf density ratio and Hilf moisture variation. AS 1289.6.1.1-1998 Soil strength and consolidation tests- Determination of the California Bearing Ratio of a soil - Standard laboratory | <p>Documents
Standards
Test Methods</p> |
|---|--|

EARTHWORKS

	method for a remoulded specimen.
AS 2187	Explosives - Storage, transport and use
AS 2187.1-1998	Storage
AS 2187.2-2006	Use of explosives

(c) Other

- AUSTROADS - Explosives in Roadworks, Users Guide 1982.
- EPA - Environmental Noise Control Manual.
- National Road Transport Commission/Federal Office of Road Safety, Joint Publication - Australian Code for the Transport of Explosives by Road and Rail.

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
Characteristic
s**

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 – VERSION 3.1, 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. This is a HOLD POINT . 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 (HP) |
|---|--|

2. Any clearing and grubbing required for these sites shall be carried out in accordance with the Specification for CLEARING AND GRUBBING – VERSION 3.1. Temporary erosion and sedimentation control measures shall be taken in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION – VERSION 3.2.

Clearing and Grubbing

3. Restoration of stockpile sites following completion of the work shall be carried out in accordance with the Specification for LANDSCAPING – VERSION 3.1.

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 – VERSION 3.1 and CLEARING AND GRUBBING – VERSION 3.1. This is a **WITNESS POINT**.

Prerequisites

(WP)

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 C213-A 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 C213-A, 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 C213-A 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. This is a **HOLD POINT**.
2. The maximum height of stockpiles shall not exceed 2.5m and the maximum batter slope shall not exceed 2h:1v.
3. Topsoil stockpiles shall not contain any timber or other rubbish and shall be trimmed to a regular shape.
4. To minimise erosion, stockpile batters shall be track rolled or stabilised by other means acceptable to the Superintendent.
5. Where seeding of stockpiles to encourage vegetation cover is specified, such work shall be carried out in accordance with the Specification for LANDSCAPING – VERSION 3.2.

**Site Survey
(HP)**

**Height and
Batter**

**Stockpiles
Trimmed**

**Erosion
Control**

**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.
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.
5. Cut faces shall be cleaned of loose or unstable material progressively as the excavation proceeds.
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.
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 is a **HOLD POINT**. This Variation shall include all additional costs incurred by the Contractor who shall not have any further claim upon the Principal as a result of the redetermination of the batter slope.

Batter Slopes

**Batters to be
Even**

**Unstable
Material**

**Blending
Material**

**Variation for
Batter Slopes
(HP)**

C213.12 BATTER TOLERANCES

- | | | |
|----|--|---|
| 1. | The tolerances for the excavation of batters, measured at right angles to the design grade line, shall be $\pm 300\text{mm}$. | 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. This is a WITNESS POINT . | Excavation beyond Batter Line

Contractor's Cost

(WP) |
| 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. This is a WITNESS POINT . | Excavation Level

(WP) |
| 2. | The Contractor shall rip or loosen all material in the floor to a minimum depth of 200mm below the designed floor level for the width of the selected material zone (or subbase layer, where no selected material zone). The maximum dimension of any particles in the ripped or loosened zone shall not exceed 150mm. | Floor Material Ripped |
| 3. | Prior to ripping or loosening the cutting floor the Contractor shall determine the CBR 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 C213-A, 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. This is a HOLD POINT . 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 (HP) |

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. This is a **HOLD POINT**. 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
(HP)**

C213.15 TRANSITION FROM CUT TO FILL

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

**Intersection
Line**

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

**Terrace
Construction
(WP)**

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**

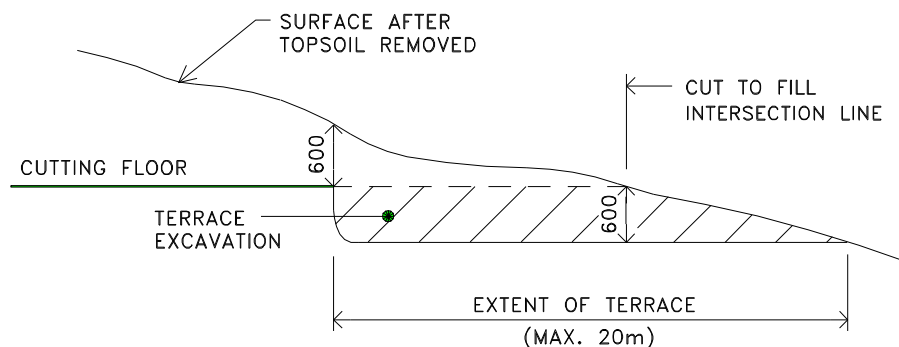


Figure C213.1 - Transition from Cut to Fill

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. The use of explosives is subject to prior approval by the Superintendent and Council. This is a **HOLD POINT**. 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 Environment Protection Authority (EPA) shall be complied with.

**Council
Approval (HP)**

**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. This is a **HOLD POINT**.

**Pre-blast
Survey
(HP)**

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. This is a **HOLD POINT**. 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
(HP)**

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. This is a **HOLD POINT**.

**Proposed
Blasting
Procedure
(HP)**

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. Report any special condition or approval requirement affecting any resident to the Superintendent. This is a **WITNESS POINT**.

**Advice to
Residents
(WP)**

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 – VERSION 3.2. 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. This is a **WITNESS POINT**. **Record Preparation (WP)**

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 EPA Noise Control Manual 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. This is a **HOLD POINT**.

**Excessive Air
Blast Over-
Pressure**

(HP)

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. This is a **WITNESS POINT**. The Contractor shall make the regression line plots available to the Superintendent, if so requested.

**Adjustment of
Blast Design**

(WP)

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. This is a **WITNESS POINT**. 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**
(WP)

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. This is a **HOLD POINT**. Prior to placing replacement material the excavated surface shall be compacted in accordance with Clause C213.36.

**Floor
Inspection**

(HP)

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 contaminants 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. This is a **HOLD POINT**.

***Inspection
(HP)***

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

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.

Shallow Embankments

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

Unsuitable Material

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

Preparation of Foundations

b) Other Embankments

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

Preparation

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

Bridging Layer

(HP)

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

***Horizontal
Terraces******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.
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.
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.
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.
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. This is a **WITNESS POINT**.
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.
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.
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.
9. For the purpose of this Clause, the CBR value of the material shall be determined by Test Method AS 1289.6.1.1.

***Uniformity of
Material******Embankment
Stability******Layer
Thickness******Maximum Size
Rock Pieces******Grading of Fill
Material******(WP)******Reworking
Stony Patches
Contractor's
Cost******Equipment
Selection for
Placement******CBR Value******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 $\pm 300\text{mm}$ 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. This is a **HOLD POINT**.

**Slope Redeter-
mination
(HP)**

C213.28 ROCK FACING OF EMBANKMENTS

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

Extent

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

**Mechanical
Interlock**

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

Graded Filter

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

**Caution in
Placement**

C213.29 TRIMMING TOPS OF EMBANKMENTS

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

Levels

2. The tops of embankments at these levels shall be compacted to meet the requirements of Clause C213.36 and trimmed so that they do not vary more than 10 mm

Tolerances

above or 40 mm below the levels as calculated above.

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. This is a **HOLD POINT**. 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 (HP)

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

Selection of Material

Contractor's Cost

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. This is a **HOLD POINT**. 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 (HP)

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 – VERSION 3.2 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. This is a **WITNESS POINT**. **Time of Placement**
(WP)

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 installed in accordance with Manufacturer's instructions. The use of a synthetic membrane shall be subject to the Superintendent's approval. This is a **HOLD POINT**. **Synthetic Membrane**
(HP)

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

- | | |
|---|--|
| <p>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.</p> | <p><i>Placement in Layers</i></p> |
| <p>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.</p> | <p><i>Horizontal Terraces</i></p> |
| <p>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.</p> | <p><i>Time of Placement</i></p> |
| <p>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.</p> | <p><i>Adjacent to Concrete Deck</i></p> |
| <p>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.</p> | <p><i>Spill through Abutments</i></p> |
| <p>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.</p> | <p><i>Framed Structures</i></p> |

C213.34 SPOIL

- | | |
|---|---|
| <p>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.</p> | <p><i>Definition</i></p> |
| <p>2. Where there is surplus material the Superintendent may direct that flatter batter slopes be provided on embankments which have not been commenced, and/or direct that the excess material be used in the uniform widening of embankments, the surface of which shall be shaped so as to provide a tidy appearance and effective drainage. The surplus material shall be spread and compacted as specified in Clauses C213.26 and C213.36 for material in embankments.</p> | <p><i>Use in Embankments</i></p> |
| <p>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 at an approved off site location by the Contractor. Surplus material deposited within the specified working area 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.</p> | <p><i>Disposal of Spoil</i></p> |

C213.35 BORROW

- | | |
|---|--|
| <p>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.</p> | <p><i>Borrow to be Authorized</i></p> |
|---|--|

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
Characteristic
s***

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 – VERSION 3.2 and Clause C213.07. Restoration of borrow sites shall be carried out in accordance with the Specification for LANDSCAPING – VERSION 3.2.

***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 and Assessment Act, the Local Council, land owners, the Rural Lands Protection Board and the NSW Soil Conservation Service, as appropriate.

***Contractor
Responsibility***

COMPACTION AND QUALITY CONTROL

C213.36 COMPACTION AND MOISTURE REQUIREMENTS

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

***Trimming and
Compaction***

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

***92%
Compaction
Requirements***

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

3. Unsuitable material shall be stockpiled as directed by the Superintendent and

Unsuitable

compacted by track rolling.

Material

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

**95%
Compaction
Requirements**

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

5. At the time of compaction the moisture content of the material shall be adjusted so as to permit the specified compaction to be attained at a moisture content which, unless otherwise approved by the Superintendent, is within the range set out in Annexure C213A of the optimum moisture content as determined by AS 1289.5.1.1 or AS 1289.5.7.1. Material which becomes wetted up after placement shall not be compacted until it has dried out so that the moisture content is within this range. The drying process may be assisted by aeration, or where approved by the Superintendent, by the use of hydrated or quick lime at the Contractor's cost. Alternatively the Contractor may transport the wet material to a stockpile site for drying out and later use as fill material. 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 Re-
presentation**

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 to carry out deflection monitoring. This is a **HOLD POINT**.

***Timing of
Deflection
Monitoring
(HP)***

2. A lot for deflection testing shall consist of a continuous length of formation 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 C213-A	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 – VERSION 3.2.
5. Clearing and grubbing of stockpile sites and borrow areas is measured and paid in accordance with the Specification for CLEARING AND GRUBBING – VERSION 3.2.
6. Seeding and restoration of stockpile sites and borrow areas is measured and paid in accordance with the Specification for LANDSCAPING – VERSION 3.2.
7. Traffic control for blasting operations is measured and paid in accordance with the Specification for CONTROL OF TRAFFIC – VERSION 3.2.
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 – VERSION 3.2 and DRAINAGE STRUCTURES – VERSION 3.2 as appropriate.
9. Selected backfilling to box culverts is measured and paid in accordance with the STORMWATER Specification for PRECAST BOX CULVERTS – VERSION 3.2.

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

EARTHWORKS

the Superintendent. No account shall be taken of level tolerances.

ANNEXURE C213 - A 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:	
<hr/>		
	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.	

ANNEXURE C213 - B**INSPECTIONS**

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title/subclause	Requirement	Notice for inspection	Release by
GENERAL			
Stockpile Sites			
C213.06.1 – Additional Stockpile Sites	Submit site for approval	3 working days	Superintendent
REMOVAL OF TOPSOIL			
Topsoil Stockpiles			
C213.09.1 – Site Survey	Submit survey for approval	3 working days	Superintendent
CUTTINGS			
Excavation			
C213.11.7 – Variation for Batter Slopes	Obtain approval for variation	3 working days	Superintendent
Treatment of Floors of Cuttings			
C213.14.4 – Inspection by Superintendent	Submit floor for inspection	3 working days	Superintendent
C213.14.6 – Inspection by Superintendent	Submit compacted floor for inspection	3 working days	Superintendent
BLASTING			
General			
C213.16.1 – Council Approval	Obtain approval to blast	14 working days before work is scheduled to commence	Superintendent – PCA concurrence required
C213.16.3 – Pre-blast Survey	Arrange inspection	3 working days	Superintendent
C213.16.5 – Amendment to Extent of Survey	Submit blast details and survey	3 working days	Superintendent
C213.16.6 – Proposed Blasting Procedure	Submit details	3 working days	Superintendent
Control of Air Blast Over-Pressure			
C213.19.5 – Excessive Air Blast Over-Pressure	Submit proposal for amendment to overcome over-pressure	3 working days	Superintendent
UNSUITABLE MATERIAL			
General			
C213.21.1 – Floor Inspection	Submit floor for inspection	3 working days	Superintendent
EMBANKMENT CONSTRUCTION			

EARTHWORKS

Foundations for Embankments			
C213.24.1 - Inspection	Submit for inspection	3 working days	Superintendent
C213.24(b)2 – Bridging Layer	Obtain approval to import suitable material	7 working days	Superintendent
Embankment Batters			
C213.27.4 - Slope Redetermination	Obtain approval	3 working days	Superintendent
Trimming Tops of Embankments			
C213.29.3 – Inspection by Superintendent	Arrange inspection of completed surface	3 working days	Superintendent
Selected Material Zone			
C213.30.8 – Inspection by Superintendent	Arrange inspection of completed surface	3 working days	Superintendent
Treatment of Weep holes			
C213.32.3 – Synthetic Membrane	Obtain approval for use	7 working days	Superintendent
Deflection Monitoring			
C213.38.1 – Timing of Deflection Monitoring	Submit lot(s) for testing	3 working days	Superintendent

Summary of WITNESS POINTS

Clause title/Item	Requirement	Notice for inspection
REMOVAL OF TOPSOIL		
Scope		
C213.07.2 – Prerequisites	Complete erosion and sediment control measures prior to stripping of topsoil	Progressive
CUTTINGS		
Batter Tolerances		
C213.12.2 – Excavation beyond Batter Line	Submit details of any proposed slope restoration	Progressive
Treatment of Floors of Cuttings		
C213.14.1 – Excavation Level	Advise Superintendent of the existence of unsuitable material	Progressive
Transition from Cut to Fill		
C213.15.2 – Terrace Construction	Construct terrace	Progressive
BLASTING		
General		
C213.16.8 - Advice to Residents	Advise any special requirements	Progressive
Blasting Records		
C213.18.2 – Record Preparation	Submit records	Progressive
Control of Ground Vibration		
C213.20.5 – Adjustment of Blast Design	Submit adjustments	Progressive
UNSUITABLE MATERIAL		
General		
C213.21.2 – Extent of Excavation	Obtain Superintendent's requirements	Progressive
EMBANKMENT CONSTRUCTION		
Placing Fill for Embankment Construction		
C231.26.5 – Grading of Fill Materials	Obtain direction for alternative material sources	Progressive
Fill Adjacent to Structures		
C231.31.2 – Time of Placement	Obtain approval for backfill if less than 21 days	Progressive



COONAMBLE SHIRE COUNCIL

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
VERSION 3.1	Specification Version 3.1 referenced	C220.01.2	A	KD	11/03/10
	Scope of works extended and requirements for Inspections added	C220.02	A		
	Standards updated, specification Version 3.1 referenced	C220.04.1	M		
	Specification Version 3.1 referenced	C220.05.1	A		
	Witness Point added	C220.05.2	A		
	Hold Point added	C220.05.3	A		
	Hold Point added	C220.06.3	A		
	Specification Version 3.1 referenced	C220.07.1	A		
	Specification Version 3.1 referenced, Hold Point added	C220.07.4	A		
	Specification Version 3.1 referenced	C220.07.7	A		
	Specification Version 3.1 referenced, Witness Point added	C220.07.6	A		
	Specification Version 3.1 referenced	C220.09.1	A		
	Specification Version 3.1 referenced	C220.10.1	A		
	Specification Version 3.1 referenced	C220.11.1	A		
	Specification Version 3.1 referenced	C220.15	A		
	Annexure added	C220-A	A		

**SPECIFICATION C220
STORMWATER DRAINAGE – GENERAL**

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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 - Version 3.1
C222	-	Precast Box Culverts - Version 3.1
C223	-	Drainage Structures - Version 3.1
C224	-	Open Drains, including Kerb and Gutter - Version 3.1

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.
- (f) demolition and removal of existing redundant pipes and drainage 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**

3. The Contractor shall give notice so that inspection may be made of all HOLD POINTS and WITNESS POINTS documented in this specification and tabulated in Annexure C211-A. Release of HOLD POINTS and WITNESS POINTS shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority, where stipulated in Annexure C220-A. **Inspections**

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.*

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 - Version 3.1
C213	-	Earthworks - Version 3.1
C271	-	Minor Concrete Works - Version 3.1

(b) Australian Standards

AS 1141	Methods for sampling and testing aggregates
AS 1141.11.1-2009	Particle size distribution - Sieving method
AS 1289	Methods of testing soils for engineering purposes
AS 1289.3.2.1-2009 --	Soil classification tests - Determination of the plastic limit of a soil - Standard method
AS 1289.3.3.1-2009 -	Soil classification tests - Calculation of the plasticity index of a soil
AS 1289 4.3.1-1997 -	Soil chemical tests - Determination of the pH value of a soil - Electrometric method
AS 1289 4.4.1-1997-	Soil chemical tests - Determination of the electrical resistivity of a soil - Method for sands and granular materials
AS 1289.5.4.1-2007 -	Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1 – 2006 -	Soil compaction and density tests - Compaction control test – Hilf density ratio and Hilf moisture variation (Rapid Method)
AS/NZS 2041:1998	Buried corrugated metal structures
AS/NZS 2566	Buried flexible pipelines
AS/NZS 2566.1-1998	Structural design - Commentary
AS/NZS 2566.2-2002	Installation
AS 3600-2009	Concrete structures
AS 3725- 2007	Design for installation of buried concrete pipes
AS 3735-2001	Concrete structures retaining liquids

(c) Other

NSW Department of Environment and Climate Change

RESOURCE NSW – *Specification for Supply of Recycled Materials for Pavements, Earthworks and Drainage*, 2003.

NSW Department of Environment and Conservation – 2006
Managing Urban Stormwater – Harvesting and Reuse.

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 - VERSION 3.1. **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. This is a **WITNESS POINT**. **Contractor's Responsibility (WP)**
3. The Contractor shall not implement any proposals to dam up or divert existing watercourses (either temporarily or permanently) without prior approval by way of approved Drawings or written instruction. This is a **HOLD POINT**. **Limitations (HP)**
4. The Contractor's material and equipment shall be located clear of watercourses or secured so that they will not cause danger or damage in the event of large runoff flows. **Location of Equipment**

C220.06 SITING OF CULVERTS

1. Before commencing construction of any culvert, the Contractor shall set out on site the culvert inlet and outlet positions to the location and levels shown on the Drawings, and shall present this set-out for inspection by the Superintendent. **Set-out**
2. The Superintendent 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 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 is obtained. This is a **HOLD POINT**. **Proposed Changes by Contractor (HP)**

AUS-SPEC #1

C220.07 EXCAVATION

1. Before undertaking stormwater drainage excavation, topsoil shall be removed in accordance with the Specification for EARTHWORKS - VERSION 3.1. **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 to the method of excavation before commencing excavation. **Approval by Public Utility Authorities**
4. Excavation by blasting shall not be undertaken unless written approval is gained from the PCA. This is a **HOLD POINT**. if permitted, 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 -VERSION 3.1. **Blasting Operation (HP)**
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 - VERSION 3.1 by the Contractor and replaced with backfill material in accordance with the requirements of this Specification and the Specifications for particular culvert types. This is a **WITNESS POINT**. 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 (WP)**
7. The excavated material shall be used in the construction of embankments backfilling or spoiled in accordance with the Specification for EARTHWORKS - VERSION 3.2. **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.

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C220.09 COMPACTION

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

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

Compaction requirements adjacent to pipe drainage for concrete, steel or UPVC pipes are set out in the specification for PIPE DRAINAGE - VERSION 3.1.

2. All material shall be compacted in layers not exceeding 150 mm compacted thicknesses. 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 – VERSION 3.1 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 - VERSION 3.1.

Standard

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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:		C220.09
	• below 1.5m of finished surface	95%	
	• within 1.5m of finished surface	100%	
	(e) Backfill material within the selected material zone	100%	C220.09
3.	Backfill		
	(a) Layers	≤ 150mm	C220.09
	(b) Moisture Content	>60%, <95%	C220.09

Table C220.1 - Summary of Limits and Tolerances

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 - VERSION 3.1.
5. Topsoil removal is measured and paid in accordance with the Specification for EARTHWORKS - VERSION 3.1.
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 - VERSION 3.1.
7. Sprayed concrete work is measured and paid in accordance with the Specification for MINOR CONCRETE WORKS - VERSION 3.1.
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 - VERSION 3.1.

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) UPVC Pipes

Width: For pipes of:-

Ext. dia at collar $\geq 75 \leq 150$	external diameter of pipe plus 200mm.
Ext. dia at collar $> 150 \leq 300$	external diameter of pipe plus 300mm
Ext. dia at collar $> 300 \leq 450$	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.

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ANNEXURE C220-A**INSPECTIONS****Notice**

Give notice so that the inspection may be made of the following:

Summary of HOLD POINTS

Clause title/Item	Requirement	Notice for inspection	Release by
CONSTRUCTION			
Temporary Drainage During Construction			
C220.05.3 - Limitations	Obtain written approval to dam or divert existing watercourses	2 weeks prior to commencing site work	Superintendent – PCA concurrence required
Siting of Culverts			
C220.6.3 – Proposed Changes by Contractor	Obtain written notice of any proposed changes to culvert set-out or design.	2 weeks prior to commencing site work	Superintendent – PCA concurrence required
Excavation			
C220.07.4 – Blasting Operation	Obtain written approval to blast	2 weeks prior to commencing site work	Superintendent – PCA concurrence required

Summary of WITNESS POINTS

Clause title/Item	Requirement	Notice for inspection
CONSTRUCTION		
Temporary Drainage During Construction		
C220.05.2 – Contractor's responsibility	Provision for run off flows	Progressive
Excavation		
C220.07.6 Unsuitable material	Replace with backfill material	Progressive



CONSTRUCTION SPECIFICATION

C221

PIPE DRAINAGE

VERSION 3.1 – December 2021

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
VERSION 3.1	Specification Version 3.1 reference	C221.01.2	A	DJ	29/11/2021
		C221.02.1	A		
	Specification Version 3.1 reference	C221.01.5	A		
	Inspection requirements added	C221.02.1	A		
	Additional standards added	C221.03.1	A		
	Hold Point added	C221.03.5	A		
	Witness Point added	C221.03.6	A		
	Specification Version 3.1 reference, Witness Point added	C221.03.8	A		
	Witness Point added	C221.05.1	A		
	Witness Point added	C221.05.3	A		
	Witness Point added	C221.06.4	A		
	Witness Point added	C221.06.7	A		
	Witness Point added	C221.07.4	A		
	Specification Version 3.1 reference	C221.07.5	A		
		C221.08.2.& 5	A		
	Hold Point added	C221.14.3	A		
	Specification Version 3.1 reference	C221.16(b).	A		
		C221.17.4	A		
	Witness Point added	C221.18.4	A		
	Specification Version 3.1 reference	C221.19.5	A		
	Specification Version 3.1 reference	C221.21.3	A		
	Specification Version 3.1	C221.22.4	A		

PIPE DRAINAGE – COONAMBLE

	reference	C221.27	A		
	Specification Version 3.1 reference	C221 - A	A		
	Specification Version 3.1 reference				
	Specification Version 3.1 reference				
	Specification Version 3.1 reference				
	Annexure added				

SPECIFICATION C221 - PIPE DRAINAGE

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SPECIFICATION C221 : PIPE DRAINAGE

GENERAL

C221.01 SCOPE

1. This Specification covers the supply and installation of pipe culverts and pipe arches for stormwater drainage. **Scope**
2. This Specification should be read in conjunction with the specification for STORMWATER DRAINAGE – GENERAL - VERSION 3.1. **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**
5. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C221-A.. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority, where stipulated in Annexure C221-A. **Notice**

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
C223	-	Drainage Structures
C230	-	Subsurface Drainage
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1141	Methods for sampling and testing aggregate
AS 1141.11.1-2009	- 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	Methods of testing soils for engineering purposes
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 1646:2007	Elastomeric seals for waterworks purposes.

AS 1762:1984	Helical lock-seam corrugated steel pipes - Design and installation.
AS 2032	- Code of practice for installation of UPVC pipe systems.
AS/NZS 2041	Buried corrugated metal structures.
AS/NZS 2566	Buried flexible pipelines
AS/NZS 2566.1:1998	- Structural design
AS/NZS 2566.2:2002	- Installation
AS 3600:2001	Concrete structures
AS 3725:2007	Loads on buried concrete pipes – Commentary (Supplement to AS/NZS 3725:2007)
AS/NZS 2566	Paints for steel structures
AS/NZS 3750.9:1994	Organic zinc-rich primer.
AS/NZS 3750.15:1998	Inorganic zinc silicate paint.
AS 3887	Paints for steel structures - Coal tar epoxy.
AS 4058:2007	Precast concrete pipes (pressure and non-pressure).
AS 4139:2003	Fibre reinforced concrete pipes and fittings.
AS/NZS 4680:2006	Hot-dip galvanised (zinc) coatings on fabricated ferrous articles.
AS/NZS ISO 9001:2008	Quality management systems - Requirements.

(c) AASHTO Standard

M190:2004	Bituminous coated corrugated metal culvert pipe and pipe arches.
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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 AS/NZS ISO 9001. This is a **HOLD POINT**.

Compliance with Quality Plan (HP)

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. Works completed on classified roads are to comply with Traffic for NSW requirements. This includes administrative and technical directions.

Certification

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

- Class and size.
- Manufacturer's name.
- Date of casting.

Marking

4. 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

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

Tolerances (WP)

6. 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 - VERSION 3.2. This is a **WITNESS POINT**.

Subsurface Drain (WP)

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

Safety

8. 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. This is a **WITNESS POINT**.

**Construction
Plant
Movement
(WP)**

9. All trunk stormwater drainage lines shall be constructed using reinforced concrete pipes. Interallotment drainage lines shall be constructed using reinforced concrete pipe or fibre reinforced cement pipes. The use of other materials for interallotment drainage lines is prohibited.

Materials

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 (Minimum class 4) 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. Twin wall polyethylene pipe equivalent to SN8 up to the size of 600mm may be used in pipe drainage

**Twin Wall
Polyethelene**

4. 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. This is a **WITNESS POINT**.

**Formation to
Subgrade
Level (WP)**

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

**Normal Trench
Conditions**

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

**Wide Trench
Conditions**

**Design Check
(WP)**

- ### Pipe Support Type

- ### Bedding Dimensions



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

D = External diameter of pipe

Table C221.1 - Pipe Installation Dimensions.

- ## 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. This is a **WITNESS POINT**.

Source (WP)

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. This is a **WITNESS POINT**.

Compaction Requirements

Design Check (WP)

		Pipe Support Type						
		U	H1	H2	H3	HS1	HS2	HS3
Minimum Relative Compaction %	Bed and Haunch Zones	—	50	60	Concrete	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 are 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 - VERSION 3.1 on all lines where the pipe gradient exceeds 5 per cent.

Bulkheads

5. The Contractor shall present the laid and jointed pipes for inspection by the Superintendent prior to commencement of trench backfilling. This is a **HOLD POINT**.

Inspection by Superintendent (HP)

(b) Joints in Reinforced Concrete Pipes

(i) Rubber Ringed Joints

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

Clean and Dry Material

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

Procedure for Rolling Rubber Rings

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

Joint Test

4. Where wedge shaped "skid" rubber rings are prescribed the Manufacturer's instructions, which include the use of lubricants, shall be followed.

"Skid" Rings

(ii) Flush or Butt Joints

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

Jointing

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

Sealing

(c) Joints in Fibre-Reinforced Cement Pipes

(i) New Pipes

1. Joints shall be of a flexible type. Rubber rings shall be used to seal joints in both rebated and spigot and socket jointed pipes in the manner specified in Clause 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 - VERSION 3.2. 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 - VERSION 3.1, shall be backfilled with material satisfying the requirements for embankment material as defined in the Specification for EARTHWORKS - VERSION 3.1. 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 - VERSION 3.1.

Trench Backfill

6. When compacted adjacent to culverts or drainage structures, the Contractor shall adopt compaction methods which will not cause damage or misalignment to any culvert or drainage structure. 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 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. | Protective Treatment |

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

- | | |
|--|---------------------------------|
| 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 | Engineer's Certification |
|--|---------------------------------|

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.

5. The Contractor shall nominate the sources of the various materials and submit documentary evidence to the Superintendent 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. This is a **HOLD POINT**.

**NATA Testing
(HP)**

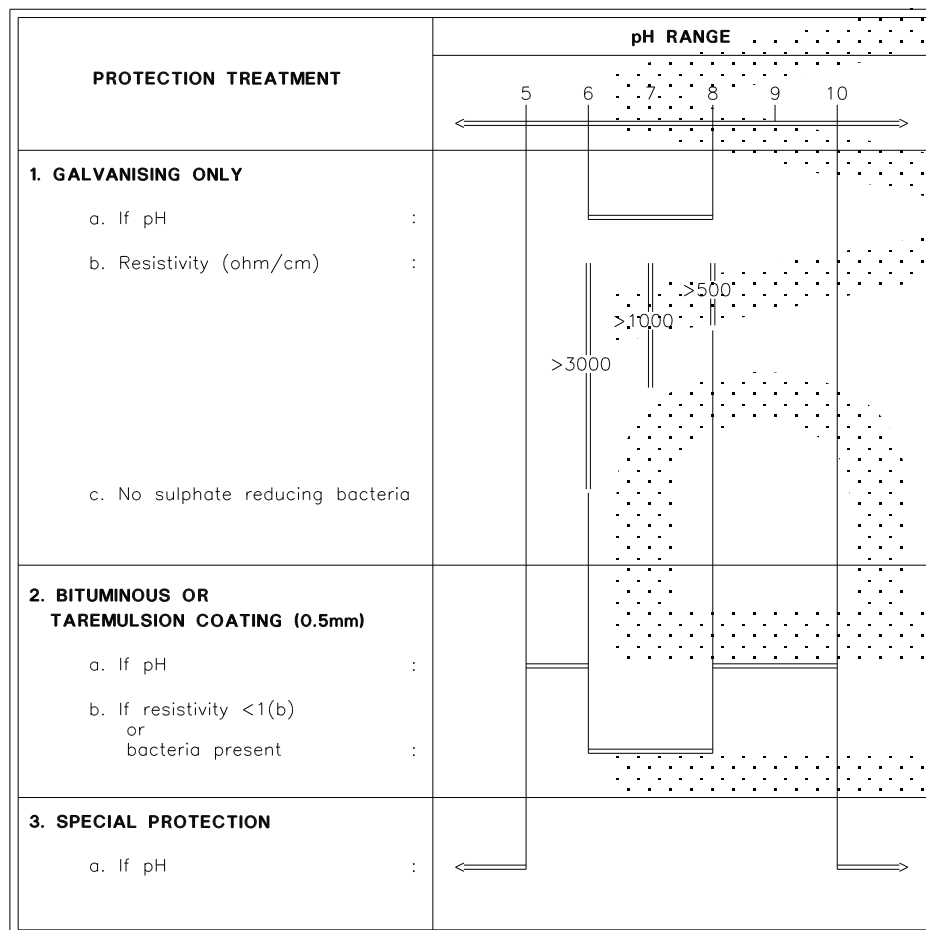


Figure C221.2 - Corrosion Protection Requirements For Steel Structures

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.
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.
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. This is a **WITNESS POINT**. 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.
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.

**Formation to
Subgrade
Level**

**Trench Width
Select Fill**

**Unsuitable
Material (WP)**

**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.
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.

**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.
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 rerolled 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.
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 - VERSION 3.2, to prevent loss of sand backfill or bedding into the pipe.

Method

**Ends to be
Rerolled**

**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 - VERSION 3.1, shall be backfilled with material satisfying the requirements for embankment material as defined in the Specification for EARTHWORKS - VERSION 3.2. 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 - VERSION 3.2.

Trench Backfill

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 - VERSION 3.2.

**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*". 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.

Specification

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/NZS 2566.2, Table 5.5)

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 - VERSION 3.2.

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.
2. Figure C221.3 and Table C221.5 indicate the dimensions of bedding and backfilling for pipes laid in trench conditions and embankment conditions, unless otherwise indicated on the Drawings.

Formation to Subgrade Level

Bedding Dimensions

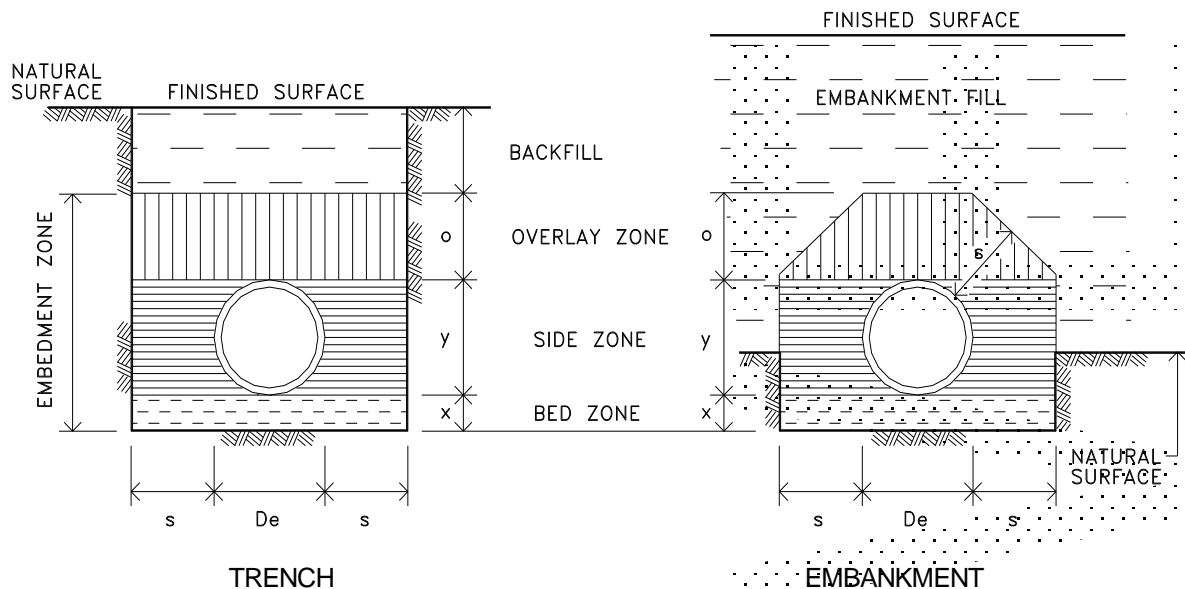


Figure C221.3 - Pipe Installation Conditions

(Figure taken from AS 2566.2)

Extreme External Dia (De)mm	Minimum Dimensions (mm)			
	x	s	o	y
$\geq 75 \leq 150$	75	100	100	Pipe dia.
$> 150 \leq 300$	100	150	150	Pipe dia.
$> 300 \leq 450$	100	200	150	Pipe dia.
$> 450 \leq 900$	150	300	150	Pipe dia.
$> 900 \leq 1500$	150	350	200	Pipe dia.
$> 1500 \leq 4000$	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 C221.5 - 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

(Table 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 Joining**
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 - VERSION 3.2. **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 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 150 mm 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 - VERSION 3.2, shall be backfilled with material satisfying the requirements for embankment material as defined in the Specification for EARTHWORKS - VERSION 3.2. 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 - VERSION 3.2.

Trench Backfill

SPECIAL REQUIREMENTS

C221.23 RESERVED

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	$\pm 10\text{mm}$	C221.03
	(b) Horizontal Alignment	$\pm 10\text{mm}$	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	$> 100\text{mm}$	C221.18
6.	Bedding Zone Compaction	$\geq 95\%$	C221.20
7.	Backfill - UPVC Pipes		
	(a) Side and Overlay Zone Compaction	$\geq 95\%$	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 - VERSION 3.2.
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 - VERSION 3.2.
6. Sprayed concrete invert protection is measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS - VERSION 3.2.
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 - VERSION 3.2.
8. Bulkheads are measured and paid in accordance with the Specification for DRAINAGE STRUCTURES - VERSION 3.2.

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

ANNEXURE C221- A

INSPECTIONS

Summary of HOLD POINTS

Clause title/Item	Requirement	Notice for inspection	Release by
COMMON REQUIREMENTS			
GENERAL			
C221.03.1 - Compliance with Quality Plan	Provide documentary evidence of manufacture of pipes	2 weeks prior to commencing site work	Superintendent
PRECAST REINFORCED CONCRETE, POLYETHYLENE AND FIBRE REINFORCED CONCRETE PIPES			
Laying			
C221.07.5 - Inspection by Superintendent	Call for inspection	1 working day	Superintendent
STEEL PIPES AND PIPE ARCHES			
Materials Against Steel Structures			
C221.13.5 - NATA testing	Provide documentation	2 weeks prior to delivery	Superintendent
FLEXIBLE PIPES			
Installation			
C221.21.4 - Approval	Call for inspection	1 working day	Superintendent

Summary of WITNESS POINTS

Clause title/Item	Requirement	Notice for inspection
COMMON REQUIREMENTS		
GENERAL		
Tolerances	Culvert alignment	Progressive
Subsurface drainage	Enclose pipe in tubular filter fabric	Progressive
Construction plant movement	Design and provide protective measures for crossings	Progressive
PRECAST REINFORCED CONCRETE AND FIBRE REINFORCED CONCRETE PIPES		
Excavation		
C221.05.1 - Formation to subgrade level	Lay pipe at subgrade level	Progressive
C221.05.3 - Wide trench conditions	Design check for compliance	Progressive
Bedding		
C221.06.4 -Source	Provide source of bedding material	2 weeks prior to delivery
C221.06.6 - Design check	Confirm pipe suitability	Progressive
STEEL PIPES AND PIPE ARCHES		
Excavation and Foundation Preparation		
C221.14.3 - Unsuitable Material	Advise Superintendent	Progressive



COONAMBLE SHIRE COUNCIL

CONSTRUCTION
SPECIFICATION

C224

**OPEN DRAINS
INCLUDING KERB & CHANNEL**

SPECIFICATION C224 - OPEN DRAINS, INCLUDING KERB AND CHANNEL

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SPECIFICATION C224 : OPEN DRAINS, INCLUDING KERB AND CHANNEL**GENERAL****C224.01 SCOPE**

1. The work to be executed under this Specification consists of the construction, lining and protection of all types of open drains including the construction of rock filled wire mattresses and gabions.

2. This Specification should be read in conjunction with the Specification for STORMWATER DRAINAGE - GENERAL, and other drainage Specifications as applicable:

C221	-	Pipe Drainage
C222	-	Precast Box Culverts
C223	-	Drainage Structures

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

Quality**C224.02 DEFINITION**

1. Open drains are all drains other than pipe and box culverts and include catch drains, contour drains, diversion drains, table drains, batter drains, swales, channels, and kerbs and channels.

Definition**C224.03 REFERENCE DOCUMENTS**

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

**Documents
Standards
Test Methods****(a) Council Specifications**

C211	-	Control of Erosion and Sedimentation
C220	-	Stormwater Drainage - General
C221	-	Pipe Drainage
C222	-	Precast Box Culverts
C271	-	Minor Concrete Works
C273	-	Landscaping

(b) Australian Standards

AS 1141.22	-	Wet/dry strength variation
AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1	-	Compaction control test (rapid method)
AS 2758.4	-	Aggregate for gabion baskets and wire mattresses
AS 2876	-	Concrete kerbs and channels - Manually or machine placed
AS/NZS 4534	-	Zinc and zinc/aluminium-alloy coatings on steel wire.

(c) Other

AUSTROADS	-	Guide to Geotextiles
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UNLINED OPEN DRAINS

C224.04 GENERAL

1. Unless shown otherwise on the Drawings, drains shall be vee shaped or of trapezoidal cross section and shall not be less than 300mm deep and have a minimum waterway area of 0.2 square metres. **Shape**
2. Open drains shall be graded to ensure free flow of water and, shall not have a grade of less than 1 per cent. **Grade**
3. Where trees marked for preservation or rock outcrops occur in the line of a drain, the drain may be neatly diverted if approved by the Superintendent. **Trees and Rock Outcrops**
4. Open drains shall be extended as necessary to lead the water clear of the work to natural drainage depressions, culverts, or pits connected to underground drainage systems. The drains shall follow existing watercourses and depressions in the natural surface, unless other locations are shown on the Drawings. **WP**
Open Drains
5. Open drains shall be located and constructed so as to avoid recharging groundwater encouraging a shallow watertable and creating or worsening salinity degradation of adjacent land. **Salinity Prevention**
6. All work shall be undertaken in accordance with the requirements of the Specification for CONTROL OF EROSION AND SEDIMENTATION. **Control of Erosion**

C224.05 TYPES

1. Catch drains shall be provided above the tops of cuttings or along the toes of embankments where shown on the Drawings before construction of the adjacent roadway. The edges of catchdrains shall be positioned not be less than 2m from the tops of cuttings or the toes of embankments nor more than is necessary to maintain the fall of the drains. **Catch Drains**
2. Minor diversion and contour drains shall be constructed where shown on the Drawings or directed by the Superintendent. Minor diversion drains shall have the same capacity as the nearest pipe culvert on the line of the drain unless otherwise approved by the Superintendent. **Diversion & Contour Drains**
3. Table drains, swales and depressed medians shall be constructed to the line and level shown or calculated from the Drawings. Their construction is deemed to be part of earthworks. **Table Drains**
4. Inlet, outlet and diversion channels shall be excavated as shown on the Drawings and, unless indicated otherwise, shall extend to join the existing stream bed in a regular manner, avoiding disturbance in stream flow. The channel shall be excavated to the full width of the structure but the existing stream bed shall be preserved as far as possible outside the limits of the excavation. **Channels**

C224.06 CONSTRUCTION

1. Material excavated from drains shall be placed on the lower sides of the drains and formed as banks with slopes not steeper than 4h:1v on the cross section of the bank to increase the capacity of the drains. This material shall be compacted in accordance with AS 1289.5.4.1 and shall be not less than 95 per cent for standard compactive effort. **Excavated Material**
2. The Contractor shall ensure that none of the activities associated with the work disturbs any watercourse outside the site. Any excavation below the level of the natural **Contractor's Responsibility**

channel shall be backfilled with suitable material compacted to a density equal to and compatible with that existing naturally.

3. Any excess material shall be legally and responsibly disposed of by the Contractor.

***Excess
Material***

4. Unlined drains and areas adjacent to open drains shall be revegetated immediately after the drains are complete, in accordance with the Specification for LANDSCAPING.

Revegetation

LINED OPEN DRAINS

C224.07 GENERAL

1. Lined open drains shall be formed as for unlined open drains with the inclusion of a lined invert in accordance with the Drawings.

Shape

2. Lining shall conform to the profile of the drain and shall be provided as soon as possible after forming the drain.

Profile

3. Before placing any lining material, the foundation material shall be shaped and compacted to form a firm base for the lining. Other than for kerb and channel constructed on pavement courses, the relative compaction, as determined by AS 1289.5.7.1 or AS 1289.5.4.1 shall not be less than 95 per cent for standard compactive effort.

***Compaction of
Foundations***

C224.08 CONCRETE LINING

1. Concrete lining for open drains shall be cast-in-situ or sprayed concrete supplied and placed in accordance with the Specification for MINOR CONCRETE WORKS. Weepholes shall be provided in the concrete at intervals of 2m or as determined by the Superintendent.

Method

2. Contraction joints in concrete lining, consisting of narrow transverse and vertical grooves, 20mm deep, shall be formed neatly in the surface of the freshly placed concrete at intervals of 3m unless otherwise specified by the Superintendent. Expansion joints shall be placed at intervals not more than 15m and shall consist of preformed jointing material of bituminous fibreboard and shall be of sufficient depth to fill the joint.

Jointing

C224.09 STONE PITCHING

1. Stone Pitching shall consist of sound durable rock not less than 100mm thick, properly bedded on approved loam or sand and mortared to present a uniform surface. The exposed surface of each stone or block shall be approximately flat and not less than 0.05 square metres in area. Spaces between adjacent stones or blocks shall not exceed 20mm in width.

***Rock Quality
and Placing***

C224.10 BATTER DRAINS

1. Batter drains shall be constructed using either half round steel pipes or precast nestable concrete units as shown and detailed on the Drawings.

Type

2. The units shall be installed in carefully excavated and template controlled trench to produce an even rim line of +0mm to –50mm from the batter line at the underside of topsoil.

Installation

3. Any over excavation and undulations in the batter line shall be backfilled and both sides of the drain compacted over the full length to form a firm shoulder against the rim of the batter drain.

Compaction

4. When topsoil is placed it shall be tapered over a width of 1m to zero thickness at the rim of the drain. Both sides of the drain shall then be turfed for minimum width of 600mm and pinned down as provided in the Specification for LANDSCAPING.

Topsoil and Turfing

C224.11 PROPRIETARY PRODUCTS

1. Unless shown on the Drawings, proprietary products may only be used with the approval of the Superintendent. Where specified, they must be used strictly in accordance with the manufacturer's instructions.

Manufacturer's Instructions

C224.12 KERB AND CHANNEL

1. Kerb and/or channels may be constructed in fixed forms, by extrusion or by slip forming, in accordance with AS 2876.

Method

2. The foundation, concrete quality, curing and testing details shall be in accordance AS 2876.

Construction Details

3. The top and face of the finished kerb and channel shall be true to line and the top surface shall be of uniform width, free from humps, sags or other irregularities. Kerb and channel shall have a steel float finish.

Finish

4. The level at any point on the surface of the channels shall be within $\pm 10\text{mm}$ of design levels. When a straight edge 3m long is laid on top of or along the face of the kerb or on the surface of channels, the surface shall not vary more than 5mm from the edge of the straight edge, except at kerb laybacks, grade changes or curves or at side entry pits requiring channel depression.

Tolerances

5. Unless shown otherwise on the Drawings, contraction joints, shall be formed every 3m of channel length for a minimum of 50 per cent of cross sectional area. The joint shall be tooled 20mm in depth to form a neat groove of 5mm minimum width.

Contraction Joints

6. Unless shown otherwise on the Drawings, expansion joints, 15mm in width for the full depth of the kerb and channel, shall be constructed at intervals not exceeding 15m and where the channel abuts against side entry pits, retaining walls and overbridges. Expansion joints shall consist of a preformed jointing material of bituminous fibreboard.

Expansion Joints

7. Where kerbs and/or channels are cast adjacent with a concrete pavement the same type of contraction, construction and expansion joints specified in the concrete base shall be continued across the kerb and/or channel.

Adjacent Concrete Pavement

8. All house stormwater outlets shall be provided and/or extended, to match the existing type and size of pipe, through the kerb as shown on the Drawings. Pipework shall be in accordance with the requirements for UPVC pipes in the Specification for PIPE DRAINAGE, or as directed by the Superintendent for other types of pipe.

Stormwater Outlets

9. Opposite all driveways, where shown on the Drawings or where directed by the Superintendent, barrier kerb shall be discontinued to provide for vehicular or pedestrian access. At such locations, kerb laybacks shall be constructed in accordance with the Drawings. Footpath crossovers shall be constructed to meet the laybacks as shown on the Drawings, or reinstated to match existing materials where not otherwise shown.

Vehicular or Pedestrian Access

10. After the new kerb and channel has been constructed and not earlier than three days after placing, the spaces on both sides of the kerb and/or channels shall be backfilled and reinstated in accordance with the Drawings, or as instructed by the Superintendent.

Backfill Timing

- | | |
|--|-------------------------------------|
| 11. Backfill material behind the kerb shall consist of granular material, free of organic material, clay and rock in excess of 50mm diameter, or material as approved by the Superintendent. | <i>Backfill
Material</i> |
| 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. | <i>Behind Kerb</i> |
| 13. Pavement material adjacent to new channel shall be backfilled in accordance with the Drawings or as directed by the Superintendent. | <i>Pavement</i> |

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. | <i>Location and
Geotextile</i> |
|--|---|

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. | <i>Dimensions</i> |
|---|--------------------------|

(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. | <i>Mattress
Dimension</i> |
| 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. | <i>Wire
Dimensions</i> |

(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 | <i>Type</i> |
|--|--------------------|

AUSTROADS Guide to Geotextiles, shall be used.

2. Samples, manufacturer's specification and instructions on installation shall be submitted to the Superintendent seven days before the intended use of geotextile.

Sample

(d) Rock Fill Material

1. The rock fill shall consist of clean hard rock complying with the requirements of AS 2758.4.

Rock Quality

2. Rock fill for gabions shall have particle sizes between 100mm and 250mm and preferably not greater than 200mm. Rock fill material may be placed by hand or suitable mechanical device to ensure fill is tightly packed with a minimum of voids. Fill material shall be levelled off 25mm to 50mm above the top of the mesh to allow for settlement.

For Gabions

3. Rock fill for wire mattresses shall have particle sizes between 75mm and two-thirds of the mattress thickness, or 250mm, whichever is the lesser. When the mattress is on a slope, rock fill material shall be placed into the units starting from the low end. Units shall be filled slightly overfull by 25mm to 50mm to allow for settlement and to provide an even tight and smooth surface of the required contour.

**For Wire
Mattresses**

C224.15 ASSEMBLY AND ERECTION

1. Before laying out the gabions or wire mattresses, geotextile shall be placed on the founding material. The edges of wire mattresses shall be firmly tied to galvanised star pickets driven a minimum of 900mm into the surrounding ground at 1m maximum intervals and the star pickets cut off level with the top of the mattress. The upstream edge of wire mattresses shall be folded down into a trench of minimum depth 300mm and filled with rock fill. This edge shall be tied to star pickets.

Procedure

LIMITS AND TOLERANCES

C224.16 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C224.1 below.

Item	Activity	Limits/Tolerances	Spec Clause
1.	Open Drains - General		
	(a) Grading	Grade >1%	C224.04
	(b) Depth	>300mm	C224.04
	(c) Waterway Area	>0.2 sq m	C224.04
	(d) Catch Drain Location	>2m from top of cuttings or toes of embankments	C224.05
	(e) Compaction	>95% (standard compaction)	C224.06
2.	Open Drains - Lining		
	(a) Compaction of Foundation	>95% (standard compaction)	C224.07
3.	Stone Pitching		
	(a) Rock Dimensions	>100mm thickness	C224.09
	(b) Exposed Surface Area	>0.05 sq m	C224.09
	(c) Spaces between Stones	<20mm width	C224.09
4.	Batter Drains		
	(a) Rim line	+0, -50 from batter line	C224.10
	Kerb and Channel		
	(a) Compaction of foundation	To AS 2876	C224.12
5.	(b) Level of channel surface	Level ± 10 mm of design level	C224.12
	(c) Surface uniformity	Deviation of kerb and channel surface from 3m straight edge ≤ 5 mm	C224.12
	(d) Contraction Joints		
	(i) Area	$\geq 50\%$ of CS area	C224.12
	(ii) Groove Width	≥ 5 mm	C224.12
	(e) Expansion Joint Interval	≤ 15 m	C224.12
	(f) Backfill behind Kerb		
	(i) Layer thickness	≤ 150 mm	C224.12
	(ii) Compaction	>95% (standard compaction)	C224.12
6.	Rock Fill for Gabions and		

OPEN DRAINS - COONAMBLE

Item	Activity	Limits/Tolerances	Spec Clause
	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



COONAMBLE SHIRE COUNCIL

CONSTRUCTION SPECIFICATION

C241

STABILISATION

VERSION 3.1 – JANUARY 2022

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
VERSION 3.1	Specification Version 3.1 referenced, requirement for inspections added	C241.01	A	KD	16/03/10
	Specification Version 3.1 referenced, Standards amended	C241.02	M		
	Specification Version 3.1 referenced, Hold Point added	C241.03	A		
	Hold Point added	C241.05.4	A		
	Hold Point added	C241.05.5	A		
	Hold Point added	C241.06.3	A		
	Hold Point added	C241.07.3	A		
	Hold Point added	C241.08.3	A		
	Hold Point added	C241.09.3	A		
	Hold Point added	C241.10.4	A		
	Hold Point added	C241.12.1.	A		
	Witness Point added	C241.12.2	A		
	Witness Point added	C241.13(a).1	A		
	Hold Point added	C241.13(b).1	A		
	Witness Point added	C241.13(b).3	A		
	Witness Point added	C241.13(b).4	A		
	Hold Point added	C241.13(b).7	A		
	Hold Point added	C241.14(a).3	A		
	Witness Points added	C241.14(b).4	A		

STABILISATION - COONAMBLE

	Hold Point added	C241.15.2	A		
	Hold Point added	C241.15.3	A		
	Specification Version 3.1 referenced, Hold Point and Witness Points added	C241.16.2	A		
	Witness Point added	C241.18(c).2	A		
	Hold Point added	C241.19.1	A		
	Specification Version 3.1 referenced	C241.24	A		
	Annexure added	C241 - B	A		

SPECIFICATION C241 STABILISATION

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SPECIFICATION C241 STABILISATION

GENERAL

C241.01 SCOPE

1. This Specification defines the materials requirements for stabilised materials provided by stationary plant production as well as materials and process requirements for in-situ stabilisation.
2. The work to be executed under this Specification consists of the supply and incorporation of stabilising binders with material in a nominated pavement course or subgrade layer (including materials for the selected material zone, and selected backfill), at specified locations in the work and the spreading, compaction, trimming and curing of such materials.
3. This Specification provides the requirements for stabilisation of the types of pavement courses and subgrade zones or layers as shown in Table C241.1.

Scope

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 for FLEXIBLE PAVEMENTS - VERSION 3.1, or as indicated on the Drawings.
5. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements.

**Associated
Specifications**

Quality

6. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C241-B. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority, where stipulated in Annexure C241-B.

*Inspections***C241.02 REFERENCE DOCUMENTS**

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

*Documents
Standards
Test Methods***(a) Council Specifications**

C201	-	Control of Traffic - Version 3.1
C213	-	Earthworks - Version 3.1
C220	-	Stormwater Drainage – General - Version 3.1
C242	-	Flexible Pavements - Version 3.1

(b) Australian Standards

AS 1141	Methods of sampling and testing aggregates
AS 1141.11.1:2009	Particle size distribution - sieving method.
AS 1289	Methods of testing soils for engineering purposes.
AS 1289.4.2.1:1997	Soil chemical tests - Determination of the sulfate content of a natural soil and the sulfate content of the ground water - Normal Method.
AS 1289.5.7.1:2006	Soil compaction and density tests - Compaction control test – Hilt density ratio and Hilt moisture variation (Rapid method)
AS 1289.5.8.1:2007	Soil compaction and density tests - Determination of field density and field moisture content of a soil using a nuclear surface moisture-density gauge - Direct transmission mode.
AS 1289.6.1.1:1998	Soil strength and consolidation tests - Determination of the California bearing ratio of a soil - Standard laboratory method for a remoulded specimen.
AS 2350	Methods of testing Portland and blended cements
AS/NZS 2350.4:2006	Setting time of Portland and blended cements.
AS 2350.9:2006-	Fineness of Portland fly ash cement.
AS 3582	Supplementary cementitious materials for use with Portland and blended cement
AS 3582.1:1998-	Fly ash.
AS 3582.2:2001	Slag - Ground granulated iron blast-furnace.
AS 3583	Methods of test for supplementary cementitious materials for use with Portland cement
AS 3583.3:1991	Determination of loss on ignition.
AS 3583.6:1995	Determination of relative water requirement and relative strength.
AS 3583.12:1991	Determination of available alkali.
AS 3583.13:1991	Determination of chloride ion content.
AS 3583.14:1991	Determination of insoluble residue content.
AS 3972	- Portland and blended cements

(c) Other Publications**Austrroads**

Glossary of Austrroads Terms

AGPT04D/06:2006 Guide to pavement technology, Part 4D – Stabilised materials

(d) NSW RTA Test Methods

T432:2001 - 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 C241-A and that the stabilised material meets the requirements of the Specification for FLEXIBLE PAVEMENTS - VERSION 3.1 if incorporated into the works as a pavement layer or alternatively the Specification for EARTHWORKS – VERSION 3.1 or STORMWATER DRAINAGE GENERAL - VERSION 3.1. This is a **HOLD POINT**.

**Contractor's
Responsibility**

(HP)

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 included in the New South Wales Government Quality Assurance Scheme at time of production.

**NSW QA
Scheme**

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. This is a **WITNESS POINT**.

**Proof of
Quality (WP)**

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. This is a **HOLD POINT**.

**Storage in
Excess of 3
months**

(HP)

C241.06 QUICKLIME

1. Quicklime, consisting essentially of calcium oxide in a highly reactive form, shall have the following properties at the point of spread:

Properties

- (i) Available Lime The content of calcium oxide, determined by AS 3583.12, shall not be less than 85 per cent.
- (ii) Slaking Rate The active slaking time shall not be greater than twenty minutes and the temperature rise on slaking, determined from the average of four samples tested in accordance with Test Method T432, shall not be less than 40°C in six minutes.

2. The particle size distribution of the quick lime determined by AS 1141.11 shall comply with the following requirements in Table C241.2.

Particle Size

3. Provide NATA laboratory test results to confirm that the quicklime supplied conforms with that specified. This is a **WITNESS POINT**.

Proof of Quality (WP)

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.

3. Provide NATA laboratory test results to confirm that the quicklime supplied conforms with that specified. Details are to include percentage of calcium hydroxide, fineness expressed by percentage by mass passing the 45 µm sieve and source. This is a **WITNESS POINT**.

Proof of Quality (WP)

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 (AS2350.9).

- (b) Relative strength (28 days) (AS 3583.6).
- (c) Source.

3. Provide NATA laboratory test results to confirm that the slag supplied conforms with that specified. Details are to include fineness expressed by percentage by mass passing the 45 µm sieve, relative strength (28 days) and source. This is a **WITNESS POINT**.

**Proof of
Quality (WP)**

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 (AS2350.9).
- (b) Loss on ignition (AS 3583.3).
- (c) Source.

3. Provide NATA laboratory test results to confirm that the flyash supplied conforms with that specified. Details are to include fineness expressed by percentage by mass passing the 45 µm sieve, loss on ignition and source. This is a **WITNESS POINT**.

**Proof of
Quality (WP)**

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 C241-A.

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).

4. Provide NATA laboratory test results to confirm that the blended stabilisation agent supplied conforms with that specified. Details to mill and batch information that is traceable to the supplier's source. This is a **WITNESS POINT**.

**Proof of
Quality (WP)**

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. Submission of a Work Plan constitutes a **HOLD POINT**.

Proposed Equipment and Procedures (HP)

2. Notwithstanding submission to the Superintendent of the Contractor's equipment and stabilisation procedures, the work shall meet all the Specification requirements, and Statutory Requirements for Occupational Health and Safety, and the Contractor shall perform such tests as specified as the work proceeds, to ensure compliance. Costs of such tests shall be borne by the Contractor. This action constitutes a **WITNESS POINT**.

Compliance Contractor's Cost (WP)

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. This is a **WITNESS POINT**.

Application Rate (WP)

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 C241- A.

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 is required. This is a **HOLD POINT**.

Application Process (HP)

2. Spreading shall be carried out using the mechanical spreader nominated in the Work Plan and subsequently approved by the Superintendent. Annexure C241-A 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 500m² of pavement treated (whichever is less) in each application of binder. This is a **WITNESS POINT**.

Tolerances (WP)

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 (m²).

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. This is a **WITNESS POINT**.

Load Cells

(WP)

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. This is a **HOLD POINT**.

**Construction
Traffic (HP)**

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. This is a **HOLD POINT**.

**Uniform
Mixture
Contractor's
Cost (HP)**

(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. This is a **WITNESS POINT**. The Superintendent may require that additional passes by the mixing equipment be carried out to improve the visual uniformity of the mix and/or the moisture content. Such additional work shall be carried out at no cost to the Principal. This is a **WITNESS POINT**.

**Additional
Mixing (WP)**

**Contractor's
Cost (WP)**

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 C241-A for the stabilising agent approved for the works. The Nominated Field Working Period shall be based on laboratory tests determining the time from mixing until such time as the calculated Wet Density for modified compaction procedures decreases by more than 2 percentage points. This testing shall be undertaken utilising AS 1289.5.7.1 and samples of the materials representative of those to be utilised in the works. This is a **HOLD POINT**.

**Based on
Laboratory
Tests**

(HP)

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. This is a **HOLD POINT**.

**Compaction
within Field
Working
Period (HP)**

C241.16 TRIMMING AND COMPACTION

1. After mixing the layer shall be trimmed and compacted in accordance with the Specification for FLEXIBLE PAVEMENTS - VERSION 3.1 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 slurring will not be accepted. This is a **HOLD POINT**. 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. This is a **WITNESS POINT**.

**Secondary
Trimming**

(HP)

**Contractor's
Cost
(WP)**

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. This is a **WITNESS POINT**.

**Straight Edge
Test**

(WP)

5. The stabilised layer shall be compacted over the entire area and depth so that the relative compaction determined by AS 1289.5.7.1 is not less than as detailed in the Specification for FLEXIBLE PAVEMENTS - VERSION 3.2, EARTHWORKS - VERSION

Compaction

3.2 or STORMWATER DRAINAGE GENERAL – VERSION 3.2, as appropriate.

6. To provide true relative compaction assessments the lots shall be sampled and tested within the nominated field working period in accordance with AS 1289.5.7.1. **Test Method**

7. The maximum wet density (modified compaction) will be determined by sampling immediately after the determination of field density and testing will be undertaken within 2 hours of sampling. This is a **HOLD POINT**. A determination of maximum wet density (modified compaction) representing the full layer depth is required for each sampling location when calculation of relative compaction is undertaken. **Wet Density (HP)**

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 **Method of Measurement**

design level.

(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. This is a **WITNESS POINT**.

Average Width (WP)

C241.19 CURING

1. The Contractor shall submit to the Superintendent details of the proposed method of curing as part of the Work Plan. This is a **HOLD POINT**.

Notice (HP)

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 C241-A 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	Limits Tolerances	Spec Clause
1.	Quicklime		
	a) Available Lime	>85% Calcium Oxide content	C241.06
	b) Slaking Rate	Active Slaking time < twenty minutes, and temperature rise on slaking not less than 40°C in six minutes (for an average of four samples).	C241.06
	c) Particle Distribution	Fraction passing AS Sieve: 100% for 13.2mm Sieve 96-100% for 9.5mm Sieve 70-100% for 4.75mm Sieve 0-90% for 2.36mm Sieve	C241.06
2.	Hydrated Lime		
	a) Available Lime	>80% Calcium Hydroxide	C241.07
	b) Particle Size	<2% residue on a 300 micron Sieve	C241.07
3.	Blended Stabilising Agents	Blend percentages shall not vary by more than $\pm 3\%$ 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 $\pm 10\%$ of the nominated rate	C241.13

STABILISATION - COONAMBLE

Item	Activity	Limits Tolerances	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 ± 15 mm 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 wheel path	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 for FLEXIBLE PAVEMENTS - VERSION 3.2 or EARTHWORKS - VERSION 3.2 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 of FLEXIBLE PAVEMENTS - VERSION 3.2.
4. Supply, spread and compact select material is measured and paid in accordance with the Specification for EARTHWORKS - VERSION 3.2.
5. Control of traffic is measured and paid in accordance with the Specification for CONTROL OF TRAFFIC - VERSION 3.2.
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 C241 - A

STABILISATION MIX DESIGN

Type of Stabilising Agent

.....

.....

Nominal Percentage of Stabilising Agent by Mass %

Spread Rate of Stabilising Agent for contractual purposes (kg/m²)

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

ANNEXURE C241- B

INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause/subclause	Requirement	Notice for inspection	Release by
INSPECTION, SAMPLING AND TESTING			
Materials proposed for use in the work			
C241.03.1 – Contractor's Responsibility	Submit NATA certificate of compliance	14 days prior to commencement of works	Superintendent – PCA concurrence required
MATERIALS			
Cement			
C241.05.5 – Storage in excess of 3 months	Re-test cement stored in excess of 3 months	2 working days prior to usage	Superintendent
STABILISATION PROCESSES			
General			
C241.12.1 - Proposed Equipment and Procedures	Submit Workplan for approval	14 days prior to commencement	Superintendent
Application of stabilising agent			
C241.13(b).1 - In situ –Application Process	Proposals for special processes of supply of stabilising agent into the mixing bowl	7 days prior to mixing	Superintendent
C241.13(b).7 – Construction Traffic	Prevent traffic from passing over spread material until mixing is complete	Progressive	Superintendent
MIXING			
C241.14(a).3 – Stationary Mixing Plant	Submit test results	Progressive	Superintendent
Field Working Period			
C241.15.2 – Based on Laboratory Tests	Submit test results of the proposed Field Working Period	3 working days prior to production stabilisation	Superintendent
TRIMMING AND COMPACTION			
C241.16.2 - Secondary Trimming	Work methods to exclude laminations and slurring	3 working days prior to production stabilisation	Superintendent
C241.16.7 – Wet Density	Undertake testing within 2 hours of sampling	Progressive	Superintendent
Curing			
C241.19.1 - Notice	Submit details of proposed curing method	As directed	Superintendent

Summary of WITNESS POINTS

Clause/subclause	Requirement	Notice for inspection
MATERIALS		
Cement		
C241.05.1 – Proof of Quality	Proof of quality and source	Progressive
Quicklime		
C241.06.3 – Proof of Quality	Proof of quality and source	Progressive
Hydrated Lime		
C241.07.3 – Proof of Quality	Proof of quality and source	Progressive
Ground Granulated Blast Furnace Slag		
C241.08.3 – Proof of Quality	Proof of quality and source	Progressive
Flyash		
C241.09.3 – Proof of Quality	Proof of quality and source	Progressive
Blended Stabilising Agent		
C241.10.4 – Proof of Quality	Proof of quality and source	Progressive
STABILISATION PROCESSES		
Quality Requirements		
Compaction	Adjustment of Field Working Period for site conditions	Progressive
Application of stabilising agent		
C241.13(a).1 - Stationary mixing plant – Application Rate	Monitoring application of stabilising agent at the plant	Progressive
C241.13(b).3 – In-Situ - Tolerances	Actual spread to be recorded and checked	Progressive
C241.13(b).4 – In-Situ – Load Cells	Record average spreading rate using load cells	Progressive
Mixing		
C241.14(b).4 - In situ – Additional Mixing	Visual inspection to ensure uniform mixing and record	Progressive
C241.14(b).4 - In situ – Additional Mixing	Additional passes of mixing equipment to improve uniformity	Progressive
Trimming and Compaction		
C241.16.2 – Secondary Trimming – Contractor's Cost	Survey to confirm pavement layer thickness remains within tolerances after trimming	Progressive
C241.16.4 -Straight Edge Test	Conform to surface tolerances prior to sealing or practical completion of work component	As directed by the Superintendent
Tolerances		
C241.18(c).2 -Average Width	Random measurement of stabilised layer width	As directed by the Superintendent



COONAMBLE SHIRE COUNCIL

CONSTRUCTION
SPECIFICATION

C242

FLEXIBLE PAVEMENTS

VERSION 3.1 – JANUARY 2022

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
VERSION 3.1	Specification Version 3.1 referenced, standards and references updated	C242.03.1	M	KD	17/03/10
	Inspection requirements added	C252.05.4	A		
	Specification Version 3.1 referenced	C252.06	A		
	Hold Point added	C242.08.7	A		
	Specification Version 3.1 referenced, Hold Point added	C242.09.	A		
	Specification Version 3.1 referenced. Hold Point and Witness Point added	C242.10.	A		
	Hold Point added	C242.12.1	A		
	Specification Version 3.1 referenced, Hold Point added	C242.13.	A		
	Hold Point added	C242.14.1	A		
	Hold Point added	C242.14.6	A		
	Hold Point added	C242.15.3	A		
	Hold Point added	C242.15.6	A		
	Hold Point added	C242.15.7	A		
	Hold Point added	C242.18.2	A		
	Hold Point added	C242.20.2	A		
	Hold Point added	C242.21.2	A		
	Hold Point added	C242.22(b).2	A		

	Hold Point added	C242.22(c). 4	A		
	Hold Point added	C242.23(a).1	A		
	Hold Point added	C242.23(a).2	A		
	Hold Point added	C242.23(b).1	A		
	Hold Point added	C242.23(b).3(ii)	A		
	Hold Point added	C242.23(b).3(iii)	A		
	Witness Point added	C242.24.2	A		
	Witness Point added	C242.24.3	A		
	Hold Point added	C242.24.4	A		
	Specification Version 3.1 referenced, Witness Point and Hold Point added	C242.25	A		
	Hold Points added	C242.26	A		
	Specification Version 3.1 referenced	C242.32	A		
	Annexure added	C242 - A	A		

SPECIFICATION C242 - FLEXIBLE PAVEMENTS – VERSION 3.1

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AUS-SPEC #1

SPECIFICATION 242 : FLEXIBLE PAVEMENTS – VERSION 3.1

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 – Version 3.2.

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.
- (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.

Definitions

C242.03 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

- | | | |
|------|---|--|
| C241 | - | Stabilisation - Version 3.1 |
| C244 | - | Sprayed Bituminous Surfacing - Version 3.1 |

AUS-SPEC #1

(b) Australian Standards

- AS 1141 Methods for sampling and testing aggregates
- AS 1141.3:1996 Sampling - aggregates
- AS 1141.14:2007 Particle shape, by proportional calliper.
- AS 1141.22:2008 Wet/dry strength variation.
- AS 1289 Methods of testing soils for engineering purposes.
- AS 1289.3.1.1:2009 Soil classification tests - Determination of the liquid limit of a soil - Four point Casagrande method.
- AS 1289.3.3.1:2009 Soil classification tests - Calculation of the plasticity index of a soil.
- AS 1289.3.6.1:2009 Soil classification tests - Determination of the particle size distribution of a soil - Standard method of analysis by sieving.
- AS 1289.3.6.3:2003 Soil classification tests - Determination of the particle size distribution of a soil - Standard method of fine analysis using a hydrometer.
- AS 1289.5.2.1:2003 Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using modified compactive effort.
- AS 1289.5.3.1:2004 Soil compaction and density tests - Determination of the field density of a soil - Sand replacement method using a sand-cone pouring apparatus.
- AS 1289.5.4.1:2007 Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio.
- AS 1289.5.8.1:2002 Soil compaction and density tests - Determination of field density and field moisture content of a soil using a nuclear surface moisture - density gauge - Direct transmission mode.
- AS 1289.6.1.1:1998 Soil strength and consolidation tests - Determination of the California bearing ratio of a soil - Standard laboratory method for a remoulded specimen.

(c) RMS (formerly RTA) Test Methods

- T114:2007 - Maximum Dry Compressive Strength of Road Construction Materials
- T116:2007 - Unconfined Compressive Strength of Remoulded Road Construction Materials
- T130:2007 - Dry Density - Moisture Relationship for Mixtures of Road Construction Materials (blended in the laboratory with cementitious binders)
- T131:2009 - Unconfined Compressive Strength of road construction (blended in the laboratory with cementitious binders) materials
- T160:2009 - Benkelman Beam Deflection Test – Deflect Measurement (Portable Beam)
- T171:2009 - Modified Texas Triaxial Compression Test for pavement materials

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(d) Other

NSW Department of Environment and Climate Change

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

AUSTROADS

Austrroads 2008 Glossary of Austrroads terms

AGPT03 – 2009 Guide to Pavement Technology Part 3 - Pavement surfacings

AGPT04A – 2008 Guide to Pavement Technology Part 4A: Granular base and subbase materials

AGPT04D – 2006 Guide to Pavement Technology Part 4D: Stabilised materials

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

4. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C242-A.. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority, where stipulated in Annexure C242-A.

Inspections

MATERIALS**C242.06 GENERAL**

1. The Contractor shall submit details of all constituents of the proposed base and subbase materials, including sources of supply and the proposed type and proportion of any binder. These details shall be submitted to the Superintendent, supported with test results from a nominated NATA registered laboratory confirming that the constituents comply with the requirements of this Specification. If the proposed base or subbase is a bound material, the Contractor shall submit a completed Annexure C241-A contained in the Specification for STABILISATION – VERSION 3.1.

**Details of
Proposed
Base and
Subbase to be
Submitted**

2. No material shall be delivered until the Superintendent has approved the source of supply.

**Source of
Supply**

3. If, after the Contractor's proposals have been approved, the Contractor wishes to make changes in any of the material constituents the Contractor shall inform the Superintendent in writing of the proposed changes. No delivery of material produced 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

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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, GMS40
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

AUS-SPEC #1

5. Base materials shall comply with the requirements of Table C242.3.

Base

Test Method	Description	Base Material Requirements			
		DGB20	GMB20	NGB20-2c	NGB20-2d
AS 1289.3.6.1	Coarse Particle Size Distribution % passing 75.0mm sieve % passing 53.0mm sieve % passing 37.5mm sieve % passing 26.5mm sieve % passing 19.0mm sieve % passing 13.2mm sieve % passing 9.5mm sieve % passing 6.7mm sieve % passing 4.75mm sieve % passing 2.36mm sieve % passing 0.425mm sieve % passing 0.075mm sieve	- - - 100 95-100 - - 50-70 - 35-55 - -	- - - 100 95-100 - 30-55 - 20-30 - -	- - - 100 93-100 71-87 47-70 35-56 14-32 6-20	- - - 100 93-100 71-87 47-70 35-56 14-32 6-20
AS 1289.3.6.3	Fine Particle Size Distribution Ratios expressed as percentages (for that portion of the material passing 2.36mm sieve) A. Pass 425µm sieve % B. Pass 75µm sieve % Pass 425µm sieve C. Pass 13.5µm sieve % Pass 75µm sieve	 35-55 35-55 35-60	 30-50 30-50 -	 - - -	 - - -
AS 1289.3.1.1	Liquid Limit (if non plastic) ▽	max 20	max 20	max 20	max 20
AS 1289.3.3.1	Plastic Limit (if plastic)	max 20	max 20	max 20	max 20
AS 1289.3.3.1	Plasticity Index ■	max 6	max 6	max 6	max 8
T114	Maximum Dry Compressive Strength on fraction passing 19mm sieve (only applies if Plasticity Index is less than 1)	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa
AS 1141.14	Particle Shape by Proportional Calliper % mis-shapen (2 : 1)	max 35	max 35	-	-
AS 1141.22	Aggregate Wet Strength ◇ For category 1 or 2a For category 2b or 2c For category 2d	 min 80 min 70 min 60	 min 150 min 130 min 100	 - - -	 - - -
AS 1141.22	Wet/Dry Strength Variation ◇ <u>Dry - Wet</u> % Dry For category 1 or 2a For category 2b or 2c For category 2d	 max 35 max 40 max 45	 max 30 max 30 max 30	 - - -	 - - -
AS 1289.6.1.1	4 day Soaked CBR (98% Modified Compaction)	-	-	80	60
AS 1289.D21	Water-soluble sulphate content (% SO ₄ by mass)	max 0.1%	max 0.1%	max 0.1%	max 0.1%
AS 1141.36	Total sulphur content (% S by mass)	max 1.5%	max 1.5%	max 1.5%	max 1.5%

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.

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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 % passing 37.5mm sieve % passing 26.5mm sieve % passing 19.0mm sieve % passing 13.2mm sieve % passing 9.5mm sieve % passing 6.7mm sieve % passing 4.75mm sieve % passing 2.36mm sieve % passing 0.425mm sieve % passing 0.075mm sieve	- - - 100 95-100 - - 50-70 - 35-55 - -	- 100 - - 50-85 - 30-55 - 25-50 -	- 100 - - 50-75 - 15-35 - 5-15 -	- - 100 96-100 - 65-89 - 47-80 32-67 14-42 6-26	100 95-100 80-97 - 48-85 - 35-73 25-58 10-33 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 % B. Pass 75µm sieve % Pass 425µm sieve C. Pass 13.5µm sieve % Pass 75µm sieve	35-55 35-55 35-60	35-60 35-60 35-65	25-50 25-50 -	- - -	- - -
AS 1289.3.1.1	Liquid Limit (if non plastic)	max 23	max 23	-	max 23	max 23
AS 1289.3.3.1	Plastic Limit (if plastic)	max 20	max 20	-	max 23	max 23
AS 1289.3.3.1	Plasticity Index	max 12	max 12	max 12	max 12	max 12
T114	Maximum Dry Compressive Strength on fraction passing 19mm sieve (only applies if Plasticity Index is less than 1)	min 1.0 MPa	min 1.0 MPa	-	1.0 MPa	1.0 MPa
AS 1141.14	Particle Shape by Proportional Calliper % mis-shapen (2 : 1)	max 35	max 35	max 35	-	-
AS 1141.22	Aggregate Wet Strength ♦	min 50kN	min 50kN	min 130kN	-	-
AS 1141.22	Wet/Dry Strength Variation ♦ Dry - Wet % Dry	max 60	max 60	max 30	-	-
AS 1289.6.1.1	4 day Soaked CBR (98% Modified Compaction)	-	-	-	30	30
AS 1289.D21	Water-soluble sulphate content (% SO ₄ by mass)	max 0.1%	max 0.1%	max 0.1%	max 0.1%	max 0.1%
AS 1141.36	Total sulphur content (% S by mass)	max 1.5%	max 1.5%	max 1.5%	max 1.5%	max 1.5%

Table C242.4 - Unbound Subbase Material Properties

AUS-SPEC #1

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, if the material complies with the RTA Modified Texas Triaxial Classification Number (T171) requirements specified in Table C242.5, (T171 tested at not less than 85 per cent of Optimum Moisture Content and 98 per cent of Maximum Dry Density as determined by AS 1289.5.2.1). This is a **HOLD POINT**.

**Modified
Texas Triaxial
Classification**

(HP)

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. This is a **HOLD POINT**. After modification, the material shall meet the requirements of Clause C242.08.

**Lime
Modification
(HP)**

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 - VERSION 3.2.

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 – VERSION 3.2. ***In-situ Operations***

7. The proportion of lime shall be not less than 1.5 per cent nor more than 4 per cent by mass. The material prior to lime treatment shall not contain any added pozzolanic material. ***Proportion***

8. The lime treated material shall yield an unconfined compressive strength not exceeding 1.0 MPa, when tested in accordance with Test Method T116 where sampling is undertaken within 24 hours of adding the lime and testing is after 7 days accelerated curing. ***Unconfined Compressive Strength***

9. For DGB20 material, prior to being treated with lime, the material shall comply with the requirements of DGS20 in Table C242.4, except that the aggregate wet strength shall not be less than 80kN and the wet/dry strength variation shall not exceed 60 per cent. ***DGB20***

10. For DGB20, the lime treated material shall yield a CBR value of not less than 100 when tested in accordance with AS 1289.6.1.1, where sampling is undertaken within 24 hours of adding the lime and testing is after 7 days of accelerated curing. ***CBR Value***

C242.10 BOUND BASE AND SUBBASE MATERIALS

1. Bound materials utilised in semi-rigid pavements as a base layer for Traffic Categories 1, 2a and 2b shall be supplied as a crushed rock product with stabilising agent incorporated in a stationary mixing plant (pugmill) at the supplier's quarry unless prior written approval is obtained from the Council. This is a **HOLD POINT**. ***Traffic Categories 1, 2a, 2b (HP)***

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. This is a **WITNESS POINT**. ***Material Requirements Prior to Stabilisation (WP)***

4. Material requirements for the stabilising agent shall be in accordance with the Specification for STABILISATION – VERSION 3.2. ***Stabilising Agent***

5. The stabilisation process shall meet the requirements of the Specification for STABILISATION – VERSION 3.2. ***Stabilisation***

6. The unconfined compressive strength (UCS) of the material after seven days accelerated curing as determined by Test Method T131 shall be not less than 4MPa nor more than 10MPa. Sampling and test specimen compaction of the material shall be undertaken within one hour of the incorporation of the stabilising agent. ***Unconfined Compressive Strength***

AUS-SPEC #1

DELIVERY, STOCKPILING AND PROCESSING OF PAVEMENT MATERIAL

C242.11 DELIVERY TO SITE

1. Materials shall be supplied sufficiently damp to avoid segregation and loss of fines during transit.

**Damp
Condition**

C242.12 STOCKPILING OF UNBOUND MATERIALS

1. Stockpile sites shall be located as shown on the Drawings or as approved by the Superintendent. This is a **WITNESS POINT**.

**Stockpile Sites
(WP)**

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. This is a **HOLD POINT**.

**Delivery
Dockets
(HP)**

4. Bound materials shall comply with the requirements of the Specification for STABILISATION - VERSION 3.2.

AUS-SPEC #1

SPREADING OF PAVEMENT MATERIAL

C242.14 SPREADING PAVEMENT MATERIALS

1. Unbound materials shall not be spread upon an underlying pavement layer which has a moisture content exceeding 90 per cent, the laboratory optimum moisture content as determined by AS 1289.5.2.1 or which has become rutted or mixed with foreign matter. The underlying layer shall be corrected to comply with this Specification before spreading of the next layer of pavement. This is a **HOLD POINT**. *Underlying Layer Quality (HP)*
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 1289.5.2.1.
6. Bound materials shall not be spread when the ambient air temperature in shade is either below 5°C or above 35°C. This is a **HOLD POINT**. *Temperature (HP)*

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. This is a **WITNESS POINT**. *Hand Operated Plant (WP)*
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. This is a **HOLD POINT**.

Placing Subsequent Layers (HP)

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 recompact and trimmed to meet the specified density requirements and level tolerances. This is a **HOLD POINT**.

Excessive Moisture Content (HP)

C242.16 CURING OF BOUND MATERIALS

1. The curing of the surface layer of a lot shall commence after compaction is completed.

Commencement Time

2. The stabilised work shall be protected against rapid drying out by keeping it continuously wet or damp during the period prior to the provision of a subsequent layer or the application of a prime or primer-seal.

Water Curing

3. Water curing shall consist of frequent light uniform spraying that will not produce significant run off or flooding on sections of the area. Slurrying of the surface or leaching of the stabilising agent shall be avoided.

Caution

ACCEPTANCE OF COMPACTED LAYERS

C242.17 LOTS FOR ACCEPTANCE

1. Acceptance of work, as far as compaction is concerned, shall be determined according to the elastic rebound deflection, and characteristic elastic rebound deflection 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.

2. Measurements shall be taken at maximum spacings of 30 metres in each lane, with a minimum of six measurements per lot. The elastic rebound deflection, and characteristic elastic rebound deflection, for any lot shall not exceed the values given in Table C242.6.

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Road Category	Elastic Rebound Deflection (mm)	Characteristic Elastic Rebound Deflection (mm)
Access Street	1.0	0.85
Local Street	1.0	0.85
Collector Street	1.0	0.85
Local Distributor Road	0.8	0.65
Arterial Road	As specified by RMS	As Specified by RMS

Table C242.6 - Limits of Elastic Rebound Deflection and Characteristic Elastic Rebound Deflection

3. The elastic rebound deflection shall be taken as the maximum deflection in accordance with Test Method T160 utilising the Benkelman Beam or equivalent. The characteristic elastic rebound deflection shall be taken as

**Elastic
Rebound
Deflection**

$$CD = \mu + Fs$$

where μ = the mean maximum deflection, s = the standard deviation, and F = a confidence limit factor. For Arterial Roads the confidence limit factor shall be 2.00, and for local distributor roads, collector streets, local streets and access streets the confidence limit factor shall be 1.65.

4. Where agreed by the principal and Council, acceptance of work may be based upon density testing of the work in lots. The lots shall be nominated in accordance with Clause C242.17.1.

C242.18 COMPACTION ASSESSMENT

1. The Superintendent shall assess compaction for each lot based on the maximum elastic rebound deflection and characteristic elastic rebound deflection.

**Elastic
Rebound
Deflection**

2. The Contractor shall arrange for testing to assess compaction, and present the results to the Superintendent for approval. This is a **HOLD POINT**.

**Super-
intendent's
Approval (HP)**

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**

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 AS 1289.5.2.1 to determine the maximum dry density (modified compactive effort) for the material.

*Maximum Dry
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 RTA Test Method T130 to determine the maximum dry density (modified compactive effort) for the material. This test method shall also be used to determine the optimum moisture content.

*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 modified compactive effort is not less than 97 per cent within the lot or the area of pavement being assessed.
- (b) In the case of bound layers an area of pavement presented for compaction assessment has within that area a zone or zones with relative compaction less than 97 per cent (modified compactive effort) but equal to or greater than 92 per cent may be accepted by the Superintendent provided such zone or zones shall not comprise more than 5 per cent of the area presented.
- (c) In the case of bound layers of target final depth in excess of 250mm, the top 150mm shall meet the requirements of paragraph 1(b) in this clause whilst the bottom 150mm shall have a relative compaction equal to or greater than 92 per cent.

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. This is a **HOLD POINT**.

*Rejection of
Lots (HP)*

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. This is a **HOLD POINT**.

*Rejected
Material
(HP)*

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. This is a **HOLD POINT**.

**Average Width
(HP)**

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 ± 10 mm.

**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 ± 5 mm 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. This is a **HOLD POINT**.

**Straight Edge
Deviation
(HP)**

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. This is a **WITNESS POINT**.

**Rejection
Criteria
(WP)**

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. This is a **HOLD POINT**.

**Corrective
Action**

(HP)

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. This is a **HOLD POINT**.

**Rejection
Criteria**

(HP)

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.

This is a **HOLD POINT**.

(HP)

(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. This is a **HOLD POINT**.

(HP)

4. 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 Superintendent. This is a **WITNESS POINT**. **Length to be Removed (WP)**
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. This is a **WITNESS POINT**. **Superintendent's Discretion (WP)**
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. This is a **HOLD POINT**. **Inspection Before Replacement (HP)**
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 - VERSION 3.2 within seven days of the date of the acceptance of such sections, unless otherwise approved by the Superintendent. This is a **WITNESS POINT**. **Primerseal (WP)**
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. This is a **HOLD POINT**. **Contractor's Responsibility (HP)**
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**

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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. This is a **HOLD POINT**.

**Restrictions
on Movement
(HP)**

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. This is a **HOLD POINT**.

**Restrictions
on Movement
of Construc-
tion Traffic
(HP)**

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. This is a **HOLD POINT**.

**Open to Traffic
- Bound
Pavement (HP)**

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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 $\geq 95\%$ (ii) Stockpile height $< 3\text{m}$ (iii) Stockpile batter $< 1.5:1$ and $> 3:1$	C242.12 C242.12
2.	Spreading Pavement Materials		
	(i) Compacted Layer Thickness	$\geq 100\text{mm}$, $\leq 200\text{mm}$	C242.14
3.	Compaction Acceptance		
	Minimum value of all calculated relative compaction results	≥ 97 per cent (modified compactive effort). For bound pavements may accept between 92% and 97% provided it represents less than 5% of the area.	C242.20
4.	Width of Pavement		
	(i) Design centre-line to edge of constructed pavement	-50mm to +300mm of dimensions on Drawings	C242.22(b)
	(ii) Average Width	The average width determined from 3 random sites over any 200m road length, or part thereof, shall be not less than the specified width.	C242.22(b)
5.	Surface Level		
	(i) Subbase levels	$< \pm 10\text{mm}$ from design level	C242.22(c)
	(ii) Base levels	$< \pm 10\text{mm}$ from design level	C242.22(c)
	(iii) Base levels adjacent to Kerb and Gutter	$< \pm 5\text{mm}$ 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 C242.7 - 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 - VERSION 3.2.

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.

ANNEXURE C242-A

INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title/Item	Requirement	Notice for inspection	Release by
MATERIALS			
Lime modified base and subbase materials			
C242.09.1 - Lime Modification	Submit proposals to modify materials	14 days before placing	Superintendent – PCA concurrence required
Bound Base and Subbase Materials			
C242.10.1 - Traffic Categories 1, 2a, 2b	Obtain approval for alternative mixing plant	14 days before placing	Superintendent – PCA concurrence required
DELIVERY, STOCKPILING AND PROCESSING OF PAVEMENT MATERIAL			
Delivery of Modified or Bound Materials			
C242.13.2 - Delivery Dockets	Availability of delivery dockets to Superintendent	Upon delivery before placing	Superintendent
SPREADING OF PAVEMENT MATERIALS			
Spreading Pavement Materials			
C242.14.1 - Underlying Layer Quality	Show suitability of previous layer for work to proceed	1 working day before placing next layer	Superintendent
C242.14.6 - Temperature	Approval to exceed allowable conditions	1 working day before placement	Superintendent
TRIMMING AND COMPACTION			
General Requirements			
C242.15.6 – Placing Subsequent Layers	Completion of testing of previous layer	1 working day before next layer	Superintendent
C242.15.7 – Excessive Moisture Content	Dry out wetted material	1 working day before next layer	Superintendent
ACCEPTANCE OF COMPACTED LAYERS			
Compaction Assessment			
C242.18.2 – Superintendent's Approval	Submit results	1 working day before and after testing	Superintendent
Compaction requirement and acceptance	Acceptance of compaction within the tolerances	1 working day after test results	Superintendent
Compaction Requirements and Acceptance			
C242.20.2 - Rejection of Lots	Rejected lots identified and reworked	1 working day after test results	Superintendent
Reworking of rejected unbound layers			
C242.21.2 – Rejected Material	Rejected material identified and replaced	Upon reworking	Superintendent

FLEXIBLE PAVEMENTS - COONAMBLE

Clause title/Item	Requirement	Notice for inspection	Release by
Tolerances			
C242.22(c).4 - Straight Edge Deviation	Reject or accept as per tolerances	1 working day before next activity	Superintendent
Action on rejection			
C242.23(a).1 – Corrective Action	Approval of removal and replacement	1 working day before next activity	Superintendent
C242.23(b).1 – Rejection Criteria	Approval of removal and replacement	3 working days before next activity	Superintendent
C242.23(b).3(ii) – Corrective Action Circumstances	Proposal to regrade sub-base and/or base course	1 working day before next activity	Superintendent
C242.23(b).3(iii) - Corrective Action Circumstances	Proposal to regrade base course	1 working day before next activity	Superintendent
Removal and replacement of rejected courses			
C242.24.4 - Inspection Before Replacement	Present for inspection the underlaying material	1 working day before next activity	Superintendent
Maintenance before completion of wearing surface			
C242.25.2 – Contractor's Responsibility	Re-prepare and submit for inspection	3 working days before next activity	Superintendent
OPENING PAVEMENT TO TRAFFIC			
General Requirements			
C242.26.1 – Restrictions on Movement	Unbound pavement not open to traffic until primerseal applied	3 working days before proposed opening	Superintendent – PCA concurrence required
C242.26.2 – Restrictions on Movement of Construction Traffic	Bound pavement not open to construction traffic for minimum 7 days after completion of primerseal	3 working days before proposed opening	Superintendent – PCA concurrence required
C242.26.1 – Open to Traffic - Bound Pavement	Bound pavement not open to traffic for minimum 7 days after completion of primer seal	3 working days before proposed opening	Superintendent – PCA concurrence required

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Summary of WITNESS POINTS

Clause title/Item	Requirement	Notice for inspection
MATERIALS		
Unbound base and subbase material		
C242.08.7 - Modified Texas triaxial classification	Submission of additional test data for approval	14 days before ordering material
Bound Base and Subbase Materials		
C242.10.3 – Material Requirements Prior to Stabilisation	Verify product constituents conform prior to stabilisation	7 days before ordering material
DELIVERY, STOCKPILING AND PROCESSING OF PAVEMENT MATERIAL		
Stockpiling of Unbound Materials		
C242.12.1 – Stockpile Sites	Gain approval for location	7 days before delivery
TRIMMING AND COMPACTION		
General Requirements		
C242.15.3 – Hand Operated Plant	Approval of alternative compaction method	Progressive
ACCEPTANCE OF COMPACTED LAYERS		
Removal and Replacement of Rejected Courses		
C242.24.2 – Length to be Removed	Protect adjacent work and make good any damage	1 working day before removal
C242.24.3 – Superintendent's Discretion	Approval for part width reconstruction	1 working day before removal
Maintenance before completion of Wearing Surface		
Primerseal	Cover base course with primer seal	Within 7 days of acceptance

AUS-SPEC #1



COONAMBLE SHIRE COUNCIL

CONSTRUCTION
SPECIFICATION

C244

**SPRAYED
BITUMINOUS SURFACING**

VERSION 3.1 – JANUARY 2022

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
VERSION 3.1	Inspection Requirements added	C244.01.6	A	KD	22/03/10
	Specification Version 3.1 referenced, Standards updated	C244.02	M		
	Specification Version 3.1 referenced	C244.03	A		
	Hold Point added	C244.06.1	A		
	Hold Point added	C244.06.2	A		
	Hold Point added	C244.08.2	A		
	Hold Point added	C244.09.1	A		
	Hold Point added	C244.09.2	A		
	Hold Point added	C244.09.3	A		
	Hold Point added	C244.10.4	A		
	Hold Point added	C244.11.2	A		
	Hold Point added	C244.14.3	A		
	Cutter oil requirements added	C244.17.6	A		
	Hold Point added	C244.20.1	A		
	Hold Point added	C244.23.1	A		
	Specification Version 3.1 referenced	C244.31	A		
	Annexure added	C244-C	A		

**SPECIFICATION C244 –
SPRAYED BITUMINOUS SURFACING – VERSION 3.1**

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SPECIFICATION C244 : SPRAYED BITUMINOUS SURFACING – VERSION 3.1

GENERAL

C244.01 SCOPE

1. The work to be executed under this Specification consists of the supply of all materials and the application of any or all of the following types of sprayed bituminous surfacing as required under the Contract:

(a) Prime

The application of a primer of field or refinery prepared cutback bitumen without aggregate to provide penetration of the surface (preferably from 5 to 10mm) and waterproofing.

(b) Primerseal

The application of a primerbinder of field or refinery prepared cutback bitumen to provide surface penetration (preferably from 2mm to 5mm) and incorporation of a light cover of aggregate to provide a temporary wearing surface.

(c) Seal or Reseal

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

(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

The application of polymer modified binder into which aggregate is incorporated. A SAMI is used as an interlayer between an asphalt wearing surface and underlying layers to provide alleviation from tensile strains developed beneath it.

(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

6. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C244-C. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority, where stipulated in Annexure C244-C.

Inspections

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 – Version 3.1

(b) Australian Standards

AS 1141	Methods for sampling and testing aggregates - List of methods
AS 2008:1997	Residual bitumen for pavements.
AS 2124:1992	General conditions of contract
AS 2150	Hot mix asphalt
AS 2157:1997	Cutback bitumen
AS 2341	Methods of Testing Bitumen and Related Roadmaking Products
AS 2758	Aggregates and rock for engineering purposes
AS 2758.2:2009	Aggregate for sprayed bituminous surfacing.
AS 3568:1999	Oils for reducing the viscosity of bitumen for pavements
AS/NZS iso 9001:2008	Quality Management Systems – Requirements
SAA HB 81	Field guide for traffic control
SAA HB 81.6:1998	Bituminous surfacing on roads

(c) NSW RTA Specifications and Forms

RTA 382	-	Sprayed Bituminous Surfacing Cutback Chart
RTA 3258	-	Aggregate Precoating Agents
RTA 3259	-	Bitumen Adhesion Agents
RTA 3268	-	Aggregate Precoating Agents (for Polymer Modified Binder)
RTA 3269	-	Bitumen Adhesion Agents (for Polymer Modified Binder)

(d) NSW State Legislation

Rural Fires Act, 1997
Local Government Act, 1993

(e) Other

AUSTROADS
Manual of Test Procedures (www.austroads.com.au/tm/testmethods.htm)
AGPT03/09-2009 Guide to Pavement Technology Part 3 – *Pavement surfacings*
AGPT04F/08-2008 Guide to Pavement Technology Part 4F - *Bituminous binders*
AGPT04K-2009 Guide to pavement technology Part 4K - *Seals*

AP-G41-2008	Bitumen Sealing Safety Guide.
AP-T37/05-2005	Geotextile reinforced seals
AP-T40-2005	Audit and surveillance of sprayed sealing contract works
AP-T41/06-2006	Specification Framework for Polymer Modified Binders and multigrade bitumens
AP-T42/06-2006	Guide to the selection and use of Polymer Modified Binders and multigrade bitumens
AP-T68-2006	Update of the Austroads sprayed seal design method.
Commentary to AG: PT/T252-2006	Penetration of road bases by bituminous primers or primebinders

Australian Asphalt Pavement Association (AAPA)

AAPA - 2004	National asphalt specification, 2nd edition
AAPA HS&E Guide No 8	Guidelines for Environmental Management when Spraying Bituminous Materials
Advisory Note 7 - 2003	Guide to the Selection, Heating and Storage of Binders for Sprayed Sealing and Hot Mixed Asphalt.

C244.03 CONTROL OF TRAFFIC

1. The Contractor shall provide for control of traffic in accordance with the requirements of the Specification for CONTROL OF TRAFFIC - VERSION 3.1 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 displacement of aggregate occurs. Where necessary, the Contractor shall use patrol vehicles to ensure that traffic travels at an acceptable speed.

Speed Control

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 RTA 3252.

(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 conform to NSW RTA Specification 3258 Aggregate Precoating Agents or RTA 3268 for polymer modified binder or as otherwise approved by the Superintendent. This is a **HOLD POINT**.

**Precoating
Agent (HP)**

2. Bitumen adhesion agents shall conform to NSW RTA Specification 3259 Bitumen Adhesion Agents or RTA 3269 for polymer modified binder or as otherwise approved by the Superintendent. This is a **HOLD POINT**.

**Adhesion
Agent (HP)**

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 AS 2758.2.
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. This is a **HOLD POINT**.

Specification

**Test
Requirements
(HP)**

3. The geotextile must be a nonwoven needle punched fabric with a minimum melting point of 165°C, minimum mass of 130 g/m² and a minimum bitumen saturation of 0.9 L/m²

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. This is a **HOLD POINT**.

Proposed Design

(HP)

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". This is a **HOLD POINT**.

AUSTROADS Design Procedure

(HP)

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

This is a **HOLD POINT**.

(HP)

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. This is a **HOLD POINT**.

**Age of
Precoating
(HP)**

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. This is a **HOLD POINT**.

**Equipment
and Methods
(HP)**

C244.12 PLANT

1. A mechanical sprayer shall be used to apply primer, primerbinder and binder. The sprayer shall have a current certification approved by the relevant State Road Authority.

**Sprayer
Certification**

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 carrying out work in accordance with this Specification.

**Faulty
Equipment**

C244.13 PREPARATION OF PAVEMENT SURFACE

1. Before the application of primer, primerbinder or binder, the pavement surface shall be swept by the use of a mechanically-operated rotary road broom or suction broom to provide a uniformly clean surface. If necessary, additional sweeping shall be done by hand, using stiff brooms. Sweeping shall, where possible, extend at least 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.
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".
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. This is a **HOLD POINT**.

**Aggregate
Lots**

**Target
Application
Rates**

**Confirm Spray
Rates (HP)**

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 AUSTROADS "Bitumen Sealing Safety Guide".
2. Bitumen shall be within the temperature range shown in Table C244.1 when mixed with cutter oil.

**Incorporated
with Cutter Oil**

Class	Temperature Range (°C)
170	160 - 190
320	170 - 200

Table C244.1 - Bitumen Temperatures

3. Refinery cutback bitumen shall be within the temperature range shown in Table C244.2 at the time of spraying.

**Spraying
Temperature**

Grade	Temperature Range (°C)
AMC 00	10 - 35
AMC 0	35 - 55
AMC 1	60 - 80
AMC 2	75 - 100
AMC 3	95 - 115
AMC 4	110 - 135
AMC 5	120 - 150
AMC 6	135 - 160
AMC 7	150 - 175

**Table C244.2 - Cutback Bitumen Spraying
Temperatures**

4. The Contractor shall measure and record the temperature of the binder, using a thermometer, which is accurate to within 2.5 per cent of the correct temperature.

**Measurement
of
Temperature**

5. If the temperature of the 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 250 mm above the tops of the heating tubes. The Contractor shall comply with the statutory requirements related to the Rural Fires and the Local Government Acts. Two or more suitable fully-charged pressurised chemical fire extinguishers shall be placed conveniently to the heaters at all times while heating is in progress.

Safe Heating Practices

6. During heating, the temperature of the binder material shall not exceed the applicable upper limit from Table C244.1 or Table C244.2 or the maximum temperature recommended by the manufacturer of the polymer modified binder. The temperature of the binder 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 and 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 and 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 and RTA 3252. 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 RTA 382 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 C244-A. | 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 C244-B 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 RTA 382.

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

***Terminating
Paper Strip***

5. Spraying shall cease immediately if any defect develops in the spraying equipment and spraying shall not recommence until the fault has been rectified.

***Equipment
Defects***

6. Where any blockage or partial blockage of nozzles occurs, spraying shall cease immediately. If the blockage is due to the condition of the binder being sprayed and is likely to re-occur, that load together with any binder from the same bulk tanker or supply unit shall not be used in the Works.

***Nozzle
Blockage***

7. Where a mechanical sprayer is not able to satisfactorily spray small areas or 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/m² (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 efficiently removed by hand brooming. **Deficient or Excess Aggregate**

6. After the aggregate has been applied to each section of the work, initial rolling shall be carried out with two or more dual axle smooth pneumatic tyred multi-wheel rollers of minimum load of one tonne per tyre and minimum tyre pressure of 550 kPa. A roller with a rubber surface drum providing equivalent compactive effort may be used in lieu of a multi-wheeled roller. Initial rolling shall continue until the aggregate is firmly embedded in the primerbinder or binder. Roller speed shall be 15-25km/h subject to safe working conditions. **Initial Rolling**

7. If the aggregate is not evenly distributed over the surface of the pavement, the surface shall be traversed with a light drag broom after the initial rolling. If the broom has any tendency to dislodge aggregate particles bedded in the primerbinder or binder, the Contractor shall defer or eliminate the drag brooming. Where drag brooming is eliminated, the Contractor shall substitute light hand brooming. **Brooming of Surface**

8. Backrolling shall then be carried out for a minimum period of one hour per 1000 square metres sprayed for roads having a traffic volume of less than 500 vehicles per lane per day and one hour per 1500 square metres sprayed for other roads, up to a maximum of twenty-four hours after the aggregate has been applied. **Backrolling**

9. Where a bituminous surfacing is specified with separate applications of coarse and fine aggregate on a single application of binder, the coarse aggregate shall be applied first, rolled and any necessary brooming carried out as described above, before application of the fine aggregate and its subsequent rolling and brooming. In this case, the time limits for incorporation of aggregate shall apply only to the application of the coarse aggregate.

Two Aggregate Application

10. When the aggregate has been evenly spread and embedded in the binder, any 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 bituminous surfacing daily record form. Details of primer, primerbinder, binder and aggregate applied shall be recorded immediately after every sprayer run. Each form shall be signed by the Contractor's representative as a true record of the work performed. The Contractor shall supply to the Superintendent a copy of each completed form. This is a **HOLD POINT**.

Sprayer Run Records (HP)

C244.21 PROTECTION OF SERVICES AND ROAD FIXTURES

1. The Contractor shall take all necessary precautions to prevent primer, primerbinder, binder, aggregate or other material used on the work from entering or adhering to gratings, hydrants or valve boxes, access chamber covers, bridge or culvert decks and other road fixtures.

Contractor's Responsibility

2. Immediately after aggregate has been spread over the binder, the Contractor shall clean off or remove any sprayed surfacing material and leave the services and road fixtures in a condition equivalent to that existing when the Contractor commenced the sprayed surfacing work.

Services and Road Fixtures

NONCONFORMANCE OF MATERIALS AND WORK

C244.22 GENERAL

1. If any materials supplied fail to conform to the requirements of the Contract or if any section of sprayed bituminous surfacing work fails to conform to the requirements of this Contract - whether failure of the work is due to bad workmanship, defective materials supplied by the Contractor or materials made defective by the method of operation adopted or any other cause, then such failure or failures shall constitute a 'nonconformance' under the Contract.

Conditions

2. If the nonconformance is not acceptable to the Principal, the nonconforming material shall be replaced or the nonconforming section of sprayed bituminous surfacing work shall be either replaced or corrected as proposed by the Contractor, subject to the approval of the Superintendent being attained.

Replace or Correct

3. 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 the Clause C244.30. The Contractor shall nominate materials or work for acceptance under this clause. This is a **HOLD POINT**. 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 (HP)

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	<p>Bitumen temperature when incorporated with cutter oil, bitumen shall be in temperature ranges as per Table C244.1.</p> <p>Refinery Cutback Bitumen temperature at the time of spraying shall be in temperature range as per Table C244.2.</p> <p>Binder materials shall not be held at temperatures within the ranges of Tables C244.1 or C244.2 or the temperature ranges recommended by the manufacturer of the polymer modified binder for periods in excess of 10 hours.</p>	<p>C244.15</p> <p>C244.15</p> <p>C244.15</p>

SPRAYED BITUMINOUS SURFACING - COONAMBLE

Item	Activity	Limits/Tolerances	Spec Clause
5.	Spraying Temperature	<p>Bituminous surfacing (excluding Polymer Modified Binder) shall not be undertaken if the pavement temperature has not been at or above 10°C for at least one hour before commencement of spraying or if the pavement temperature falls below 10°C during the period of spraying.</p> <p>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°C for at least one hour before commencement of spraying or if the pavement temperature falls below 25°C during the period of spraying.</p>	<p>C244.16</p> <p>C244.16</p>
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	<p>Area to be sprayed shall be limited to area which can be covered by aggregate at target application rate within 15 minutes of spraying.</p> <p>Application rates and quantities shall apply to a temperature of 15°C and have T1 tolerances of as set out in Clause C244.23 and T2 tolerances as set out in Annexure C24-B.</p> <p>At least a 48 hour period shall elapse after spraying of primer before binder for a seal is applied.</p> <p>At least a 14 day period shall elapse after spraying of primer binder before application of binder.</p>	<p>C244.18</p> <p>C244.18</p> <p>C244.18</p> <p>C244.18</p>
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

SPRAYED BITUMINOUS SURFACING - COONAMBLE

Item	Activity	Limits/Tolerances	Spec Clause
10.	Rolling		
	(a) Roller Numbers and Type	Initial rolling shall be carried out with two or more dual axle smooth pneumatic tyred multi-wheeled rollers. Minimum load of one tonne per tyre and minimum tyre pressure 550KPa.	C244.19
	(b) Backrolling	(i) For traffic volume of <500 vehicles per lane per day, backrolling for minimum of one hour per 1000 square metres sprayed.	C244.19
11.	Nonconformance		
		Bitumen with viscosity at 60°C within the specified limits, but with other properties outside the limits specified in AS 2008, shall incur deductions.	C244.30
		For Class 170 bitumen, or Class 320 bitumen having a viscosity at 60°C outside the limits specified in AS 2008, deductions shall apply.	C244.30
		Cutback bitumen with viscosity at 60°C within the specified range according to Table 1 of AS 2157, but having any property outside the range specified by AS2150, shall incur deductions.	C244.30
		For cutback bitumen having a viscosity at 60°C outside the range specified in Table 1 of AS 2150, deductions shall apply.	C244.30
		Polymer Modified Binder, having viscosity at 60°C within the specified limits but having any property outside the range specified by RTA 3252, 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 RTA 3252, 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.
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 shall apply.
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.

Superintendent's Authority

Deductions other than Viscosity

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 percent of the schedule rate for Pay Items C244(a), C244(b) and/or C244(c) shall apply.

Deductions other than Viscosity

5. In the case of cutback bitumen having a dynamic viscosity at 60°C outside the range specified in 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 2150 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°C within the specified limits but having any property outside the range specified by RTA 3252, 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 RTA 3252, 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 – VERSION 3.2.

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 [m²/m³]) 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 Binder Type	Primer Seal		Seal or Reseal	
Road Name			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 \pm percentages
0mm Prime	

**ANNEXURE C244- C
INSPECTIONS**

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Item/Clause title	Requirement	Notice for inspection	Release by
MATERIALS			
Aggregate Precoating Agent and Bitumen Adhesion Agent			
C244.06.1 – Precoating Agent	Conform with RTA specifications	7 days	Superintendent
C244.06.2 – Adhesion Agent	Conform with RTA specifications	7 days	Superintendent
Aggregate and Geotextile Fabric			
C244.08.2 – Test Requirements	Submit NATA aggregate test results	7 days	Superintendent
DESIGN OF BITUMINOUS SURFACING			
General			
C244.09.1 – Proposed Design	Submit details of proposed bituminous surfacing design	15 days	Superintendent – PCA concurrence required
C244.09.2 – AUSTROADS Design Procedure	Submit design rates of application of binder and aggregate	15 days	Superintendent – PCA concurrence required
C244.09.3 – Additional Information Sought	Submit additional details	15 days	Superintendent – PCA concurrence required
PRECOATING OF AGGREGATE			
General			
C244.10.4 – Age of Precoating	Retreat stockpiles precoated more than 7 days in advance of use	2 days	Superintendent
APPLICATION OF SPRAYED BITUMINOUS SURFACING			
General			
C244.11.2 – Equipment and Methods	Submit details of equipment and methods for approval	7 days	Superintendent
Review of Nominated Application Rates			
C244.14.3 – Confirm Spray Rates	Provide notice of intention to spray and confirm spray rates and aggregate	5 days	Superintendent
Work Records			
C244.20.1 – Sprayer Run Records	Submit daily work record forms	2 days	Superintendent
NONCONFORMANCE OF MATERIALS AND WORK			
Acceptance of Nonconformances			
C244.23.1 – Superintendent's Authority	Nominate materials or work for acceptance under this clause	5 days	Superintendent



COONMABLE SHIRE COUNCIL
CONSTRUCTION SPECIFICATION

C245

ASPHALTIC CONCRETE

VERSION 3.1 – JANUARY 2022

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
VERSION 3.1	Inspection requirements added	C254.01.3	A	KD	23/03/10
	Specification Version 3.1 reference, standards updated	C254.02.1	M		
	Witness Point & Hold Point added	C254.03	A		
	Specification Version 3.1 reference	C254.05	A		
	Hold Point added	C254.08(a).1	A		
	Hold Point added	C254.09.1	A		
	Hold Point added	C254.13.2	A		
	Australian Standards referenced, Hold Point added, special aggregate requirements added	C254.14.	A		
	Hold Points added	C254.15	A		
	Type R mix referenced	C254.18(b).4	A		
	Hold Point added	C254.18(d).1	A		
	Hold Point added	C254.21(b).3	A		
	Specification Version 3.1 reference	C254.22	A		
	Witness Point added	C254.25.2	A		
	Hold Point added	C254.34.7	A		
	Industrial category deleted	C254.40	A		
	Version 3.1ss specifications reference	C254.41	A		
		C254 - D	A		
	Annexure added				

SPECIFICATION C245
ASPHALTIC CONCRETE – VERSION 3.1

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SPECIFICATION C245: ASPHALTIC CONCRETE – VERSION 3.1

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 600 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

3. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C245-D. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority, where stipulated in Annexure C245-D.

Inspections

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

C201 - Control of Traffic - Version 3.1

(b) Australian Standards

AS 1141	Methods for sampling and testing aggregates
AS 1141.11	Particle size distribution by dry sieving.
AS 1141.14	Particle shape, by proportional calliper.
AS 1141.17:1995	Voids in dry compacted filler

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AS 1141.18	Crushed particles in coarse aggregate derived from gravel.
AS 1141.22	Wet/dry strength variation.
AS 1141.25.3:2003	Degradation factor - Fine aggregate
AS 1141.42	Pendulum friction test (PAFV)
AS 1160:1996	Bitumen emulsions for the construction and maintenance of pavements.
AS 1672	Limes and Limestones
AS 1672.1-1997	Limes for Building
AS 2008:1997	Residual bitumen for pavements.
AS 2124:1992	General conditions of contract
AS 2150:2005	Hot mix asphalt - a guide to good practice
AS 2357	Mineral fillers for asphalt.
AS 2734	Asphalt (hot-mixed) paving - Guide to good practice.
AS 2758	Aggregates and rock for engineering purposes
AS 2758.5:1996	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.
AS 3582	Supplementary cementitious materials for use with Portland cement
AS 3582.1-1998	Fly Ash
AS 3582.2-2001	Slag – Ground Granulated Iron Blast-Furnace.
AS 3940-1990	Quality control - Guide to the use of control chart methods including Cusum techniques
AS 3942-1993	Quality control - Variables charts - Guide
AS 3972-1997	Portland and Blended Cements
AS/NZS/ISO 9001:2008	Quality Management Systems – Requirements

(c) NSW RTA Test Methods

T640	-	Resistance to Stripping Test
QA Specification 3253-2009		Bitumen for pavements.

(d) AUSTROADS

APRG Report No.18-2003	Selection and design of Asphalt mixes
AP-T41/06-2006	Specification framework for polymer modified binders and multigrade bitumens
AGPT03/09-2009	Guide to Pavement Technology Part 3 – <i>Pavement surfacings</i>
AGPT04B/07-2007	Guide to Pavement Technology Part 4B - <i>Asphalt</i>
AGPT04E/09-2009	Guide to Pavement Technology Part 4E – <i>Recycled materials</i>
AGPT04F/08-2008	Guide to Pavement Technology Part 4F - <i>Bituminous binders</i>
AGPT04J/08-2008	Guide to Pavement Technology Part 4J - <i>Aggregate and source rock</i>
AGPT04K/09-2009	Guide to Pavement Technology Part 4K - <i>Seals</i>

(e) Other

Australian Asphalt Pavement Association (AAPA)

AAPA 2004	National asphalt specification 2004
Advisory note 7	Guide to the selection, heating and storage of binders for sprayed sealing and hot mixed asphalt.
AAPA IG-3-2004	Asphalt plant process control guide (Implementation Guide)

series)

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.
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. This is a **WITNESS POINT**.
3. All plant shall be registered and insured as appropriate to its use on a public road and shall comply with statutory environmental regulations. This is a **HOLD POINT**.

Contractor's Responsibility

Plant to be Suitable

(WP)

Registered Plant (HP)

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 Specification for CONTROL OF TRAFFIC – VERSION 3.2 while undertaking the work.
2. Any costs incurred as a result of the supply of labour and materials complying with the Specification for CONTROL OF TRAFFIC – VERSION 3.2 shall be borne by the Contractor.
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.

Provision for Traffic

Contractor's Cost

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 C245-A 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. This is a **HOLD POINT**.
2. Delivery dockets stating the mass of each truck load of asphalt shall be attached to the Asphalt Work Record.

Asphalt Work Record

(HP)

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 C245-C.

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. This is a **HOLD POINT**. **Quality (HP)**
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. This is a **HOLD POINT**.

Constituents (HP)

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 C245-C.

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. This is a **HOLD POINT**.

Approval (HP)

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

Mixing Time

(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°C (Pa.s)	1500 min	8000 min	MBT 21
Torsional Recovery at 25°C (%)	12 min	58 min	MBT 22
Viscosity at 165 °C (Pa.s)	0.75 max	0.9 max	MBT 11
Softening Point °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 600 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. This is a **HOLD POINT**.

**RAP Source
(HP)**

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. All properties shall be determined using the appropriate Australian Standard referenced in Clause 245.02.

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 21 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.

**Submission of
Nominated Mix
(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**

6. When asphalt containing special aggregate is specified, the special aggregate shall comprise all coarse and fine aggregates of 4.75mm nominal size and greater.

**Special
Aggregate**

Property	Requirements						
	Moderately High Traffic Roads (Collector, Arterial & Industrial)				Local Residential Roads**		
Aggregate passing AS Sieve (% by mass)	Nominal Size of Asphalt				Type A	Type B	Type R
	7mm (AC7)	10mm (AC10)	14mm (AC14)	20mm (AC20)			
53.0mm							
37.5mm							
26.5mm				100			
19.0mm			100	90-100			
13.2mm		100	90-100	75-90	100	100	
9.50mm	100	90-100	75-90	65-85	95-100	90-100	
6.70mm					80-95	65-85	100
4.75mm	70-100	60-80	53-73	47-67	65-80	60-80	85-100
2.36mm	50-70	45-65	40-60	35-55	45-60	55-75	55-80
1.18mm	35-55	33-50	30-46	27-43	35-50	45-65	38-60
0.600mm	28-42	23-38	21-36	19-34	25-40	30-50	25-43
0.300mm	17-30	13-26	12-25	11-23	15-25	20-30	15-30
0.150mm					7-15	10-18	8-20
0.075mm	5-12	4-10	4-9	3-8	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°	0.6-1.2°	0.6-1.2°	0.6-1.2°	0.6-1.2°	0.6-1.2°	0.6-1.2°
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: <ul style="list-style-type: none"> * Some increase beyond these ranges of binder content may be permitted for aggregates having unusually high absorption characteristics. Superintendent's approval 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. ° 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
<p>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.</p> <p># 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.</p>		

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. This is a **HOLD POINT**.

Approved Mix
(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. This is a **HOLD POINT**.

Changes to
Approved Mix
(HP)

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. The production mix shall comply with the materials and mix requirements cited in this specification as assurance to the Principal of quality processes and materials. Additionally the mix shall display the following key performance requirements at delivery and during laying:

- (a) The mix shall not show evidence of segregation of aggregate after mixing, transport or paving.
- (b) Mix that is not homogeneous and is observed to be "fatty" (bitumen rich) or "bony" (coarse and porous) shall be excluded from the work lots at the Contractor's expense.
- (c) The workability and compactability of the mix as delivered shall be consistent and compatible with the capacity of paving and compaction equipment on site.

3. 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.

4. 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.

**Characteristic
s**

(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. (°C)	140	140	180	115	115
Max. Binder Temp. (°C)	165	170	190	165	170
Min. Asphalt Temp. (°C)	140	140	150	125	125
Max. Asphalt Temp. (°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 C245-C. 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. The Resistance to Stripping Test, RTA Test T640 is not required for Type R mix designs as described in Table 245.2.

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. This is a **HOLD POINT**.

Registered Laboratory

(HP)

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°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.
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.
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.

Layers

**Weather
Conditions**

**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. Whilst preparing the surface the Contractor shall be responsible for compliance with environmental requirements including but not limited to prevention of materials from entering stormwater drains and dust.
2. Surface preparation shall be in accordance with AS 2734. Thermoplastic linemarking or other linemarking, where indicated necessary by the Superintendent in Annexure C245-C, will be removed prior to paving. Raised pavement markers shall be removed prior to paving.
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.

Requirement

**Surface
Preparation**

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.
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.
3. 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.

**Contractor's
Responsibility,
Contractor's
Cost**

**Correction
Courses**

(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 - VERSION 3.2 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 match the output of the paver such that continuous laying of asphalt is achieved. | Continuous 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°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°C with a range from at least 0°C to 200°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 the 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 & Class 320 Bitumen	5-10	*	*	145
	10-15	150#	145##	140
	15-25	145#	140##	135
	over 25	140	135	130
SBS polymer modified bitumen **	15-25	NA	160	155
	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

- Where Annexure C245-B - 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**
- 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**
- 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**
- Intermediate courses shall be automatically controlled by programmed computer control of the paver or a joint matching shoe. **Intermediate Course**
- 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**
- 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 C245-C 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**

- continuous and parallel.
- coincident within 150mm of line of change in crossfall.
- offset by at least 150mm from joints in underlying layers.
- located away from traffic wheel paths.
- 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 "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°C for dense graded mix and below 50°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.
2. Transverse joints shall be at right angles to the direction of laying. They shall be staggered by at least 1.0m between successive layers and between adjacent runs.
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.
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.

Location

Staggered Layers

Feathered Edge

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.
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. This is a **WITNESS POINT**.
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.

Compaction Fleet

Confined Areas (WP)

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.
2. Initial rolling shall commence as soon as possible after laying has commenced. Rollers shall be operated as close as possible to the paver.
3. The transverse and longitudinal joints and edges shall be compacted first.
4. Initial rolling shall be completed before the asphalt temperature falls below 105°C, or 120°C for polymer modified asphalt.

Roller Type

Commencing Time

Priority

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 C245.12 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 the Hold Point.
Inspection (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

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Item	Activity	Limits/Tolerances	Spec Clause
8.	Temperatures for 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°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°C or 120°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°C.	C245.26(b)
		Final Rolling: Rolling to be completed before asphalt temperature falls below 60°C.	C245.26(c)
	(b) Open Graded Asphalt	Rolling to be completed while asphalt temperature is >90°C and <110°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 and Arterial 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 and Arterial Mix	4 3.0 - 3.9 <3.0	4 3.0 - 3.9 <3.0	NIL 20% REJECT
Collector and Arterial 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 - VERSION 3.2.

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.

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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.

ANNEXURE C245-A

QUEANBEYAN CITY COUNCIL
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. 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 C245-B

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 C245-C

ASPHALT AND BINDER TYPES

1. Nominal sizes of asphalt required for this contract (tick box) and enter binder type:

AC TYPE		BINDER
AC 5	<input type="checkbox"/>	
AC 10	<input type="checkbox"/>	
AC 14	<input type="checkbox"/>	

AC TYPE		BINDER
AC 20	<input type="checkbox"/>	
AC 28	<input type="checkbox"/>	
AC 40	<input type="checkbox"/>	

AC TYPE		BINDER
Type A	<input type="checkbox"/>	
Type B	<input type="checkbox"/>	
Type R	<input type="checkbox"/>	

OG TYPE	ASPHALT	BINDER
OG 10	<input type="checkbox"/>	
OG 14	<input type="checkbox"/>	

OG TYPE	ASPHALT	BINDER
OG 28	<input type="checkbox"/>	
OG 40	<input type="checkbox"/>	

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 _____ (e.g. 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:

ANNEXURE C245- D**INSPECTIONS**

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause/subclause	Requirement	Notice for inspection	Release by
GENERAL			
Plant			
C245.03.3 – Registered Plant	Evidence that plant is registered and insured	2 weeks before using plant	Superintendent
Work Records			
C245.06.1 – Asphalt Work Record	Complete daily Work Record Sheets	Progressive	Superintendent
MATERIALS			
Aggregates			
C245.08(a).1 - Quality	Coarse aggregate to comply with AS 2758.5	7 days before proceeding with selection	Superintendent
Mineral Filler			
C245.09.1 - Constituents	Submit evidence of quality and effect of material on the properties of the asphalt mix	7 days before proceeding with mix	Superintendent
Binder			
C245.10(b).1 - Approval	Incorporate binder in accordance with specified requirements	7 days before proceeding with mix	Superintendent
Reclaimed Asphalt Pavement (RAP)			
C245.13.2 – RAP Source	Submit proposed change in RAP supply	5 days prior to proposed usage	Superintendent
Nominated Mix			
C245.14.3 – Submission of Nominated Mix	Submit mix design for approval	21 days before using mix	Superintendent – PCA concurrence required
Approved Mix			
C245.15.1 – Approved Mix	Submit mix design for approval	21 days before using mix	Superintendent – PCA concurrence required
C245.15.2 – Changes to Approved Mix	Submit for approval	21 days before using mix	Superintendent – PCA concurrence required
PRODUCTION			
Sampling and Testing of Production Mix			
C245.18(d).1 – Registered Laboratory	Arrange testing by NATA laboratory	7 days before delivery	Superintendent

Clause/subclause	Requirement	Notice for inspection	Release by
Preparation of Pavement			
C245.21(b).3 – Pavement Preparation	Submit pavement for inspection	2 working days	Superintendent
Removal and Replacement of Rejected Material			
C245.34.7 - Inspection	Submit area for re-inspection	2 working days	Superintendent

Summary of WITNESS POINTS

Clause/subclause	Requirement	Notice for inspection
GENERAL		
Plant		
C245.03.1 – Plant to be Suitable	Superintendent to assess faulty plant	Progressive
COMPACTION		
Plant and Equipment		
C245.25.2 – Confined Areas	Obtain approval for use of equipment	Progressive

AUS-SPEC #1



COONAMBLE SHIRE COUNCIL

CONSTRUCTION
SPECIFICATION

C248

**PLAIN OR REINFORCED
CONCRETE BASE**

VERSION 3.1 – JANUARY 2022

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
VERSION 3.1	Requirement for inspections added	C248.10.4	A	KD	29/03/10
	Specification Version 3.1 referenced, standards updated	C248.03.1	M		
	Hold Point added	C248.04.3	A		
	Hold Point added	C248.05.3	A		
	Hold Point added	C248.07.5	A		
	Hold Point added	C248.08(a).2	A		
	Hold Point added	C248.08(d).2	A		
	Hold Points added	C248.14	A		
	Clause added	C248.15.2	A		
	Hold Point added	C248.18.5	A		
	Hold Point added	C248.19.4	A		
	Hold Point added	C248.20.1	A		
	Hold Point added	C248.21(a).1	A		
	Witness Point added	C248.22(c).1	A		
	Witness Point added	C248.22(c).3	A		
	Witness Point added	C248.25.2(a)	A		
	Specification Version 3.1 reference, Hold Points added	C248.29	A		
	Witness Point added	C248.30.1	A		
	Witness Point added	C248.32.4	A		

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	Hold Point added	C248.33(b).2	A		
	Hold Point added	C248.36.1	A		
	Witness Point added	C248.36.2	A		
	Hold Point added	C248.36.3	A		
	Hold Point added	C248.39.1	A		
	Hold Point added	C248.39.6	A		
	Hold Point added	C248.42(b).4	A		
	Specification Version 3.1 reference	C248.45.6	A		
	Witness Point added	C248.47.2	A		
	Specification Version 3.1 reference, Witness Point added	C248.48	A		
	Hold Point added	C248.50.2	A		
	Specification Version 3.1 reference, Hold Point added	C248.52	A		
	Specification Version 3.1 reference	C248.59	A		
	Annexure added	C248 - A	A		

SPECIFICATION C248

PLAIN OR REINFORCED CONCRETE BASE – VERSION 3.1

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PLAIN OR REINFORCED CONCRETE BASE - COONAMBLE

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SPECIFICATION C248 PLAIN OR REINFORCED CONCRETE BASE – VERSION 3.1

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 and traffic signal approach 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**
4. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C248-A.. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority, where stipulated in Annexure C248-A. **Inspections**

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 - Version 3.1
C231	-	Subsoil and Foundation Drains - Version 3.1
C247	-	Mass Concrete Subbase – Version 3.1

(b) Australian Standards

AS 1012	Methods of testing concrete
AS 1012.1:1993-	Sampling fresh concrete.
AS 1012.3.1:1998	Determination of properties related to the consistence of concrete - Slump test.
AS 1012.4.2:1999	Determination of air content of freshly mixed concrete - Measuring reduction in air pressure in chamber above concrete.
AS 1012.8.1:2000	Making and curing concrete - Compression, indirect tensile and flexure test specimens in the laboratory or in the field.
AS 1012.9:1999-	Determination of the compressive strength of concrete specimens.
AS 1012.12.2:1998	Determination of mass per unit volume of hardened concrete - Water displacement method.
AS 1012.13:1992	Determination of the drying shrinkage of concrete for samples prepared in the field or in the laboratory.
AS 1012.14:1991	Method for securing and testing cores from hardened concrete for compressive strength or indirect tensile strength.

PLAIN OR REINFORCED CONCRETE BASE - COONAMBLE

AS 1141	Methods for sampling and testing aggregates
AS 1141.11.1:2009	Particle size distribution – sieving method
AS 1141.14:2007	Particle shape by proportional calliper.
AS 1141.18:1996	Crushed particles in coarse aggregate derived from gravel.
AS 1141.22:2008-	Wet/dry strength variation.
AS 1141.24:1997	Aggregate Soundness - Evaluation by exposure to sodium sulphate solution
AS 1160:1996	Bitumen emulsions for construction and maintenance of pavements.
AS 1289	Methods of testing soils for engineering purposes
AS 1289.4.2.1-1997	Determination of the sulfate content of a natural soil and the sulfate content of the groundwater - Normal method
AS 1302	Steel reinforcing bars for concrete.
AS 1303	Steel reinforcing wire for concrete.
AS 1304	Welded wire reinforcing fabric for concrete.
AS 1379:2007	The specification and manufacture of concrete.
AS 1478.	Chemical admixtures for concrete, mortar and grout
AS 1478.1:2000	Admixtures for concrete.
AS/NZS 1554	Structural steel welding
AS/NZS 1554.3:2008	Welding of reinforcing steel.
AS 2350 various	Methods of testing Portland and blended cements
AS 2758	Aggregates and rock for engineering purposes
AS 2758.1:1998	Concrete aggregates.
AS 3582	Supplementary cementitious materials for use with Portland and blended cement
AS 3582.1:1998	Flyash.
AS 3799:1998 -	Liquid membrane - forming curing compounds for concrete.
AS 3972:1997 -	Portland and blended cement.
AS/NZS 4671: 2001	Steel reinforcing materials
SAA HB 155 – 2002	Guide to the use of recycled concrete and masonry materials

(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.
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MATERIALS FOR CONCRETE

C248.04 CEMENT

1. Cement shall be Type GP Portland cement complying with AS 3972 and shall be from a source included in the New South Wales Government *Cement Quality Assurance Scheme*. **NSW QA Scheme**
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. This is a **HOLD POINT**. **Proof of Quality (HP)**
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 included in the New South Wales Government *Cement Quality Assurance Scheme*. The use and quality of flyash shall comply with AS 3582.1. **NSW QA Scheme**
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. This is a **HOLD POINT**. **Documentary Evidence (HP)**

C248.06 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**

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. This is a **HOLD POINT**.

Source and Type (HP)

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. This is a **HOLD POINT**.

Source and Type (HP)

(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. This is a **HOLD POINT**.

**Introduction of
Foreign Matter**

(HP)

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. This is a **HOLD POINT**.

**Documentary
Evidence**

(HP)

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. This is a **HOLD POINT**. The cost of all samples and tests shall be borne by the Contractor.

Sampling (HP)

**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 $23 \pm 5^{\circ}\text{C}$ 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°C and the heating shall extend beyond the portion to be bent. Heated bars shall not be cooled by quenching.

Bending

2. Bars bent by any method shall not be straightened and incorporated within the works.

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 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.

Position

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. This is a **HOLD POINT**. 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

(HP)

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 2MPa of the median. The compressive strength for 28 days shall not be less than 36MPa.

Compressive Strength

4. These details shall be submitted at least 21 days before using the nominated mix in the work. This is a **HOLD POINT**.

Submission of Details (HP)

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. This is a **HOLD POINT**.
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.
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.

**Approval for
Mix Variation
(HP)**

**Contractor's
Responsibility**

**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. This is a **HOLD POINT**.
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.
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.
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
Responsibility**

(HP)

Sampling

Curing

Marking

**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. This is a **WITNESS POINT**. 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. 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

(WP)

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. This is a **WITNESS POINT**. The compressive strength shall be determined as to be either:-

**Superintendent's
Absolute
Discretion
(WP)**

(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 requirements of the

**Location of
Cores**

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

Core

PLAIN OR REINFORCED CONCRETE BASE - COONAMBLE

represented by the compaction core shall be removed and replaced in accordance with Clauses C248.50, C248.51 and C248.52.

**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**

- 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. This is a **WITNESS POINT**.
- Cementitious material shall be weighed in an individual hopper, with the Portland cement weighed first.
- 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.

**Certificates
(WP)**

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

- The mixer shall be charged in accordance with the manufacturer's instructions.
- 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.
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.

Batch in Mixer

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.
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.
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. The cost of consistency testing shall be borne by the Contractor.
4. Check tests shall be done on each truckload of concrete.

Tolerances

Test Method

Timing of Testing

Contractor's Cost

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. This is a **HOLD POINT**.
Contractor's Responsibility (HP)
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. This is a **HOLD POINT**.
Written Notice (HP)
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 - VERSION 3.1.
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. This is a **WITNESS POINT**. 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 (WP)
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's Responsibility
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

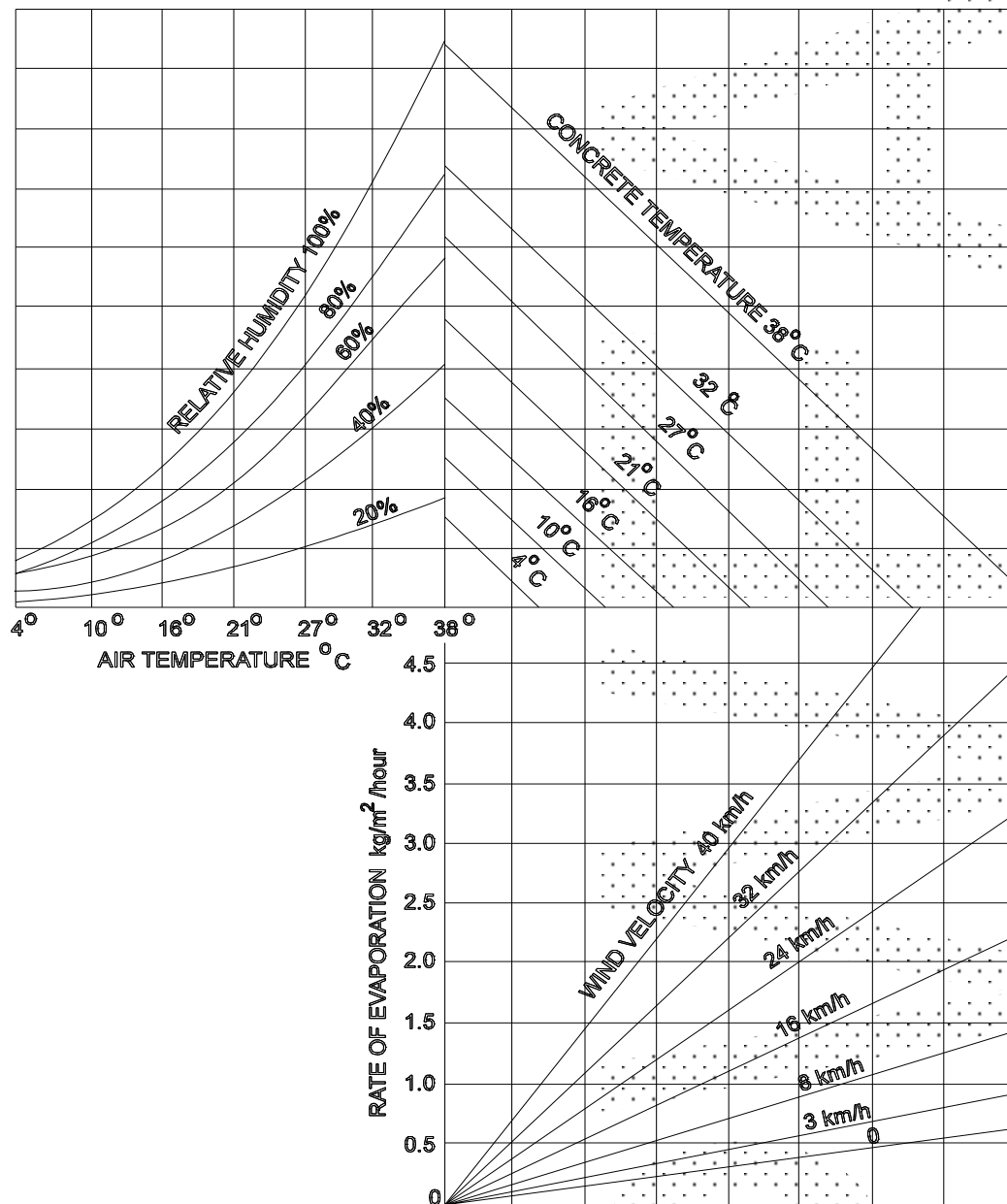


Figure C248.1 - Rate of Evaporation

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 $1.6 \text{ kg/m}^2/\text{hour}$.

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 build-up 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. This is a **WITNESS POINT**. 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 3m 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. This is a **HOLD POINT**.

Surface Level

(HP)

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

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- 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 a 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. This is a **HOLD POINT**.

**Temperature
Control**

(HP)

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. This is a **WITNESS POINT**.

**Rain
Protection
(WP)**

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. This is a **HOLD POINT**.

**Traffic
Restrictions
(HP)**

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. This is a **HOLD POINT**.

Location

(HP)

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. This is a **HOLD POINT**.

**New Trial
Section**

(HP)

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 1 m 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. This is a **HOLD POINT**.

**Rejected
Sawcuts (HP)**

(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 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.

Installation

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 | Sealant Quality |

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the details shown on the Drawings.

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° 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 - VERSION 3.2 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 2m 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. This is a **WITNESS POINT**.

Transverse Joint (WP)

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 recompact, 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. This is a **WITNESS POINT**.

Spoil (WP)

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

Sub-Soil

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the Specification for SUBSOIL AND FOUNDATION DRAINS - VERSION 3.2 and details shown on the Drawings.

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. This is a **HOLD POINT**.

***Details
(HP)***

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 250mm 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 over-sawing 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 to the Superintendent.

Disposal

5. Any slab, adjoining the removed slabs, damaged by the Contractor's operations

Contractor's

shall also be removed and replaced in accordance with this Clause.

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 VERSION 3.2.

**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. This is a **HOLD POINT**.

**Traffic
Restrictions
(HP)**

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 than 7% when discharged from the	C248.13

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Item	Activity	Limits/Tolerances	Spec Clause
3.	Concrete Mixing and Transport	transport vehicle ready for placement 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°C or above 38°C. The temperature of the concrete shall be neither less than 10°C nor more than 32°C. Where the value of Rate of Evaporation exceeds 0.50kg per square metre per hour, the Contractor shall cease work.	C248.29 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°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
	b. Transverse Contraction	(i) May be reduced locally to a skew of 1 in 12 to accommodate construction joints and slab anchors. (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	C248.42

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Item	Activity	Limits/Tolerances	Spec Clause
		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	<p>(i) All parts of any tie bar shall be within 50mm of its designed position.</p> <p>(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.</p> <p>(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.</p> <p>(iv) For Ribbon-Induced joints, the inducer ribbon shall be a minimum of 0.5mm thick and when placed it shall be within 50 of the vertical plane.</p>	C248.44
	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 - VERSION 3.2.
8. Construction of kerb and/or gutter is measured and paid in accordance with the Specification for OPEN DRAINS INCLUDING KERB AND GUTTER - VERSION 3.2.
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 - VERSION 3.2.

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).

ANNEXURE C248 - A

INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause/subclause	Requirement	Notice for inspection	Release by
MATERIALS FOR CONCRETE			
Cement			
C248.04.3 – Proof of Quality	Supply documentary evidence for cement	As requested	Superintendent – PCA concurrence required.
Flyash			
C248.05.3 – Documentary Evidence	Supply documentary evidence for flyash	As requested	Superintendent– PCA concurrence required
Admixtures			
C248.07.5 – Source and Type	Supply documentary evidence for admixture	As requested	Superintendent– PCA concurrence required
Aggregates			
C248.08(a).2 – Source and Type	Supply documentary evidence for each aggregate	As requested	Superintendent– PCA concurrence required
C248.08(d).2 – Introduction of Foreign Matter	Provide evidence of correction	As required	Superintendent– PCA concurrence required
STEEL REINFORCEMENT			
Material			
C.248.14.4 – Documentary Evidence	Provide test certificates	As required	Superintendent– PCA concurrence required
C248.14.5 - Sampling	Random sample material that cannot be identified by a test certificate	As required	Superintendent– PCA concurrence required
Placing			
C248.18.5 - Inspection	Arrange for inspection of fastened reinforcement	At least 4 working hours	Superintendent
DESIGN AND CONTROL OF CONCRETE MIXES			
General			
C248.19.4 – Submission of Details	Submit details of nominated concrete mix	28 days before ordering concrete	Superintendent– PCA concurrence required
Variations to Approved Mixes			
C247.20.1 – Approval for Mix Variation	Submit details of proposed changes to approved mix	28 days before ordering concrete	Superintendent– PCA concurrence required
CONFORMANCE FOR CONCRETE STRENGTH AND THICKNESS			

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Clause/subclause	Requirement	Notice for inspection	Release by
Concrete Cylinders			
C248.21(a).1 – Contractor's Responsibility	Submit NATA certificates of compliance	28 days before ordering concrete	Superintendent – PCA concurrence required
PLACING AND FINISHING CONCRETE BASE			
General			
C248.29.1 – Contractor's Responsibility	Supply details of equipment and paving plan	Four weeks prior to commencement	Superintendent
C248.29.2 – Written Notice	Submit written notice of intent to commence works to the Superintendent	7 days	Superintendent
Alignment and Surface Tolerances			
C248.33(b).2 – Surface Level	Surface shall not pond water	1 working day	Superintendent
Protection of Work			
C248.36.1 – Temperature Control	Call for inspection where unable to maintain 5°C temperature in concrete for 24 hours after placement	1 working day	Superintendent
C248.36.3 – Traffic Restrictions	Traffic to be restricted until concrete strength and 10 day period since pouring has elapsed	1 working day	Superintendent
Trial Concrete Base			
C248.39.1 - Location	Construct a trial section to demonstrate capability to proceed	At least 5 working days of proceeding with the remaining works	Superintendent – PCA concurrence required
C248.39.6 – New Trial Section	Construct a new trial section to demonstrate capability to proceed where directed	At least 5 working days of proceeding with the remaining works	Superintendent – PCA concurrence required
JOINTS			
Transverse Construction Joints			
C248.42(b).4 – Rejected Sawcuts	Submit any proposed joint repair method for approval	5 working days	Superintendent
REMOVAL AND REPLACEMENT OF BASE			
General			
C248.50.2 - Details	Submit proposed methods of carrying out the work	7 days	Superintendent – PCA concurrence required
Replacement of Base			
C248.52.2(e) – Traffic Restrictions	Traffic to be restricted until concrete strength and 10 day period since pouring has elapsed	1 working day	Superintendent

Summary of WITNESS POINTS –

Clause title/Item	Requirement	Notice for inspection
CONFORMANCE OF CONCRETE STRENGTH, COMPACTION AND THICKNESS		
Compressive Strength of Concrete		
C248.22(c).1 – Coring	Obtain Superintendent's requirements	1 working day
C248.22(c).3 – Superintendent's Absolute Discretion	Obtain Superintendent's determination of compressive strength.	1 working day
PRODUCTION, TRANSPORT AND CONSISTENCY OF CONCRETE		
Production and Handling of Concrete		
C248.25.2(a) – Certificates	Provide certificates of calibration of scales	Progressive
PLACING AND FINISHING CONCRETE BASE		
Rate of Evaporation		
C248.30.1 – Evaporation Limit	Submit proposed precautionary measures to the Superintendent for approval	Progressive
Hand Placing		
C248.32.4 – Disruption	Provide a construction joint where directed	Progressive
Protection of Work		
C248.36.2 – Rain Protection	Submit proposed protection measures to the Superintendent for approval	Progressive
SLAB ANCHORS		
General		
C248.47.2 – Transverse Joint	Obtain Superintendent's authorisation of any modified joint spacing	Progressive
Excavation		
C248.48.3 – Spoil	Obtain approval for spoil sites	Progressive



COONAMBLE SHIRE COUNCIL

CONSTRUCTION
SPECIFICATION

C254

SEGMENTAL PAVING

VERSION 3.1 – JANUARY 2022

SEGMENTAL PAVING - COONAMBLE

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
VERSION 3.1	Specification Version 3.1 reference, Inspection requirements added	C254.01	A	KD	30/03/10
	Specification Version 3.1 reference, Standards updated	C254.04	M		
	Hold Point added	C254.05.2	A		
	Specification Version 3.1 reference	C254.10	A		
	Specification Version 3.1 reference, Hold Point added	C254.11	A		
	Specification Version 3.1 reference, Hold Point added	C254.12	A		
	Specification Version 3.1 reference, Hold Point added	C254.13	A		
	Specification Version 3.1 reference	C254.14	A		
	Witness Point added	C254.15.4	A		
	Witness Point added	C254.17.1	A		
	Specification Version 3.1 reference	C254.27	A		
	Annexure added	C254 - B	A		

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SPECIFICATION C254 - SEGMENTAL PAVING – VERSION 3.1

GENERAL

C254.01 SCOPE

1. This Specification covers the construction of both clay and concrete segmental paving for road pavements, medians, traffic islands, driveways, cycleways, footpaths and other pedestrian areas.

2. The work to be executed under this Specification consists of the supply, placement and compaction of segmental pavers including the provision of a sand bedding course and joint filling sand, over bound or unbound base and/or subbase layer/s.

3. This Specification should be read in conjunction with the appropriate Specifications for the construction of the base and subbase layers beneath the segmental paving, ie. STABILISATION – VERSION 3.1, FLEXIBLE PAVEMENTS - VERSION 3.2, MASS CONCRETE SUBBASE – VERSION 3.2.

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

5. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C254-B. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority to be obtained, where stipulated in Annexure C254-B.

Inspections

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

Clay Pavers

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twice the width, plus 2mm.

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° or 45° 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 - Version 3.1
C224	-	Open Drains including Kerb and Gutter - Version 3.1
C241	-	Stabilisation - Version 3.1
C242	-	Flexible Pavements - Version 3.1
C247	-	Mass Concrete Subbase - Version 3.1
C271	-	Minor Concrete Works - Version 3.1

(b) Australian Standards

AS 1141	Methods for sampling and testing aggregates
AS 1141.11.1:2009	Particle size distribution by dry sieving.
AS/NZS 4455:1997	Masonry units and segmental pavers.
AS/NZS 4456.	Masonry units and segmental pavers - Methods of test
AS/NZS 4456.3:2003	Determining dimensions.
AS/NZS 4456.5:2003	Determining breaking load of segmental paving units.
AS/NZS 4456.9:2003	Determining abrasion resistance.
AS/NZS 4586:2004sd	Slip resistance classification of new pedestrian surface materials.
AS/NZS 4663:2004	Slip resistance measurement of existing pedestrian surface

(c) Concrete Masonry Association of Australia Specifications

T44:1997	-	Concrete Segmental Pavements - Guide to Specifying.
T45:1997	-	Concrete Segmental Pavements - Design Guide for Residential Access Ways and Roads.
T46:1997	-	Concrete Segmental Pavements - Detailing Guide.

(d) Clay Brick and Paver Institute Specifications

Manual 1:2003	Clay paving design and construction
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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. This is a **HOLD POINT**. 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,
Super-
intendent's
Approval (HP)**

C254.06 CONCRETE SEGMENTAL PAVERS

1. Concrete segmental pavers shall comply with the requirements of T44, T45, T46, and AS/NZS 4455 for each area of application.

Specification

2. The material requirements for concrete pavers for each application, derived from T44, are shown in Table C254.1.

Requirements

Application	Characteristic breaking load ³ (kN)	Characteristic flexural strength ³ (MPa)	Minimum Thickness (mm)	Shape ⁴ (type)	Dimensional deviations (Category - AS 4455)	Abrasion resistance (mean abrasion index)
Residential Driveways						
Light Traffic	3	2	No limit	Any	DPA1 or DPB1	7
Medium Traffic ¹	5	3	No limit	Any	DPA1 or DPB1	7
Public Footpaths						
Low Volume	5	3	No limit	Any	DPB2	5
High Volume and Pedestrian Malls ¹	5	3	No limit	Any	DPB2	3.5
Roads ⁴						
Minor	5	3	60	Any	DPB2	5
Local and Collector	5	3	80	Any	DPB2	5
Distributor	5	3	80	A	DPB2	5
Industrial Pavements ²	10	4	80	A	DPB3	7

Table C254.1
Material Requirements for Concrete Segmental Pavers

- Notes:
1. Capable of taking occasional 8.2-t axle loads.
 2. The resultant joint width is a combination of paver dimensional deviation and laying procedures.
 3. At 28 days.
 4. Interlocking shapes offer superior performance in road applications.

3. The pavers shall meet the requirements for the relevant application given in Table C254.1 when tested in accordance with the following test methods: **Test Methods**

• characteristic breaking load	AS/NZS 4456.5
• characteristic flexural strength	AS/NZS 4456.5
• Minimum thickness	Not Applicable
• Shape type	Not Applicable
• Dimensional deviations	AS/NZS 4456.3
• Abrasion resistance	AS/NZS 4456.9

C254.07 CLAY SEGMENTAL PAVERS

1. Clay segmental pavers shall comply with the requirements of Part 1 - Specifying Clay Pavers of Paver Note 1 - 'Specifying and Laying Clay Pavers' and with the requirements of AS/NZS 4455. **Specification**

2. Clay pavers shall be classified as Class 1, 2, 3 or 4 in accordance with Paver Note 1 - Specifying and Laying Clay Pavers. Unless otherwise indicated, Class 4 pavers shall be used for all road and driveway pavements, medians and traffic islands. Class 2 or 3 pavers may be used for footpaths, cycleways and other pedestrian areas, except where they are subject to vehicular traffic with axle loads greater than 2.7 tonnes, in which case Class 4 pavers shall be used. Class 1 pavers shall only be permitted for low-volume pedestrian applications not subject to any vehicular traffic. **Class**

3. The abrasion resistance as determined by the SCC Abrasion Test (Paver Note 1) 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 - VERSION 3.2.

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 - VERSION 3.2.

Levels

2. The finished subgrade foundation for the provision of subbase and/or base shall be subject to the approval of the Superintendent. This is a **HOLD POINT**.

Superintendent's Approval (HP)**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 - VERSION 3.1, FLEXIBLE PAVEMENTS - VERSION 3.2, or MASS CONCRETE SUBBASE - VERSION 3.2.

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. This is a **HOLD POINT**.

Superintendent's Approval (HP)

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 for FLEXIBLE PAVEMENTS – VERSION 3.1.

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 for FLEXIBLE PAVEMENTS - VERSION 3.2 for base of $\pm 10\text{mm}$ 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 $+ 10\text{mm}$ or $- 0\text{mm}$ 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. This is a **HOLD POINT**.

Superintendent's Approval (HP)

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 - VERSION 3.2 and MINOR CONCRETE WORKS – VERSION 3.2.

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 or subject to rain shall be checked for level and rescreeded where necessary before pavers are placed. This is a **WITNESS POINT**. 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
(WP)**

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 smaller in size than one quarter of a full block shall not be used.

Odd Shapes

4. Access chambers, drainage gullies and similar penetrations through the pavement shall be finished against the paving with a concrete surround or apron designed to suit and fit the laying pattern, otherwise complying with the requirements for edge restraints.

Penetrations

5. Where pavers are placed over an isolation, contraction or expansion joint in an underlying concrete pavement, a joint is to be provided in the pavers. The joint shall consist of 10mm thick preformed jointing material of bituminous fibreboard.

Formed Joints

6. Any foot or barrow traffic shall use boards overlaying paving to prevent disturbance of units prior to compaction. No other construction traffic shall be allowed on the pavement prior to compaction and provision of joint filling sand.

**Construction
Traffic**

7. On completion of subsequent bedding compaction and joint filling operations, all joints shall have widths within the range 2-4mm.

Tolerance

C254.17 BEDDING COMPACTION

1. After laying the pavers the sand bedding shall be fully compacted and the surface brought to design levels and surface profiles by not less than two passes of a high frequency low amplitude plate compactor which covers at least 12 units. Compaction shall continue until all pavers form a smooth surface with adjacent paver edges matching. The level difference between adjoining edges of any two pavers shall be a maximum of 2mm, to avoid trip hazards, unless approved otherwise by the Superintendent for rough textured pavers. This is a **WITNESS POINT**.

Compaction

(WP)

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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 ± 10 mm 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 ± 6 mm for road pavements and ± 8 mm 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	≤ 2 mm	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 - VERSION 3.2.
5. Subbase and Base are measured and paid in accordance with the Specifications for STABILISATION - VERSION 3.1, FLEXIBLE PAVEMENTS - VERSION 3.2, or MASS CONCRETE SUBBASE - VERSION 3.2 as appropriate.
6. Kerb and/or gutter is measured and paid in accordance with the Specification for OPEN DRAINS INCLUDING KERB AND GUTTER - VERSION 3.2.
7. Edge strips are measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS - VERSION 3.2.
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 - VERSION 3.2.

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

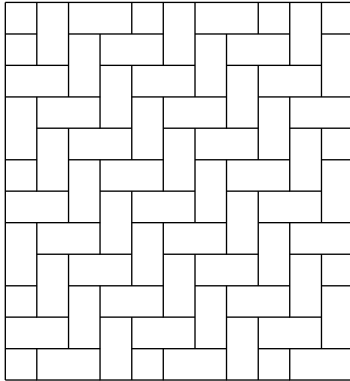
1. The unit of measurement shall be the square metre of surface of segmental paving for road and driveway pavements.
2. The width and length shall be as shown on the Drawings or as directed by the Superintendent.
3. The schedule rate shall include all activities involved in the supply, laying and compaction 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

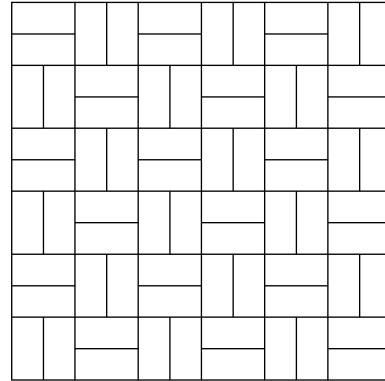
1. The unit of measurement shall be the square metre of surface of segmental paving for other than road pavements, including medians, traffic islands, footpaths, cycleways, and other pedestrian areas.
2. The width and length shall be as shown on the Drawings or as directed by the Superintendent.
3. The 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

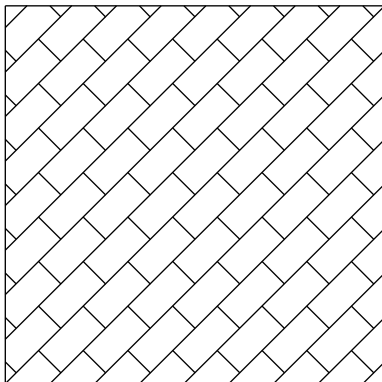
LAYING PATTERNS



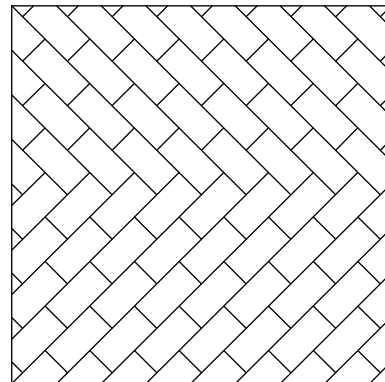
Herringbone



Basketweave



Stretcher



Zig Zag Running Bond

ANNEXURE C254- B

INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title/Item	Requirement	Notice for inspection	Release by
MATERIALS			
General			
C245.05 – Superintendent's Approval	Submit pavers type, quality and supplier	2 weeks before ordering	Superintendent – PCA concurrence required
CONSTRUCTION			
Subgrade preparation			
C254.11.2 – Superintendent's Approval	Present the finished subgrade	1 working day before proceeding	Superintendent
Subbase			
C254.12.3 – Superintendent's Approval	Present finished subbase for approval	1 working day before proceeding	Superintendent
Base			
C254.13.5 – Superintendent's Approval	Present the finished base for approval	2 working days before proceeding	Superintendent

Summary of WITNESS POINTS

Item	Requirement	Notice for inspection
CONSTRUCTION		
Sand bedding course		
C254.15.4 - Screeding	Re-inspect screed left more than 1 day	Progressive
Bedding Compaction		
C254.17.1 - Compaction	Regularly inspect joints after completion	Progressive



COONAMBLE SHIRE COUNCIL

CONSTRUCTION
SPECIFICATION

C255

**BITUMINOUS
MICROSURFACING**

VERSION 3.1 – JANUARY 2022

BITUMINOUS MICROSURFACING - COONAMBLE

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
VERSION 3.1	Specification Version 3.1 reference, Inspection requirements added	C255.01	A	KD	31/03/10
	Specification Version 3.1 referenced, Standards updated	C255.03	M		
	Witness Point added	C255.04.3	A		
	Hold Point added	C255.05.4	A		
	Witness Point added	C255.05.5	A		
	Witness Point added	C255.06.1	A		
	Hold Point added	C255.08.1	A		
	Hold Point added	C255.11.1	A		
	Hold Point added	C255.14.3	A		
	Hold Point added	C255.15.1	A		
	Hold Point added	C255.17.7	A		
	Hold Point added	C255.18.2	A		
	Specification Version 3.1 reference	C255.24	A		
	Specification Version 3.1 reference	C255.28	A		
	Annexure added	C255 - A	A		

SPECIFICATION C255: BITUMINOUS MICROSURFACING – VERSION 3.1

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BITUMINOUS MICROSURFACING - COONAMBLE

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SPECIFICATION C255 : BITUMINOUS MICROSURFACING – VERSION 3.12

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 - VERSION 3.2. For new works on road and carpark pavements, bituminous microsurfacing 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

6. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C255-A. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority to be obtained where stipulated in Annexure C255-A.

Inspections

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 - Version 3.1

(b) Australian Standards

AS 1141 Methods for sampling and testing aggregates
AS 1141.11:1996 Particle size distribution by dry sieving
AS 1141.12:1996 Material finer than 75 µm in aggregates (by washing)
AS 1141.22:2008 Wet/dry strength variation
AS 1141.23:1995 Los Angeles value
AS 1141.25.1:2003 Degradation factor - Source rock
AS 1141.25.2 Degradation factor - Coarse aggregate
AS 1141.25.3 Degradation factor - Fine aggregate
AS 1141.42:1999 Pendulum friction test (PAFV)
AS 1160:1996 - Bitumen emulsions for construction and maintenance of pavements
AS 1289 Methods of testing soils for engineering purposes
AS 1289.3.7.1:2002 Determination of the sand equivalent of a soil using a power-operated shaker
AS 1348:2002 Glossary of terms - Roads and traffic engineering
AS 2008:1997 Residual bitumen for pavements
AS 2350 Methods of testing Portland and blended cements
AS/NZS 2891 Methods of sampling and testing asphalt
AS/NZS 2891.3.1:1997 Bitumen content and aggregate grading (reflux method)

(c) International Slurry Surfacing Association

ISSA TB 100:1990 Test method for wet track abrasion of slurry surfaces
ISSA TB 114:1990 Wet stripping test for cured slurry seal mix
ISSA TB 139:1990 Test method to classify emulsified asphalt/aggregate mixture systems by modified cohesion tester measurement of set and cure characteristics
ISSA TB 144:1990 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. This action constitutes a **WITNESS POINT**.

**Verification
(WP)**

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 from 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. This action constitutes a **HOLD POINT**.

NATA Certification (HP)

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. This is a **WITNESS POINT**.

Stockpile Test Reports (WP)

C255.06 MINERAL FILLER

1. Mineral filler shall consist of hydrated lime, flyash, Portland cement, or other material approved by the Superintendent. This action constitutes a **WITNESS POINT**.

Type (WP)

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. This action constitutes a **HOLD POINT**. **Type and Proportion (HP)**

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 microsurfacing mix design for the work including the target application rate (m³ of mix/m² 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. This is a **HOLD POINT**. **Submit for Approval (HP)**

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.
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.
3. No paving unit shall be allowed on the work until the calibration has been verified and approved by the Superintendent. This is a **HOLD POINT**.

Calibration

Documentation

Approval by Superintendent (HP)

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. This is a **HOLD POINT**.
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.

Clean Pavement (HP)

Protection of Services

C255.16 WEATHER LIMITATIONS

1. Bituminous microsurfacing shall not commence if either the pavement or air temperature is below 10°C and falling.
2. Bituminous slurry may be applied when both pavement and air temperatures are above 7°C and rising, or above 10°C.
3. Spreading shall not proceed during rain or when rain appears imminent.

Temperature

Temperature

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.
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.
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.

Water Fog Spray

Paving Unit

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. This is a HOLD POINT .	Traffic (HP)
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. This is a HOLD POINT . If the surface texture is acceptable to the Superintendent, then all subsequent work shall be finished to an equivalent surface texture.	Test Run (HP)
3. Where increased surface texture is required, a fabric skirt may be trailed behind the spreader box.	Increased Texture
C255.19 JOINTS	
1. Longitudinal joints in the wearing course shall be straight and placed at either the edge or the centre of a traffic lane. If necessary, the edges and joints shall be lightly screeded with a hand squeegee to achieve a smooth uniform appearance and to remove excess build-up of material.	Uniform Joints
C255.20 SAMPLING AND TESTING OF PRODUCTION MIX	
(a) Lot Definition	
1. Compliance sampling and testing of bituminous microsurfacing shall be undertaken on a lot by lot basis. For this purpose, 50m ³ or one day's production (whichever is the lesser), or such smaller quantity which is considered as representative of consistent production of the paving unit, shall be considered as representative of consistent production of the paving unit.	Lots
(b) Responsibility of Sampling	
1. The Contractor shall be responsible for taking samples and shall supply all facilities, equipment and labour for that purpose.	Contractor's Responsibility
2. The costs associated with taking samples of production mix shall be borne by the Contractor.	Contractor's Cost

(c) Frequency of Sampling

1. For the testing of production mix, two 1.5kg representative samples of bituminous microsurfacing shall be taken from each lot at random intervals. The samples shall be taken from the discharge of the paving unit and the sample containers immediately sealed.

Mix Samples

2. For the testing of the binder, two 2L samples of bitumen emulsion shall be taken from each bulk delivery in accordance with AS 1160.

Bitumen Emulsion**(d) Testing**

1. The samples of bituminous microsurfacing shall be treated and tested at a NATA registered laboratory to confirm compliance with Table C255.4. Prior to testing for Residual Binder Content and Aggregate Gradation, as determined by AS 2891.3.1, the samples shall be dried to constant weight in an oven at 60°C for a minimum of 15 hours.

Mix Tests

2. Each delivery of emulsion shall be tested for residual binder content in accordance with AS 1160 Appendix D and accompanied by a certification of specification compliance traceable to the relevant batch at the supplier's 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 $\pm 10\text{mm}$. 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 ± 10 mm 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 - VERSION 3.2 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 - VERSION 3.2 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.

ANNEXURE C255 - A**INSPECTIONS**

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title/Item	Requirement	Notice for inspection	Release by
MATERIALS			
Mineral Aggregates			
C255.05.4 – NATA Certification	Details of aggregate sources and NATA testing to be submitted for approval	2 weeks before testing materials	Superintendent – PCA concurrence required
Additives			
C255.08.1 – Type and Proportion	Provide details of any proposed additive	7 days prior to use	Superintendent
MIX DESIGN			
Nominated Mix			
C255.11.1 – Submit for Approval	Submit mix design for approval	2 weeks prior to use	Superintendent – PCA concurrence required
PRODUCTION AND PAVING			
Paving Unit Calibration			
C255.14.3 - Approval by Superintendent	Submit details of paver calibration for approval	7 days prior to use	Superintendent
Preparation of Pavement			
C255.15.1 - Clean Pavement	Provide clean surface for application	1 day	Superintendent
Spreading			
C255.17.7 - Traffic	Provide trafficable surface within one hour of spreading	1 day	Superintendent
Surface Texture			
C255.18.2 - Test Run	Provide test pavement	1 day	Superintendent

Summary of WITNESS POINTS –

Clause title/Item	Requirement	Notice for inspection
MATERIALS		
Binder		
C255.04.3 - Verification	Provide details to verify binder is compliant	1 week before commencing work
Mineral Aggregates		
C255.05.5 – Stockpile Test Reports	Stockpile samples	7 days
Mineral Filler		
C255.06.1 - Type	Approval of alternate material	7 days



COONAMBLE SHIRE COUNCIL

**CONSTRUCTION
SPECIFICATION**

C261

PAVEMENT MARKINGS

VERSION 3.1 – JANUARY 2022

Amendment Record for this Specification Part

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VERSION 3.1	Specification Version 3.1 reference, Inspection requirements added	C261.01	A	KD	1/04/10
	Specification Version 3.1 reference, standards updated	C261.02	M		
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	Hold Point added	C261.06.1	A		
	Hold Point added	C261.07.2	A		
	Hold Point added	C261.08.1	A		
	Specification Version 3.1 reference	C261.10.1	M		
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	Hold Point added	C261.16.2	A		
	Witness Point added	C261.16.4	A		
	Witness Point added	C261.17.1	A		
	Witness Point added	C261.17.2	A		
	Witness Point added	C261.18.1	A		
	Hold Point added	C261.20.1	A		
	Witness Point added	C261.21.2	A		
	Hold Point added	C261.23.2	A		
	Hold Point added	C261.28	A		
	Specification Version 3.1 reference	C261 - C	A		
	Annexure added				

SPECIFICATION C261 - PAVEMENT MARKINGS – VERSION 3.1

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SPECIFICATION C261 : PAVEMENT MARKINGS – VERSION 3.1**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 - Version 3.2.

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*.

Conformance

4. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C261-C. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority to be obtained, where stipulated in Annexure C261-C.

Inspections**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 - Version 3.1

(b) Australian Standards

AS 1289	Methods of testing soils for engineering purposes
AS 1289.2.1.4-2005	Soil moisture content tests - Determination of the moisture content of a soil - Microwave-oven drying method (subsidiary method)
AS 1580	Paints and related materials—Methods of test
AS 1580.107.3	Determination of wet film thickness by gauge.
AS 1742.2:2009	Traffic control devices for general use.
AS 1742.3:2009	Manual of uniform traffic control devices - Traffic control devices for works on roads
AS 1906	Retroreflective materials and devices for road traffic control purposes
AS 1906.3:1992	Raised pavement markers (retroreflective and non-retroreflective).
AS/NZS 2009:2006	Glass beads for road-marking materials.
AS 2700-1996	Colour Standards for general purposes
AS 4049	Paints and related materials—Pavement marking materials
AS 4049.1-2005	Solvent-borne paint - For use with surface applied glass beads
AS 4049.2:2005	Thermoplastic road marking materials.
AS 4049.3:2005	Waterborne paint - For use with surface applied glass beads

(c) Other

Roads and Traffic Authority (NSW) -

RTA Delineation manual 2008 Sections 1 to 5
RTA Test method T841
RTA QA Specification DCM R141 Pavement Marking

C261.03 TYPE OF MARKINGS

1. Details of the various types of pavement markings and devices are generally in accordance with the requirements of AS 1742.2. **Standard**

C261.04 TYPES OF MATERIALS TO BE APPLIED

1. The materials shall be applied as follows: **Locations for Use**
- (a) Pavement Marking Paint
Permanent markings on all wearing surfaces. Temporary markings, other than on the final wearing surfaces. Traffic islands and kerbs where specified.
 - (b) Thermoplastic Pavement Marking Material
Permanent markings where explicitly indicated on the Drawings:
 - (c) Pavement Marking Tape
Temporary markings on final wearing surfaces.
 - (d) Reflective Glass Beads
To be applied to all painted and thermoplastic markings.
 - (e) Raised Pavement Markers
To be installed as permanent and temporary markings as shown on the Drawings.
 - (f) Cold Applied Plastics
To be installed in accordance with manufacturer's 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 manufacturer's 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 **Contractor's Responsibility**

of the materials, including paint, glass beads, raised pavement markers and thermoplastic material proposed for use. This is a **HOLD POINT**. (HP)

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. The work shall be set out with materials which will be easily removable upon placement of permanent markings. This action constitutes a **HOLD POINT**. **Contractor's Responsibility** (HP)

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). This is a **HOLD POINT**. **Wet Weather** (HP)

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 - VERSION 3.2, 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 4049.3 and NSW Roads and Traffic 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. **Glass Beads Quality**

Note: 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.

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 manufacturer's instructions.

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. This is a **WITNESS POINT**.

Paint Thickness (WP)

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 the 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/m².

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 AS 1742.2.

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 C261-A and as quantified in Table 261.1.

**Beads
Application**

Road Speed km/h	Line Widths				
	80mm	100mm	120mm	150mm	200mm
8	396	495	594	742	990
13	643	804	965	1207	1698
16	791	990	1188	1484	1484

1. Tolerance of +10% shall be permissible when measuring the above volume.
2. When two or more glass bead dispensers are to be used, each dispenser shall be checked separately to make up the totals shown.
3. Glass beads weigh approximately 1.53 grams per millilitre.

Table C261.1 - Volume of glass beads (ml) required in 10 seconds of operation

THERMOPLASTIC PAVEMENT MARKING MATERIAL

C261.14 MATERIALS

1. Thermoplastic pavement marking material shall comply with the requirements of AS 4049.2.

**Thermoplastic
Quality**

2. In this Specification, the term 'thermoplastic material' shall mean 'thermoplastic pavement marking material'.

Definition

3. Glass beads shall be incorporated in thermoplastic material, in the proportion of 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% 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. This is a **HOLD POINT**.

**Tack Coat
(HP)**

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 overheating 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. This is a **WITNESS POINT**. 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 (WP)

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/m².

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, approved by the Superintendent, and templates to control the pattern. This is a **WITNESS POINT**.

Screed (WP)

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/m².

Beads for Other Markings

7. Pavement marking shall be straight or with smooth, even curves where intended. All edges shall have a clean, sharp cut off. Any marking material applied beyond the defined edge of the marking shall be removed leaving a neat and smooth marking on the wearing surface of the pavement.

Pavement Marking Finish

8. The lengths of longitudinal lines shall not vary by more than 20mm from the lengths shown in AS 1742.2. The widths of longitudinal lines shall not vary by more than 10mm from the widths shown in AS 1742.2.

Longitudinal Line Tolerances

9. The lengths and widths of transverse lines shall not vary by more than 10mm from the lengths and widths shown in AS 1742.2.

Transverse Line Tolerances

10. The dimensions of arrows, chevrons, painted medians, painted left turn islands and speed markings shall 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, & 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. This is a **WITNESS POINT**.

**Thickness of
Thermoplastic
Material (WP)**

2. The application rate of glass beads applied to the surface of the markings shall be checked by the method described in Annexure C261A. This is a **WITNESS POINT**.

**Glass Beads
Application
Rate (WP)**

PAVEMENT MARKING TAPE

C261.18 MATERIALS

1. Pavement marking tape shall be a strippable type of tape approved by the Superintendent. This is a **HOLD POINT**.

Brands (HP)

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
Recommendation**

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. This is a **WITNESS POINT**.

**Manufacturer's
Recommendation
(WP)**

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. This is a **HOLD POINT**.

**Bitumen
Adhesive (HP)**

C261.22 INSTALLATION OF RAISED PAVEMENT MARKERS

1. Raised pavement markers shall be fixed to the wearing surface of the pavement

Adhesive

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.

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 diameter of the base of the raised pavement marker, shall be provided. The adhesive shall be applied to fill the irregularities in the pavement surface to produce a flat, smooth surface flush with the upper stone level. The adhesive pad shall be allowed to set. Additional adhesive shall be applied to the pavement, as described above, and then the raised pavement marker shall be pressed down onto the adhesive pad on the pavement surface to ensure good adhesion.

**Rough
Surfaces**

REMOVAL OF PAVEMENT MARKINGS

C261.23 GENERAL

1. The Contractor shall remove pavement markings, no longer required, from the wearing surface of pavements without significant damage to the surface. 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. This is a **HOLD POINT**.

**Removal
Method (HP)**

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 -0mm from lengths shown in AS 1742.3	C261.16
	(b) Width	+10mm -0mm (except for double barrier lines where the gap between lines must not decrease) from widths shown in AS 1742.3	C261.12 C261.16
3.	Transverse Lines		
	(a) Length)	±10mm from lengths and widths shown in AS 1742.3	C261.12
	(b) Width)		C261.16
4.	Arrows, Chevrons, Painted Medians, Speed Markings etc.	±50mm from the dimensions shown in AS 1742.3	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 - VERSION 3.2.

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 C261- A

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/m².

ANNEXURE C261 - B

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. They should be intermixed at a rate of not less than 20% by mass. Class C beads may also be used for surface applications to a wet film of pavement marking to provide initial retroreflectivity. They 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. They 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. They should be intermixed at a rate of not less than 20% by mass.

ANNEXURE C261- C

INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title/subclause	Requirement	Notice for inspection	Release by
GENERAL			
Setting Out			
C261.06.1 – Contractor's Responsibility	Obtain approval for set out	3 days	Superintendent
Material Quality			
C261.05.1 – Contractor's Responsibility	Submit NATA Test Reports on materials	14 days before work is scheduled to commence	Superintendent – PCA concurrence required
Surface preparation			
C261.07.2 – Wet Weather	Obtain direction on suspension of work	Progressive	Superintendent
THERMOPLASTIC PAVEMENT MARKING MATERIAL			
Materials			
C261.14.5 – Tack Coat	Obtain approval for tack coat material	7 days before work is scheduled to commence	Superintendent
PAVEMENT MARKING TAPE			
Materials			
C261.18.1 - Brands	Obtain approval for type of strippable tape	7 days before work is scheduled to commence	Superintendent
RAISED PAVEMENT MARKERS			
Materials			
C261.21.2 – Bitumen Adhesive	Submit adhesive for approval	7 days before work is scheduled to commence	Superintendent
REMOVAL OF PAVEMENT MARKINGS			
General			
C261.23.2 – Removal Method	Submit method for approval	7 working days before commencement of the activity	Superintendent

Summary of WITNESS POINTS

Clause title/subclause	Requirement	Notice for inspection
PAVEMENT MARKING PAINT		
Application of Paint and Beads		
C261.12.3 - Paint Thickness	Application of paint and beads to be checked for quality	Progressive
THERMOPLASTIC PAVEMENT MARKING MATERIAL		
Application of Thermoplastic Material and Beads		
C261.16.2 – Longitudinal Lines	Self propelled spraying machine to be approved by the Superintendent	Progressive
C261.16.4 - Screed	Mobile applicator to be approved by the Superintendent	Progressive
Field Testing		
C261.17.1 – Thickness of Thermoplastic Material	Confirm thickness by micrometer measurement	Progressive
C261.17.2 – Glass Beads Application Rate	Confirm application rate	Progressive
PAVEMENT MARKING TAPE		
Removal of Pavement Marking Tape		
C261.20.1 – Manufacturer's Recommendation	Direction to remove tape	Progressive



COONAMBLE SHIRE COUNCIL

CONSTRUCTION
SPECIFICATION

C262

SIGNPOSTING

VERSION 3.1 – JANUARY 2022

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
VERSION 3.1	Inspection requirements added	C262.01.3	A	KD	31/03/10
	Specification Version 3.1 reference, standards updated	C262.02.1	M		
	Specification Version 3.1 referenced	C262.03	A		
	Hold Point added	C262.04.1	A		
	Hold Point added	C262.04.2	A		
	Hold Point added	C262.07.1	A		
	Hold Point added	C262.12(c).2	A		
	Hold Point added	C262.13.4	A		
	Specification Version 3.1 reference	C262.15.5	A		
	Hold Point added	C262.17.1	A		
	Sign Types specified, Hold Point added	C262.18	A		
	Annexure added	C262 - A	A		

SPECIFICATION C262 – SIGNPOSTING – VERSION 3.1

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SPECIFICATION C262 : SIGNPOSTING – VERSION 3.1

GENERAL

C262.01 SCOPE

1. The work to be executed under this Specification consists of:
 - (a) the supply and erection of the Regulatory, Warning, Guide, Information and Direction signs as described in AS 1742, AS 1743 and AS 1744.
 - (b) the supply and erection of sign support structures to support the signs, and
 - (c) the adjustment of existing signs and sign support structures.

2. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements – Version 3.2.

Quality

3. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C262-A. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority to be obtained where stipulated in Annexure C262-A.

Inspections

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 - Version 3.1 |
| C271 | - | Minor Concrete Works - Version 3.1 |

(b) Australian Standards

- | | |
|---------------------|---|
| AS 1163:1991 | Structural steel hollow sections |
| AS 1214:1983 | Hot-dip galvanised coatings on threaded fasteners |
| AS 1250 | The use of steel in structures (SAA Steel Structures Code) |
| AS 1379:2007 | The specification and manufacture of concrete |
| AS/NZS 1554 | Structural steel welding. |
| AS/NZS 1554.1:2004 | Welding of steel structures |
| AS 1580 | Paints and related materials—Methods of test. |
| AS 1580.108.2: 2004 | Dry film thickness—Paint inspection gauge. |
| AS/NZS 1580.602.2 | Measurement of specular gloss of non-metallic paint films at 20°, 60° and 85° |
| AS 1580.108.2 - | Dry film thickness - Paint inspection gauge. |
| AS 1627 | Metal finishing – Preparation and pre-treatment of surface |
| AS 1627.1: 2003 | Removal of oil, grease and related contamination |
| AS 1627.4: 2005 | Abrasive blast cleaning of steel |
| AS 1627.9: 2002 | Pictorial surface preparation standards for painting steel surfaces |
| AS 1734:1997 - | Aluminium and aluminium alloys - flat sheet, coiled sheet and plate |
| AS 1742 | Manual of uniform traffic control devices |
| AS 1742.5-1997 | Street name and community facility name signs |

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AS 1743:2001	-	Road Signs - Specifications
AS 1744:1975		Forms of letters and numerals for road signs
AS/NZS 1866:1997		Aluminium and aluminium alloys - extruded rod, bar, solid and hollow shapes
AS 2700:1996	-	Colour standards for general purposes
AS/NZS 3678:1996		Structural steel - hot-rolled plates, floorplates and slabs
AS/NZS 3679		Structural steel.
AS/NZS 3679.1:1996		Structural steel - hot-rolled bars and sections
AS 4100:1998		Steel in structures.
AS/NZS 4671: 2001		Steel reinforcing materials.
AS/NZS 4680:2006		Hot-dip galvanised (zinc) coatings on fabricated ferrous articles

(C) Other publications

Austrroads Glossary of Austrroads Terms 2008

C262.03 PROVISION FOR TRAFFIC

- | | |
|---|------------------------------------|
| 1. The Contractor shall provide for traffic in accordance with the requirements of the Specification for CONTROL OF TRAFFIC - VERSION 3.1 while undertaking the work and shall organise the work to avoid or minimise delays and inconvenience to traffic. | Minimise
Inconvenience |
| 2. Where a sign is erected before its intended use by traffic and is visible to traffic, the face of the sign shall be completely and securely wrapped in porous cloth sheeting or other opaque covering material approved by the Superintendent, until the Superintendent directs that the sign shall be uncovered. The covering shall not allow the sign to be visible at night when exposed to vehicle headlights. | 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. This is a HOLD POINT . | Approved
Supplier (HP) |
| 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). This is a HOLD POINT . | Proof of
Quality (HP) |
| 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 Council. This is a HOLD POINT . The background and legend material shall be compatible both in application and durability. | Approval (HP) |
| 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

- | | |
|---|----------------|
| 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. | Quality |
|---|----------------|

- | | |
|--|--------------------|
| 2. The paint shall be applied using conventional air spray application to give a | Application |
|--|--------------------|

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uniform cover free of blemishes. A minimum dry film thickness of 38 microns is required when tested in accordance with AS 1580.108.2.

- | | | |
|--|--|--------------------------|
| 3. | Background paint shall be as specified from one of the following colours: | Colours |
| | <ul style="list-style-type: none">(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 |
| | <ul style="list-style-type: none">(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 | | Painted Head |
-

of the shank into the standard drilled hole for that rivet.

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**

Sign Reference Number
Manufacturer's Name
Month and Year of Manufacture
Manufacturer and Class of Retro-Reflective Material

4. The requirements for reference markings shall not apply to proprietary street name or community facility name signs.

**Proprietary
Signs**

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

**Damaged
Surfaces**

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structure. Any structure with totally-damaged coating areas exceeding 2500 square millimetres shall be regalvanised by the Contractor.

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. This is a **HOLD POINT**.

Contractor's Responsibility (HP)

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. This is a **HOLD POINT**.

Approval of Superintendent (HP)

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

Concrete

Specification for MINOR CONCRETE WORKS - VERSION 3.1 and have a minimum compressive strength at 28 days of 20MPa for pipe support footings and 32MPa for purpose-designed support footings.

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. This is a **HOLD POINT**.

Extent of Work

(HP)

SPECIAL REQUIREMENTS

C262.18 STREET AND COMMUNITY FACILITY NAME SIGNS

1. All street and community facility name signs shall comply with Council's adopted signage system and with the details as shown on the Drawings.

Signage System

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2. Proprietary signs shall be manufactured and installed in accordance with the requirements of AS 1742.5, Street Name and Community Facility Name Signs, to the following details:

***Proprietary
Sign
Requirements***

STREET NAME SIGNS

- a) Colour:
 - Legend - *Wineberry*, Non-reflective
 - Background - *Cream*, Class 1 Retroreflective
- b) Lettering and Numerals:
 - Font Type - *Series D*
 - Height - 100mm

COMMUNITY FACILITIES SIGNS

- a) Colour:
 - Legend - *White*, Non-reflective
 - Background - *Blue*, Class 1 Retroreflective
- b) Lettering and Numerals:
 - Font Type - *Series D*
 - Height - 100mm

3. Details of the signs and legends to be provided under the Contract shall be as shown on the Drawings.

Legends

4. 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. This is a **HOLD POINT**.

***Council
Approval (HP)***

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 - VERSION 3.1.
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 - VERSION 3.1.

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.

ANNEXURE C262 - A**INSPECTIONS**

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause/subclause	Requirement	Notice for inspection	Release by
MATERIALS			
General			
C262.04.1 – Approved Supplier	Provide suppliers details	1 week prior to engaging supplier	Superintendent – PCA concurrence required
C262.04.2 – Proof of Quality	Evidence that materials and parts proposed comply with requirements	1 week prior to engaging supplier	Superintendent
Retro-reflective Material for Background and Legend			
C262.07.1 - Approval	Details of material and compatibility in application and durability	1 week prior to ordering	Superintendent
Sign Support Structures			
C262.12(c).2 – Contractor's Responsibility	Details of proposed attachment system	2 weeks prior to fabrication	Superintendent
ERECTION OF NEW SIGNS			
Setting Out			
C262.13.4 – Approval of Superintendent	Submit proposed location and alignment	1 week prior to erection	Superintendent
ADJUSTMENT OF EXISTING SIGNS AND SUPPORT STRUCTURES			
General			
C262.17.1 – Extent of Work	Call for inspection of adjusted signs	2 working days	Superintendent
SPECIAL REQUIREMENTS			
Street and Community Facility Name Signs			
C262.18.4 – Council Approval	Details of manufacturer materials and attachment systems	2 week prior to commencement of manufacture	Superintendent – Council concurrence required



COONAMBLE SHIRE COUNCIL

CONSTRUCTION
SPECIFICATION

C263

GUIDE POSTS

VERSION 3.1 - JANUARY 2022

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
VERSION 3.1	Inspection requirements added	C263.01.2	A	KD	1/04/10
	Specification Version 3.1 reference, standards updated	C263.02.1	M		
	Hold Point added	C263.03(c).1	A		
	Specification Version 3.1 reference, Hold Points added	C263.04	A		
	Witness Point added	C263.06.3	A		
	Hold Point added	C263.06.4	A		
	Witness Point added	C263.07.3	A		
	Specification Version 3.1 reference	C263.11	A		
	Annexure added	C263 - A	A		

SPECIFICATION C263 - GUIDE POSTS – VERSION 3.1

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C263.04	GENERAL	2
C263.05	PROTECTIVE TREATMENT OF TIMBER GUIDE POSTS.....	3
C263.06	ERECTION OF GUIDE POSTS.....	3
C263.07	DELINEATORS	3
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C263.08	RESERVED.....	4
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MEASUREMENT AND PAYMENT		4
C263.11	PAY ITEMS	4
ANNEXURE		5
C263-A	INSPECTIONS	5

SPECIFICATION C263 : GUIDE POSTS – VERSION 3.1

GENERAL

C263.01 SCOPE

1. The work to be executed under this Specification consists of the setting out, supply of all materials and erection of guide posts at the locations shown on the Drawings or as directed by the Superintendent in areas where street lighting is not provided.

2. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C263-A.. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority to be obtained where stipulated in Annexure C263-A.

Inspections

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 - Version 3.1

(b) Australian Standards

AS 1604	Specification for preservative treatment –
AS1604.1:2005	Sawn and round timber.
AS 1742	Manual of uniform traffic control devices
AS 1742.2:2009	Traffic control devices for general use
AS/NZS 1906	Retroreflective materials and devices for road traffic control purposes.
AS/NZS 1906.2:2007	Retroreflective devices (non-pavement application).
AS 2082:2007	Timber – Softwood - Visually stress-graded for structural purposes
AS 2311: 2009	Guide to the painting of buildings.
AS 2858: 2008	Timber – Softwood – Visually stress – graded for structural purposes.
AS 3730	Guide to the properties of paints for buildings.
AS 3730.17: 2006	Primer – Wood – Latex – Interior/exterior.
AS 3730.18: 2006	Undercoat/sealer – Latex – Interior/exterior.
AS 5604: 2005	Timber – Natural durability ratings

(c) Other publications

Austrorads Glossary of Austrorads Terms 2008

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. | <i>Dimensions</i> |
|----|---|--------------------------|

(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. | <i>Quality</i> |
| 2. | The posts shall be of rectangular cross-section having dimensions of 100mm x 50mm and shall be 1,400mm in length. The tops of the guide posts shall be sloped so that one 100mm edge is 10mm lower than the opposite edge. | <i>Dimensions</i> |

(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. This is a HOLD POINT . | <i>Details</i>

<i>(HP)</i> |
|----|---|---|

(d) Delineators

- | | | |
|----|---|------------------------|
| 1. | Corner-cubed delineators, conforming to AS 1906.2 shall be attached to each post. | <i>Standard</i> |
| 2. | The delineators shall be neither less than 80mm nor more than 85mm diameter. | <i>Diameter</i> |

CONSTRUCTION

C263.04 GENERAL

- | | | |
|----|--|---|
| 1. | The Contractor shall at all times conform to the requirements of the Specification for CONTROL OF TRAFFIC – VERSION 3.1. | <i>Traffic Control</i> |
| 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. This is a HOLD POINT . | <i>Positioning</i>

<i>(HP)</i> |
| 3. | Guide posts shall be erected at the locations shown on the Drawings. | <i>Location</i> |
| 4. | Underground services laid in proximity to the guide posts shall be located prior to erection of posts. This is a HOLD POINT . | <i>Underground Services (HP)</i> |

C263.05 PROTECTIVE TREATMENT OF TIMBER GUIDE POSTS

- | | |
|--|----------------------|
| 1. The portion of the guide post below ground level shall be treated with creosote, such that the penetration and retention of creosote preservative conforms with the requirements for minimum Hazard Class H4 treatment in accordance with AS 1604.1. | Creosote |
| 2. All timber above ground level shall be painted with pink primer and any holes, cracks, or other surface imperfections in the timber, shall be stopped with white putty. This work shall be followed by painting with a white undercoat and a white enamel finishing coat. | Painting |
| 3. Painted surfaces shall be thoroughly dry before the second coat is applied. Paints shall be handled and applied in accordance with the manufacturer's directions. | Dry Surfaces |
| 4. All paints shall be of the best quality, durable and suitable for exterior application on timber surfaces. | Paint Quality |

C263.06 ERECTION OF GUIDE POSTS

- | | |
|---|-------------------------------------|
| 1. Guide posts shall be set vertically in the ground to a depth of approximately 500mm. In order to offset shoulder irregularities this depth shall be varied so as to give uniform display of guide posts to a height of approximately 900mm above ground level, with the tops evenly graded. Each guide post shall be erected with the 100mm axis at right angles to the centre line of the road. | Details |
| 2. Allowance shall be made in the height of guide posts above the ground for the effects of superelevation and other road geometry in order to keep the guide posts within the range of the beam of vehicle headlights. | Vertical Alignment |
| 3. Backfilling shall be compacted in layers of depth not more than 150mm for the full depth of the guide posts up to ground level. The density of the compacted backfilling shall not be less than that of the adjacent undisturbed ground. Guide posts shall be firm in the ground to the satisfaction of the Superintendent. This is a WITNESS POINT . | Backfilling (WP) |
| 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. Provide manufacturers instructions for anchorage. This is a HOLD POINT . | Proprietary Guide Posts (HP) |
| 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. This is a WITNESS POINT . | Arrangement (WP) |

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 - VERSION 3.2.

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.

ANNEXURE C263- A

INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause/subclause	Requirement	Notice for inspection	Release by
GENERAL			
Materials			
C263.03(c).1 - Details	Proposal for supplier and manufacturer details	2 weeks before manufacture	Superintendent – Council concurrence required
CONSTRUCTION			
General			
C263.04.2 - Positioning	Call for inspection	1 working day	Superintendent
C263.04.4 - Underground Services	Check for services	5 working days	Superintendent
Erection of Guide Posts			
C263.06.4 – Proprietary Guide Posts	Provide manufacturers anchorage instructions	5 working days	Superintendent

Summary of WITNESS POINTS

Clause/ subclause	Requirement	Notice for inspection
CONSTRUCTION		
Erection of Guide Posts		
C263.06.3 - Backfilling	Firm embedment in ground	Progressive
Delineators		
C263.07.3 - Arrangement	Arrangement of delineators relative to traffic direction	Progressive



COONAMBLE SHIRE COUNCIL

CONSTRUCTION
SPECIFICATION

C264

**NON-RIGID ROAD
SAFETY BARRIER SYSTEMS**
(Public Domain)

VERSION 3.1 – JANUARY 2022

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
VERSION 3.1	Inspections requirements added	C264.01.3	A	KD	1/04/10
	Specification Version 3.1 reference, standards updated	C264.02.1	M		
	Hold Point added	C264.04.1	A		
	Specification Version 3.1 reference, Hold Points and Witness Points added	C264.05	A		
	Witness Points added	C264.06	A		
	Specification Version 3.1 reference	C264.07	A		
	Witness Point added	C264.08.5	A		
	Hold Point added	C264.09.2	A		
	Requirements for wire rope added. Hold Point added	C264.11.1	A		
	Specification Version 3.1 reference	C264.16	A		
	Annexure added	C264 - A	A		

SPECIFICATION C264 – NON-RIGID ROAD SAFETY BARRIER SYSTEMS (Public Domain) – VERSION 3.1

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SPECIFICATION C264: NON-RIGID ROAD SAFETY BARRIER SYSTEMS (Public Domain) – VERSION 3.1

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.

3. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C264-A.. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority to be obtained, where stipulated in Annexure C264-A.

Inspections

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 - Version 3.1 |
| C271 | - | Minor Concrete Works - Version 3.1 |

(b) Australian Standards

- | | |
|--------------------|---|
| AS1214:1983 | Hot-dip galvanised coatings on threaded fasteners (ISO metric course thread series) |
| AS/NZS1594:2002 | Hot-rolled steel flat products |
| AS 1627 | Metal finishing – Preparation and pre-treatment of surfaces |
| AS1627.4-2005 | Abrasive cleaning of steel |
| AS1627.5-2003 | Pickling |
| AS/NZS 1906 | Retroreflective materials and devices for road traffic control purposes |
| AS/NZS 1906.2:2007 | Retroreflective devices (non pavement application). |
| AS 2858:2008 | Timber—softwood – visually stress-graded for structural purposes |
| AS 2311:2009 | Guide to the painting of buildings |
| AS 3730 | Guide to the properties of paints for buildings |
| AS 3730.10:2006 | Latex – Exterior – Gloss |
| AS 3730.18:2006 | Undercoat / Sealer – Latex - Interior |
| AS/NZS 3845:1999 | Road safety barrier systems. |
| AS/NZS 4680:2006 | 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.
2. Timber posts are to be used only in W-beam terminal sections, as detailed on the Drawings and shall be of the timber type, grade, size and treatment level in accordance with AS/NZS 3845. All surfaces shall be smooth and free from obvious saw marks.

Steel

Timber

C264.04 CERTIFICATION

1. Steel and timber road safety barrier components shall not be erected until the Contractor has produced documentary evidence to the Superintendent that the steel and timber road safety barrier components conform to the requirements of this Specification. This is a **HOLD POINT**.

**Evidence of
Conformance
(HP)**

CONSTRUCTION

C264.05 GENERAL

1. The Contractor shall at all times conform to the requirements of the Specification for CONTROL OF TRAFFIC - VERSION 3.1.
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. This is a **WITNESS POINT**.
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. Peg or paint mark the start and finish points and line of safety barrier, transitions and terminals including the line of flare if applicable. This is a **HOLD POINT**.
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. This is a **HOLD POINT**.
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. This is a **WITNESS POINT**.
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.

Traffic Control

**Timing of
Construction
(WP)**

**Set Out
(HP)**

**Cables and
Ducts (HP)**

**Underground
Obstruction
(WP)**

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

Positioning of

NON-RIGID ROAD SAFETY BARRIER SYSTEMS - COONAMBLE

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.

Posts

2. When erected in position the posts shall be on a smooth line both horizontally and vertically with the tops of posts within ± 20 mm 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. This is a **WITNESS POINT**. 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
(WP)**

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. This is a **WITNESS POINT**.

**Contractor's
Cost (WP)**

C264.07 ERECTION OF TIMBER POSTS

1. The safety barrier posts are to be located as shown on the Drawings. The top of the posts shall be 710mm ± 20 mm above the ground level, unless otherwise shown on the Drawings. On terminal ends the level of the posts shall be such as to conform to the extended crossfall of the main pavement, unless shown otherwise on the Drawings.

**Positioning of
Posts**

2. When erected in position the posts shall be on a smooth line both horizontally and vertically.

Smooth Line

3. The section of the timber posts to be cast into a reinforced concrete footing shall be wrapped in 12mm thick polystyrene foam sheeting before concrete casting.

**Polystyrene
Foam**

4. Concrete used in the footings for timber posts shall have a minimum compressive strength of 32MPa at 28 days and shall conform with the requirements of the Specification for MINOR CONCRETE WORKS - VERSION 3.1.

Concrete

5. Concrete footings shall be 600mm diameter, and shall have tolerances of minus zero or plus 50mm. Overbreak and excessive depth shall be filled with 32MPa concrete at no cost to the Principal.

Footing Size

6. Wire fabric reinforcing shall be as detailed on the Drawings.

**Reinforcing
Fabric**

7. The surface area of the posts which will be above ground shall be painted with two coats of grey acrylic paint.

Painting

C264.08 ERECTION OF ROAD SAFETY BARRIER RAILS

1. Steel blockout pieces shall be erected with the open section pointing in the same direction as adjacent traffic.

Blockouts

2. All rail laps shall be in the same direction as adjacent traffic such that approach rail ends are not exposed to traffic.

Rail Laps

3. Stiffening pieces, 300mm long, shall be used on intermediate posts.

Stiffening Pieces

- | | |
|---|--|
| <p>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.</p> | <p><i>Minor Damage to Galvanising</i></p> |
| <p>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. This is a WITNESS POINT.</p> | <p><i>Contractor's Cost (WP)</i></p> |
| <p>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.</p> | <p><i>Erection Procedure</i></p> |
| <p>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.</p> | <p><i>Splice Bolt Tightening</i></p> |

C264.09 END TREATMENT OF ROAD SAFETY BARRIERS

- | | |
|--|--|
| <p>1. Both approach and departure ends of the road safety barrier shall be constructed with leading and trailing terminal sections at locations shown and as detailed on the Drawings.</p> | <p><i>Leading, Trailing Terminals</i></p> |
| <p>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. Submit locations prior to ordering. This is a HOLD POINT.</p> | <p><i>MELT (HP)</i></p> |
| <p>3. The approach and departure ends of double sided road safety barriers shall have terminal sections as detailed on the Drawings.</p> | <p><i>Double Sided Safety Barrier</i></p> |
| <p>4. Non-rigid road safety barrier connections to rigid road safety barriers or bridge parapets shall be as detailed on the Drawings.</p> | <p><i>Connections to Rigid Barriers</i></p> |

C264.10 DELINEATORS

- | | |
|---|-----------------------------|
| <p>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:-</p> | <p><i>Fixing</i></p> |
|---|-----------------------------|

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	16th post
(including straight road)	

- | | |
|---|---|
| <p>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.</p> | <p><i>Arrangement and Colour</i></p> |
|---|---|

SPECIAL REQUIREMENTS

C264.11 INSTALLATION OF WIRE ROPE SAFETY BARRIER SYSTEMS

1. Submit certification that the wire rope has been tensioned to conform with the manufacturer's published requirements. The certificate must include the date, time, ambient air temperature, tension force and signature and name of the individual managing the work at the time. This is a **HOLD POINT**.

***Manufacturer's
Published
Requirements
(HP)***

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 - VERSION 3.1.
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 - VERSION 3.2.
6. Traffic control is measured and paid in accordance with the Specification for CONTROL OF TRAFFIC - VERSION 3.2.

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.

NON-RIGID ROAD SAFETY BARRIER SYSTEMS - COONAMBLE**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.

ANNEXURE C264- A
INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Item/Clause title	Requirement	Notice for inspection	Release by
MATERIALS			
Certification			
C264.04.1 – Evidence of Conformance	Provide documentary evidence of conformity of components	1 week prior to erection	Superintendent
CONSTRUCTION			
General			
C264.05.4 – Set Out	Obtain approval to set out	1 week prior to erection	Superintendent
C264.05.5 – Cables and Ducts	Locate underground services	5 working days prior to erection	Superintendent
End treatment of road safety barriers			
C264.09.2 - MELT	Submit alternative MELT locations	1 week prior to ordering	Superintendent
SPECIAL REQUIREMENTS			
Installation of wire rope safety barrier systems			
C264.11.1 - Manufacturers Published Requirements	Submit tension certificates and testing	Same day as tensioning	Superintendent

Summary of WITNESS POINTS

Item	Requirement	Notice for inspection
CONSTRUCTION		
General		
C264.05.3 – Timing of Construction	Erection after pavement activities	1 week before installation – progressive
C264.05.6 – Underground Obstruction	Alternative method due to obstructions	1 week before setting posts
Erection of Steel Posts		
C264.06.3 – Foundation and Testing	Equipment and procedure for erection	1 week before installation
C264.06.5 – Contractor's Cost	Assessment by Superintendent for replacement	3 working days before removal of damaged post
Erection of Road Safety Barrier Rails		
C264.08.5 – Contractor's Cost	Assessment and rejection by Superintendent	1 working day after perceived damage



COONAMBLE SHIRE COUNCIL

CONSTRUCTION
SPECIFICATION

C271

MINOR CONCRETE WORKS

VERSION 3.1 – JANUARY 2022

MINOR CONCRETE WORKS - COONAMBLE

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
VERSION 3.1	Specification Version 3.1 reference, Inspection requirements added	C271.01	A	KD	6/04/10
	Standards updated	C271.02.1	M		
	Hold Point added	C271.08.1	A		
	Hold Points added	C271.11(b)	A		
	Hold Point added	C271.12.3	A		
	Hold Point added	C271.15.3	A		
	Hold Point added	C271.17.1	A		
	Hold Point added	C271.18.1	A		
	Hold Point added	C271.23.1	A		
	Witness Point added	C271.26.1	A		
	Hold Point and additional sub-clauses added,	C271.30	A		
	Hold Point added	C271.36.1	A		
	Hold Point & Witness Point added	C271.37	A		
	Hold Point added	C271.40.5	A		
	Witness Point added	C271.41.1	A		
	Hold Point added	C271.41.4	A		
	Witness Point added	C271.43.3	A		
	Annexure added	C271 - A	A		

**SPECIFICATION C271
MINOR CONCRETE WORKS – VERSION 3.1**

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SPECIFICATION C271 MINOR CONCRETE WORKS – VERSION 3.1

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 – Version 3.2.

Quality

4. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C271-A. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority to be obtained, where stipulated in Annexure C271-A.

Inspections

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	Methods of testing concrete
AS 1012.1	- Sampling fresh concrete
AS 1012.3.1:1998	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 1012.14:1991	Method for securing and testing cores from hardened concrete for compressive strength
AS 1141	Methods for testing and sampling aggregates
AS 1141.14:2007	Particle shape by proportional calliper
AS 1141.21:1997	Aggregate crushing value
AS 1141.23:1995	Los Angeles value
AS 1141.24:1997	Aggregate Soundness (Evaluation by exposure to 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

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AS 1303	Steel reinforcing wire for concrete
AS 1304	Welded wire reinforcing fabric for concrete
AS 1379:1997	The specification and manufacture of concrete
AS 1478	Chemical admixtures for concrete, mortar and grout
AS 1478.1:2000	Admixtures for concrete
AS 1554	Structural steel welding
AS 1554.3:2008	Welding of reinforcing steel
AS/NZS 1859 -	Reconstituted wood-based panels - Specifications
AS/NZS 1859.1: 2004	Particleboard
AS 2082:2000	Timber – Hardwood - Visually stress-graded for structural purposes
AS 2271:2004	Plywood and blockboard for exterior use
AS 2327	Composite structures
AS 2327.1-2003	Simply supported beams
AS 2758.1	Concrete aggregates
AS 3600:2001	Concrete structures
AS 3610:1995	Formwork for concrete
AS 3735-2001	Concrete structures retaining liquids
AS 3799:1998	Liquid membrane-forming curing compounds for concrete
AS 3972:1997	Portland and blended cements
AS/NZS 4586: 2004	Slip resistance classification of new pedestrian surface materials
AS/NZS 4671: 2001	Steel reinforcing materials
AS/NZS 4680: 2006	Hot-dipped galvanized (zinc) coatings on fabricated ferrous articles
AS 6669-2007	Plywood – Formwork
AS/NZS ISO 9001: 2000	Quality management systems - Requirements
CIA CPN35-2003	Fibres in concrete
CIA Z48-2002	Precast concrete handbook

(b) Other publications

Environmental Best Management Practice Guideline for Concreting Contractors from the
Department of Environment and Conservation (NSW)

NTN DES 001-2005 Slip resistance

SAA HB 197-1999 An introductory guide to the slip resistance of pedestrian surface materials

WTIA TN11-2004 Commentary on the Structural Steel Welding - Standard
AS/NZS 1554

EXCAVATION AND FOUNDATIONS

C271.03 GENERAL

1. The subgrade, or subbase where specified, shall be formed at the required depth below the finished surface levels shown on the Drawings. Rock foundations shall be neatly excavated to form a bed for the concrete, and shall be thoroughly scraped and cleaned. Soil foundation shall, as far as possible, be excavated neatly from the solid material to coincide with the under-surface of the concrete, or of the subbase material (where specified).

Foundations

2. All soft, yielding or other unsuitable material shall be replaced with sound material approved by the Superintendent, and the subgrade shall be compacted to provide a minimum relative compaction of 92 per cent as determined by AS 1289.5.4.1 for modified compactive effort. If the subgrade is dry it shall be sprinkled with as much water as it will readily absorb, before the concrete is placed.

Unsuitable Material

3. The Contractor shall supply all necessary sheeting and bracing to safely support the excavation in accordance with Statutory requirements. The excavation shall be kept free of water.

Shoring

C271.04 NEW JERSEY TYPE BARRIERS, DRIVEWAYS AND FOOTPATHS

1. For New Jersey type barriers, driveways and footpaths a subbase of approved quality and of minimum 150mm compacted thickness, unless otherwise shown on the Drawings, shall be placed over the subgrade. The surface shall then be checked for uniformity, line and level, and all irregularities shall be made good.

Subbase

2. The subbase material shall be compacted to provide a minimum relative compaction as determined by AS 1289.5.4.1 of 97 per cent for standard compactive effort or 95 per cent for modified compactive effort as appropriate.

Compaction

3. The finished subbase shall not deviate more than 15mm under a straight edge 3 metres long, subject to any necessary allowance on vertical curves.

Subgrade and Subbase Tolerances

C271.05 DRAINAGE PITS AND OTHER SUPPLEMENTARY STRUCTURES

1. Where the excavation is in sound rock, and the Superintendent so directs, part of the concrete lining of gully pits and other structures may be omitted, provided that a neatly formed pit of the required dimensions is constructed, and provided that the wall of the pit adjacent to and parallel with the road is constructed of formed concrete in all cases.

Pit Walls

C271.06 RETAINING WALLS, HEADWALLS AND WINGWALLS

1. In the case of rock foundations for retaining walls, headwalls and wingwalls, the excavation shall be carried into the rock for a minimum depth of 150mm. Where cut-off walls are to be provided, the depth of cut-off in rock foundations may be 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.

Precast 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 in-situ earth.

Side Forms

3. Design of formwork for high sections shall be such that it shall not be necessary

Placement of

MINOR CONCRETE WORKS - COONAMBLE

to drop concrete freely from a greater height than 1.2 metres or to move concrete along the formwork after deposition.

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. This is a **HOLD POINT**.

**Approval to
Design (HP)**

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

- (i) Dimensions and position of forms, shall be carefully checked after the forms are erected. Forms shall be aligned accurately and the location of all fittings, hold formers, etc. checked prior to placing concrete. Departure of the forms from the surfaces shown on the drawings shall not exceed 1/300 of the space between supports for any surface visible in the completed work and 1/150 for hidden work. For tolerances in plan position and levels, refer to Clauses C271.24 and C271.27.

**Formwork
Position
Tolerances**

- (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

- (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. This is a **HOLD POINT**.

**Reinforcement
Placement
(HP)**

- (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. This is a **HOLD POINT**.

**Concrete
Placement
(HP)**

- (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 included in the New South Wales Government Cement Quality Assurance Scheme.

**NSW QA
Scheme**

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. This is a **HOLD POINT**.

**Proof of
Quality (HP)**

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 shall be free from injurious amounts of materials harmful to concrete and to its reinforcement and neither salty nor brackish.

Quality

2. Water which is not potable for human beings shall not be used in reinforced concrete.

Potability

C271.14 FINE AGGREGATE

1. Fine aggregates shall consist of clean, hard, tough, durable uncoated grains, uniform in quality, and shall conform to the requirements of AS 2758.1 in respect of bulk density, water absorption (maximum 5 per cent) material finer than 2 micrometres, impurities and reactive materials.

Quality

2. Fine aggregates shall be evenly graded within the absolute limits shown in Table C271.1, and shall not deviate from the proposed grading by more than the amounts in Table C271.1.

Grading Requirements

Australian Standard Sieve	Proportion Passing (% of Mass)	Deviation from Proposed Grading (% of Mass of Sample)
9.50mm	100	
4.75mm	90 - 100	±5
1.18mm	40 - 85	±10
300µm	8 - 30	±10
150µm	2 - 10	±5
75µm	0 - 4	±3

Table C271.1 - Fine Aggregate Grading

C271.15 COARSE AGGREGATE

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.

This is a **HOLD POINT**.

(HP)

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	Extrusion Concrete	
	For Walls exceeding 150mm thickness	For all other structures		
53.0	100			
37.5	95 - 100			±10
26.5		100		
19.0	30 - 70	95 - 100		±10
13.2			100	
9.50	10 - 35	25 - 35		±5
4.75	0 - 10	0 - 10		±5
2.36	0 - 2	0 - 2		

Table C271.2 - Coarse Aggregate Gradings

C271.16 ADMIXTURES

1. Chemical admixtures and their use shall comply with AS 478.1. 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 WRRé) 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 WRRé 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 WRRé complying with AS 1478.1) may be used in the mix.

Retarder for Cool Season

C271.17 TESTING OF MATERIALS

1. The Contractor shall submit to the Superintendent a copy of a NATA Certified Laboratory Test Report on the quality and gradings of the aggregates proposed to be used in the work. This is a **HOLD POINT**.

**Contractor's
Responsibility
(HP)**

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. This is a **HOLD POINT**.

(HP)

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

- 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.
- The nominal proportions given in Table C271.4 may be used as a guide for volume batching.

**Mixing by
Volume on
Site**

**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

- 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

- 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 $\pm 15\text{mm}$.
- 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.

**Consistency
Requirements**

**Extruded
Concrete
Consistency**

C271.22 MIXING AND DELIVERY

(a) General

- 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.
- Any concrete which exhibits signs of segregation shall not be used.

**Mechanical
Mixing**

**Segregation of
Concrete**

(b) Machine Mixing at Site

- The mixing of concrete shall be done in a batch mixer which will ensure a uniform distribution of the materials throughout the batch.
- 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

**Mixer
Requirements**

Mixer Capacity

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exceed the manufacturer's rated capacity of the mixer.

- (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**

C271.23 PLACING AND COMPACTING CONCRETE

1. No concrete shall be mixed or placed, without the approval of the Superintendent, while the air temperature is, or is likely to be within 24 hours, below 5°C or while the shade temperature exceeds 38°C. This is a **HOLD POINT**. 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 (HP)**

2. The concrete shall be mixed in the quantities required for immediate use and shall be placed in position as rapidly as possible. Any concrete which has developed initial set, or which does not reach the forms within 30 minutes after the water has been added (except when transported in agitator trucks) shall not be used. **Placement within Time Limit**

3. The concrete shall be deposited in the forms, without separation of the aggregates. Concrete shall not be dropped freely from a height greater than 1.2 metres, or be deposited in large quantities at any point and moved or worked along the forms. Conveying equipment, including open troughs and chutes, where used, shall be made of **Placement in Forms, Vibrating**

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.

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 shall not deviate from level or alignment by more than 5mm from a straight-edge 3 metres long, subject to any necessary allowances on vertical and horizontal curves.

Surface Tolerance

C271.25 CURING AND PROTECTION

1. All exposed surfaces of the freshly placed concrete shall be kept moist either by the use of plastic sheeting, damp sand or commercial curing compounds, in accordance with AS 3799, for a minimum period of 3 days. During this time the work must be adequately protected from the effects of excessive surface evaporation, rain, running water, vandalism and other causes likely to damage the concrete. All costs involved in making good or replacing any work that has been damaged due to the above mentioned factors shall be borne by the Contractor.

Curing Requirements

2. Curing for concrete shall generally be in accordance with the appropriate surface exposure classification in AS 3600.

Contractor's Cost

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°C during the periods specified. This is a **WITNESS POINT**.

Walls, Sumps etc. (WP)

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
- (ii) 0.6m to 3m
- (iii) 3m to 6m
- (iv) 6m to 9m

1 day

2 days

3 days

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 15m and where the pavement abuts against gutters, pits and structures. Expansion joints shall consist of a preformed jointing material of bituminous fibreboard. **Footpaths, Medians, Driveways**
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 2m². The ratio of the longest side to the shortest side shall not exceed 1.6. **Unreinforced Paving**

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	
		Kg	mm	7 days	28 days
				MPa	MPa
Foundations, mass retaining walls	20	270 (330)	40	15	20
Mass concrete footings, pitching, linings etc.	20	270 (330)	20	15	20
Drainage structures, driveways footpaths, New Jersey barrier, miscellaneous minor concrete work	20	270 (330)	20	15	20
Reinforced concrete culverts, headwalls, base slabs, sign structure large footings, retaining walls	32	320 (380)	20	24	32
Extruded concrete	20	270 (330)	14	15	20

Table C271.5 - Concrete Strength Requirements

NOTE:

The total cement and Portland cement quantities indicated as minima are aimed at providing suitably durable concrete for exterior public works under normal circumstances.

4. The strengths specified at 28 days shall be increased by multiplying by factors as shown in Table C271.6 for tests at ages in excess of 28 days.

Strength Age Factor

*Age of test specimen in days of date of testing	Factor
28	1.00
35	1.02
42	1.04
49	1.06
56	1.08
70	1.10
84	1.12
112	1.14
140	1.16
168	1.18
196	1.20
224	1.22
308	1.24
365 and greater	1.25
*For intermediate ages the factor shall be determined on a pro-rata basis	

Table C271.6 - Concrete Age Conversion Factors

5. If the test specimens fail to achieve the specified strength, the Contractor may, with the approval of the Superintendent, arrange for cores to be taken from the work. If the average strength of such cores complies with the specified requirements nominated in Table C271.5, the concrete will be accepted.

**Cores and
Test
Acceptance**

6. If cores taken fail to satisfy the strength requirements, the concrete shall be removed.

**Failure of
Cores**

C271.30 SAMPLING CONCRETE

1. Equipment and facilities shall be provided by the Contractor for the taking and storage of samples of any materials or concrete being used, or intended to be used in the work.

**Contractor's
Responsibility**

2. Concrete test specimens shall be cylinders 300mm long and 150mm diameter, moulded concurrently in the presence of the Superintendent or Superintendent's representative, in accordance with AS 1012.8, from samples taken in accordance with AS 1012.1. This is a **HOLD POINT**.

**Moulding of
Test Cylinders
(HP)**

3. Test specimens shall be tested only by laboratories with appropriate NATA registration. Copies of test results shall be forwarded to the Superintendent immediately upon receipt.

Testing

4. The costs of all work and material required in the taking, handling, delivery and testing of specimens shall be borne by the Contractor.

**Contractor's
Cost**

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. This is a **HOLD POINT**. Test certificates shall show the results of mechanical tests and chemical analysis.
Documentary Evidence (HP)
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 $23 \pm 5^{\circ}\text{C}$ 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°C and the heating shall extend beyond the portion to be bent. Heated bars shall not be cooled by quenching.
Cutting and Bending

C271.33 SPLICING

(a) General

1. All reinforcement shall be furnished in the lengths indicated on the Drawings. If splicing is required, it shall be in accordance with the provisions of AS 1302.
Plan Lengths
2. The cost of any test ordered in connection with splices not shown on the drawing shall be borne by the Contractor.
Contractor's Cost

(b) Lapped Splices

1. Laps in reinforcing bars, wire or fabric shall be as shown on the Drawings. Laps not shown on the Drawings shall be as follows for unhooked bars:-

**Lap
Dimensions**

Plain bars, Grade 250	40 bar diameters
Deformed bars, Grade 400	35 bar diameters
Hard-drawn wire	50 bar diameters

2. Splices in reinforcing fabric shall be so made that the overlap, measured between outermost transverse wires of each sheet of fabric is not less than the spacing of those wires plus 25mm.

**Splice
Dimensions**

C271.34 MARKING

1. Bars of identical shape shall be made up in bundles of three and securely tied together by soft iron wire. Each bundle shall have a stout metal label of not less than 40mm diameter attached to it. Each metal label shall be punched with the appropriate marking in accordance with the steel list shown on the drawings. If called for on the Drawings the marking shall incorporate a prefix, and bars with different prefixes shall be stored separately.

**Marking
Details**

C271.35 STORAGE

1. Reinforcement shall be stored above the surface of the ground and shall be protected from damage and from deterioration by exposure.

**Protection of
Reinforcement**

C271.36 DELIVERY AND RECEIPT OF REINFORCEMENT

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. This is a **HOLD POINT**.

**Test Before
Delivery (HP)**

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.

Notice to Test

C271.37 PLACING

1. Reinforcement shall be accurately placed as shown on the Drawings and shall be securely held by blocking from the forms, by supporting on concrete or plastic chairs, or metal hangers, and by wiring together at all intersections or at 0.5m centres, whichever is the greater distance, using annealed iron wire of diameter not less than 1.25mm. Steel shall not be supported on metal supports which extend to the surface of concrete, on wooden supports, or on pieces of coarse aggregate. Reinforcement shall have the minimum cover shown on the Drawings.

**Reinforcement
Position**

2. The Superintendent may approve the use of tack welding instead of wire ties on reinforcing wire. All welding of reinforcing steel shall be in accordance with AS 1554.3. Tack welding of cold-worked and hard grade bars shall not be permitted.

Tack Welding

3. The reinforcement in each section of the work shall be approved by the Superintendent before any concrete is deposited in the section and adequate time shall be allowed for inspections and any corrective work which may be required. Notice for inspection shall not be less than four normal working hours. This is a **HOLD POINT**.

**Inspection
Required**

(HP)

4. Splices shall be staggered where practicable and when not shown on the drawings they shall be arranged as directed by the Superintendent. This is a **WITNESS POINT**.

Splices

5. Bars forming a lapped splice shall be securely wired together in at least two places, unless welded.

Lapped Splice

6. The clear cover of any bar, including stirrups, to the nearest concrete surface shall be as shown on the Drawings. Where not so indicated it shall be as stated below:

Bar Cover

- | | | |
|-----|---|------|
| (a) | Concrete normally in contact only with air | |
| | (i) Slabs: | 40mm |
| | (ii) Other than slabs: | 45mm |
| (b) | Concrete in contact with earth or fresh water | |
| | (i) Slabs of box culverts: | 50mm |
| | (ii) Other than culverts: | 50mm |

In no cases shall the cover be less than 1½ times the diameter of the bar.

BACKFILLING

C271.38 GENERAL

1. Backfilling at barriers, paving, etc, and minor concrete works shall not commence until after the concrete has hardened and not earlier than three days after placing.

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

**Adjacent to
Walls**

3. Selected backfill shall be placed against retaining walls and cast-in-place box culverts for a horizontal distance equal to one-third of the height of the wall. It shall consist of granular material, free from clay and stone larger than 50mm gauge. The Plasticity Index of this selected backfill material shall not be less than 2 or more than 12, when tested in accordance with AS 1289.3.3.1. The material shall be placed in layers not exceeding 150mm and shall be compacted to provide a relative compaction of not less than 92 per cent as determined by AS 1289.5.4.1 for modified compactive effort.

**Selected
Backfill**

C271.39 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:

**Size & Type of
Backfill
Material**

- | | |
|-----|--|
| (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, 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.

Extent of Material

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

Synthetic Membrane

SPRAYED CONCRETE

C271.40 GENERAL

1. Sprayed concrete is concrete pneumatically applied at high velocity on to a surface. Application may be either a wet or dry process. A sound homogeneous product shall be provided with surface finish reasonably uniform in texture and free from blemishes.

Definition

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.

Colour

4. Sprayed concrete shall have a minimum cement content of 380 kg/m³ 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. This is a **HOLD POINT**.

Test Cores (HP)

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. This is a **HOLD POINT**.

Contractor's Responsibility (HP)

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. This is a **WITNESS POINT**. 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. This is a **WITNESS POINT**.

Test Panels (WP)

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

Defective Core

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Contractor shall modify the mix design and/or method of placement and prepare fresh test panels for testing and inspection.

4. Sprayed concrete shall not be applied to the Works until the Contractor produces test panels for the approval of the Council. This is a **HOLD POINT**. *Approval (HP)*

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°C. This is a **WITNESS POINT**. *Air Temperature (WP)*
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° and 45° 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

MINOR CONCRETE WORKS - COONAMBLE

Item	Activity	Limits/Tolerances	Spec Clause
6.	Aggregate Moisture Content	Where moisture content of fine aggregate exceeds 8%, or moisture content of coarse aggregate exceeds 3%, the proportion of mix shall be changed.	C271.19
7.	Consistency	In accordance with AS 1012.3, Method 1 the slump shall not exceed the nominated slump $\pm 15\text{mm}$.	C271.21
		In the case of concrete placed by extrusion machine, the slump will be between 10mm and 15mm.	C271.21
8.	Ready-Mixed Concrete		
	(a) Mixing & Delivery	The time taken from the introduction of water until the concrete is completely discharged shall be not more than 1.5 hours.	C271.22
		Where non-agitating equipment is used the concrete shall be completely discharged not more than 30 minutes after the addition of water.	
9.	Placing & Compacting of Concrete	Concrete shall not be placed without the approval of the Superintendent if the air temperature within 24 hours is likely to be below 5°C or the shade temperature is likely to exceed 38°C.	C271.23
10.	Finishing of Unformed/ Formed Concrete Surfaces		
	(a) Wearing Surface	To be finished true and uniform so that departure from designed grade shall not exceed 5mm in any 3 metre length.	C271.24(b)
	(b) Finished Surfaces		
	(i) Not Adjacent to Roads	$\leq 25\text{mm}$ Plan position $\leq 25\text{mm}$ Level	C271.24(c) C271.27
	(ii) Adjacent to Roads	$\leq 10\text{mm}$ Alignment $\leq 10\text{mm}$ 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.

ANNEXURE C271- A
INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title / item	Requirement	Notice for inspection	Release by
FORMWORK			
Approval of Formwork Design			
C271.08.1 – Approval to Design	Submit details	One week before manufacture	Superintendent
Erection			
C271.11(b)(i) – Reinforcement Placement	Submit formwork for inspection	2 days before concrete pour	Superintendent
C271.11(b)(ii) – Concrete Placement	Submit placed reinforcement for inspection	2 days before concrete pour	Superintendent
MATERIALS FOR CONCRETE			
Cement			
C271.12.3 – Proof of Quality	Supply documentary evidence for cement	As requested	Superintendent
Coarse Aggregate			
C271.15.3 – Additional Tests	Provide test results where required	As requested	Superintendent
Testing of Materials			
C271.17.1 – Contractor's Responsibility	Submit NATA test results	One week before pouring	Superintendent
HANDLING AND TREATMENT OF CONCRETE			
Measuring			
C271.18.1 – Measurement of Material	Approval to measurement by volume	1 working day	Superintendent
Placing and Compacting Concrete			
C271.23.1 – Air Temperature Requirements	Obtain approval for mixing or placing outside nominated air temperature range	1 working day	Superintendent
Sampling Concrete			
C271.30.2 – Moulding of Cylinders	Inspect cylinder moulding	1 working day	Superintendent
STEEL REINFORCEMENT FOR CONCRETE			
Material			
C271.31.4 – Documentary Evidence	Submit evidence of compliance	7 days prior to delivery	Superintendent
Delivery and Receipt of Reinforcement			
C271.36.1 – Test Before Delivery	Submit test results	10 working days before delivery	Superintendent
Placing			

C271.37.3 – Inspection Required	Request inspection of steel reinforcement	4 hours	Superintendent
SPRAYED CONCRETE			
General			
C271.40.5 – Test Cores	Submit NATA test results	1 week	Superintendent
Test Panels			
C271.41.4 - Approval	Obtain approval of test panel	1 week	Superintendent

Summary of Witness Points

Item	Requirement	Notice for inspection
HANDLING AND TREATMENT OF CONCRETE		
Removal of forms		
C271.26.1 – Walls, Sumps etc.	Extend minimum period for form removal	Progressive
STEEL REINFORCEMENT FOR CONCRETE		
Placing		
C271.37.4 - Splices	Obtain stagger requirements where not indicated on the drawings	One week before activity
Test Panels		
C271.41.1 – Test Panels	Conduct test spray and submit panels for examination	One week before activity
Application of Sprayed Concrete		
C271.43.3 – Air Temperature	Spray in air temperature not less than 5°C	Progressive



COONAMBLE SHIRE COUNCIL

COONAMBLE DEVELOPMENT
CONSTRUCTION SPECIFICATION

C305

**TRENCHLESS CONDUIT
INSTALLATION**

VERSION 3.1 – JANUARY 2022

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
VERSION 3.1	Specification VERSION 3.1 reference,			KD	6/04/10
	Hold Point added	C305.04.1	A		
	Specification VERSION 3.1 reference,	C305.09	A		
	Specification VERSION 3.1 reference,	C305.13	A		
	Annexure added	C305-A	A		

SPECIFICATION C305 - TRENCHLESS CONDUIT INSTALLATION – VERSION 3.1

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SPECIFICATION C305

TRENCHLESS CONDUIT INSTALLATION – VERSION 3.1

GENERAL

C305.01 SCOPE

1. The work to be executed under this Specification covers the installation of any type of drainage or service conduit where it is a requirement of the Contract that trenchless techniques are to be used. Trenchless techniques minimise interference with existing features, facilities or traffic. These techniques may be by either jacking, ramming, bursting, thrust or auger boring, micro-tunnelling, directional drilling or other suitable technique as appropriate for the particular installation.

2. The work to be executed under this worksection consists of supply of the conduit, installation and all necessary ancillary work, whether such work is temporary or permanent, as shown on the Drawings.

3. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C305-A.. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority to be obtained where stipulated in Annexure C305-A. *Inspections*

C305.02 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 - VERSION 3.1
C271	-	Minor Concrete Works – VERSION 3.1
C306	-	Road Openings and Restoration - VERSION 3.1
C220	-	Stormwater Drainage – General - VERSION 3.1
C221	-	Pipe Drainage.- VERSION 3.1
C222	-	Precast Box Culverts.- VERSION 3.1
C223	-	Drainage Structures.- VERSION 3.1

(b) Australian Standards

AS 1074-1989	Steel tubes and tubulars for ordinary service
AS 1726-1993	Geotechnical site investigations
AS/NZS 2053:various	Conduits and fittings for electrical installations
AS/NZS 2053.2:2001	Rigid plain conduits and fittings of insulating material
AS/NZS 2053.4:1995	Flexible conduits and fittings of insulating material
AS/NZS 2053.7:2002	Rigid metal conduits and fittings
AS/NZS 2053.8:1995	Flexible conduits and fittings of metal or composite material
AS/NZS 3725:2007	Design for installation of buried concrete pipes.
AS/NZS 4058:2007	Precast concrete pipes (pressure and non-pressure)

(c) Other publications

Concrete Pipe Association of Australia (CPAA)

Concrete pipe jacking, Technical brief

International Society for Trenchless Technology (ISTT)

(Represented in Australia by the Australasian Society for Trenchless Technology)

Glossary of trenchless terms, 2005

Australasian Society for Trenchless Technology (ASTT)

Guidelines for horizontal directional drilling, pipe bursting microtunnelling and pipe jacking

C305.03 TERMINOLOGY

Some of the trenchless techniques available are described below in accordance with the ISTT *Glossary of trenchless terms*:

- Jacking: A system of directly installing pipes behind a shield machine by hydraulic jacking from a drive shaft such that the pipes form a continuous string in the ground.
- Ramming: A non-steerable system of forming a bore by driving a steel casing, usually open-ended, using a percussive hammer from a drive pit.
- The soil may be removed from an open-ended casing by augering, jetting or compressed air. In appropriate ground conditions a closed casing may be used.
- Bursting: A technique for breaking the existing pipe by brittle fracture, using force from within, applied mechanically, the remains being forced into the surrounding ground.
- At the same time a new pipe, of the same or larger diameter, is drawn in behind the bursting tool.
- The pipe bursting device may be based on a pneumatic impact moling tool to exert diverted forward thrust to the radial bursting effect required, or by a hydraulic device inserted into the pipe and expanded to exert direct radial force.
- Thrust boring: A method of forming a pilot bore by driving a closed pipe or head from a thrust pit into the soil which is displaced.
- Some small diameter models have steering capability achieved by a slanted pilot-head face and electronic monitoring, generally in conjunction with a locator.
- Back reaming may be used to enlarge the pilot bore.
- Auger boring: A technique for forming a bore from a drive pit to a reception pit, by means of a rotating cutting head.
- Spoil is removed back to the drive shaft by helically wound auger flights rotating in a steel casing.
- The equipment may have limited steering capability.
- Micro-tunnelling: Steerable remote control pipe jacking to install pipes of internal diameter less than that permissible for man-entry.
- Directional drilling: A steerable system for the installation of pipes, conduits and cables in a shallow arc using a surface launched drilling rig.
- Traditionally the term applies to large scale crossings in which a fluid filled pilot bore is drilled without rotating the drill string, and this is then enlarged by a washover pipe and back reamer to the size required for the product pipe.
- The required deviation during pilot boring is provided by the positioning of a bent sub.
- Tracking of the drill string is achieved by the use of a downhole survey tool.

METHODOLOGY

C305.04 SUBMISSION

1. The Contractor shall submit a clear and detailed methodology for the execution of the trenchless conduit installation. This is a **HOLD POINT**.

**Methodology
(HP)**

2. The Method Statement shall adequately address the following items as a minimum requirement:

**Method
Statement**

- General description of method and sequence of operation.
- Specialist subcontractors to be utilised.
- Conduit type and specification, including compliance with relevant Australian Standard.
- Jointing type and specification.
- Grout type, if required, methodology and equipment for grout injection.
- Mechanical description of any motorised pumping, jacking, horizontal boring, directional drilling or mining equipment intended for use.
- Existing underground utility services:
 - . Treatment at conflict locations.
 - . Protection of services in zone of influence.
- Survey equipment and methods.
- Direction of installation of conduit.
- Size, depth and position of temporary access pits required.
- Location of temporary spoil site if required and nature of haulage equipment.
- Programmed daily working hours and duration for the operation.
- Strategy for dealing with noise pollution problems.
- Traffic management.
- Dewatering.

3. General requirements and design guidelines for jacking precast concrete and other rigid pipes are given in the CPAA publications, *Pipe jacking—Design guidelines* and *Concrete pipe jacking—Technical Bulletin*.

C305.05 LOCATION OF SERVICES

1. The 'Dial Before You Dig' Service, telephone 1100, shall be contacted to obtain locations of water, sewer, stormwater, gas, electricity and telephone services, during the preparation of the Method Statement.

CONSTRUCTION

C305.06 CONDUIT

1. For precast concrete pipes, the strength of the conduit shall be verified by the Contractor as adequate for the purpose utilising the methodology set out in AS 3725 with reference to AS 4058, for cracking load test parameters, and the Contractor's own determination of appropriate soil parameters.

Concrete Pipe Strength

2. The ultimate load for the conduit is to exceed cracking load by a factor of safety of 50%.

3. The Contractor shall provide similar and equivalent verification if the conduit does not comprise precast reinforced concrete pipe.

Other Pipe Strengths

4. The conduit shall not be installed until the Contractor has produced documentary evidence to the Superintendent that appropriate load testing as required by Australian Standards and this worksection has been carried out and the representative specimens have satisfied the appropriate requirements. This action constitutes a **HOLD POINT**. The Superintendent's approval of the documentary evidence is required prior to the release of the hold point.

Load Testing (HP)

C305.07 INSTALLATION

1. The installation shall provide for the following performance requirements:

Dimensions

- The installation of the conduit by open trenching shall not be permitted over the length designated for trenchless techniques.
- Where appropriate, voiding around the conduit shall be eliminated by grouting prior to completion of works, with material and methodology of grouting described in the Method Statement.
- The line and grade of the conduit shall comply with the Drawings within the tolerances indicated on the Drawings or stated in **Tolerances** when not explicitly shown on the Drawings.
- After installation all joints shall be flush to the internal conduit walls and watertight.
- After installation of the conduit laid by trenchless techniques and prior to any grouting procedures, bulkhead walls shall be established at locations shown on the Drawings. Such bulkheads shall comply with **Bulkheads**.
- The installation of the conduit shall not affect any adjacent building foundations and shall provide for consistent support prior to, during and after installation.

2. The installation of the conduit shall not endanger the stability or health of the root systems of trees to be retained as designated by the PCA. Any approval required from the PCA to remove root systems constitutes a **HOLD POINT**.

Root Systems (HP)

C305.08 TOLERANCES

1. The conduit shall be installed in accordance with the horizontal and vertical alignment as shown on the Drawings subject to the following definition of tolerances:

- The position of both the inlet and outlet of the conduit shall be determined by a registered Surveyor and shall comply with the Drawings for horizontal position to a tolerance of ± 30 mm.
- Vertical tolerance at the inlet/outlet of the conduit where installation commences shall be ± 10 mm.
- The average grade of the conduit shall comply with the grade as shown on the Drawings $\pm 0.05\%$.
- The conduit alignment at all joints will be true with a tolerance of ± 5 mm deflection in any direction at 1.5 m from the joint.

C305.09 PERMANENT AND TEMPORARY PITS

1. Any permanent and/or temporary pits established for purposes of installation shall be constructed in accordance with the Specification for STORMWATER DRAINAGE – GENERAL - VERSION 3.1

Excavation

2. Backfilling of temporary pits shall comply with the backfilling and compaction requirements of the Specification for STORMWATER DRAINAGE – GENERAL - VERSION 3.1. The surface of temporary pits, after backfilling, shall be restored to pre-construction condition.

Temporary Pits

3. Permanent pits or access chambers, located at the pits used for trenchless conduit installations, shall be constructed to the details as shown on the Drawings and in accordance with the appropriate Specification following demobilisation of the trenchless conduit installation equipment. Backfill and compaction around permanent pits or access chambers shall be in accordance with the Specification for STORMWATER DRAINAGE – GENERAL - VERSION 3.1

Permanent Pit Construction**C305.10 CONCRETE WORK**

1. For all concrete work, the Contractor shall comply with the Specification for MINOR CONCRETE WORKS – VERSION 3.1 in relation to the supply and placement of normal class concrete and steel reinforcement, formwork, tolerances, construction joints, curing and protection.

SPECIAL REQUIREMENTS**305.11 RESERVED****305.12 RESERVED**

MEASUREMENT AND PAYMENT

C305.13 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 C305(a) to C305(e) 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, except Item (a) shall not be accepted.
4. Excavation for permanent pits or access chambers is measured and paid in accordance with the Specification for STORMWATER DRAINAGE – GENERAL - VERSION 3.1.
5. Excavation and backfilling for temporary pits, including additional excavation and backfill at permanent pits sites, is measured and paid in this worksection and not the Specification for STORMWATER DRAINAGE – GENERAL - VERSION 3.1.
6. Restoration for temporary pits is measured and paid in accordance with this worksection.
7. Construction of, and backfilling for, permanent pits or access chambers is measured and paid in accordance with the appropriate conjunctive Specifications.
8. Bulkheads are measured and paid in accordance with this worksection and not the Specification for MINOR CONCRETE WORKS - VERSION 3.1.

Pay Item C305(a) – MOBILISATION, ESTABLISHMENT AND DEMOBILISATION

1. The unit of measurement shall be an item.
2. The sum shall include all activities involved in the mobilisation, establishment and demobilisation of the trenchless conduit installation equipment and facilities.
3. The sum shall be inclusive.

Pay item C305(b) – TRENCHLESS INSTALLATION OF CONDUIT

1. The unit of measurement shall be the plan linear metre measured in the plane including access pits along the centreline of each particular type, class and size of conduit installed by trenchless techniques.
2. The schedule rate shall include :
 - Survey and setting out.
 - Supply of conduit.
 - Installation.
 - Jointing.
 - Lining.
 - Grouting.
 - Excavation, removal and disposal.
 - Temporary pits, excavation, backfill and restoration.

Pay item C305(c) - BULKHEADS

1. The unit of measurement shall be "each" bulkhead completed.
2. The schedule rate shall include all activities and materials required to complete the bulkhead structures as shown on the Drawings.

Pay item C305(d) – EXCAVATION FOR TEMPORARY PITS

1. The unit of measurement shall be the cubic metre measured as bank volume of excavation.
2. The schedule rate shall be an average rate to cover all types of material encountered during excavation.
3. Separate rates shall not be included for earth and rock.
4. The plan area for payment shall be the area calculated from the outside dimensions of the pit as shown on the Drawings.
5. The depth shall be determined from the actual site measurement of the distance from the surface at the time of excavation to the base of the pit.

Pay item C305(e) - BACKFILL FOR TEMPORARY PITS

1. The unit of measurement shall be the cubic metre of compacted material.
2. The schedule of rate shall include backfill and compaction in layers as specified and restoration of surface to pre-construction condition.

ANNEXURE C305- A**INSPECTIONS**

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title / item	Requirement	Notice for inspection	Release by
METHODOLOGY			
Submission			
C305.04.1 - Methodology	Submit methodology for approval	14 days prior to use	Superintendent - PCA concurrence required
CONSTRUCTION			
Conduit			
C305.06.4 – Load Testing	Provide documentary evidence of compliance	7 days prior to use	Superintendent
Installation			
C305.07.2 - Root systems of trees	Obtain approval for any tree root removal	7 days prior to use	Superintendent - PCA concurrence required



COONAMBLE SHIRE COUNCIL

COONAMBLE DEVELOPMENT
CONSTRUCTION SPECIFICATION

C306

**ROAD OPENINGS
AND
RESTORATIONS**

VERSION 3.1– JANUARY 2022

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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Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
VERSION 3.1	Specification VERSION 3.1 reference, inspection requirements added	C306.01	A	KD	9/04/10
	Specification VERSION 3.1 reference, standards updated	C306.03.1	A		
	Specification VERSION 3.1 reference, Hold Point added	C306.04.2	A		
	Specification VERSION 3.1 reference, code reference updated, Hold Point added	C306.05(a)	A, M		
	Hold Point & Witness Point added	C306.08	A		
	Hold Points added	C306.09	A		
	Hold Point added	C306.09.5	A		
	Hold Point and Witness Point added	C306.11	A		
	Witness Point and Hold Point added	C306.12	A		
	Hold Point added	C306.13.3	A		
	Specification VERSION 3.1 reference, Witness Point added	C306.15	A		
	Specification VERSION 3.1 reference	C306.16	A		
	Specification VERSION 3.1 reference, Witness Point added	C306.17	A		
	Hold Point added	C306.20.3	A		
	Hold Point added	C306.21.1	A		
	Specification VERSION 3.1 reference	C306.24	A		
	Annexure added	C306-B	A		

SPECIFICATION C306 - ROAD OPENINGS AND RESTORATION – VERSION 3.1

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ROAD OPENINGS AND RESTORATIONS - COONAMBLE

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	INSPECTIONS

SPECIFICATION C306 : ROAD OPENINGS AND RESTORATIONS – VERSION 3.1**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. This Specification shall be read in conjunction with Council's Utility Services Code Of Engineering Practice.

**Code of
Engineering
Practice**

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 - VERSION 3.1.

**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**

6. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C306-B. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Principal Certifying Authority to be obtained where stipulated in Annexure C306-B.

Inspections

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. The terms are:

Standard

- 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 - VERSION 3.1
 - 242 - Flexible Pavements - VERSION 3.1
 - 243 - Bituminous Cold Mix - VERSION 3.1
 - 244 - Sprayed Bituminous Surfacing - VERSION 3.1
 - 245 - Asphaltic Concrete - VERSION 3.1
 - 254 - Segmental Paving - VERSION 3.1
 - 305 - Trenchless Conduit Installation - VERSION 3.1
- Utility Services Code of Engineering Practice – Revision D

(b) Australian Standards

- AS 1289 Methods for testing soils for engineering purposes
- AS 1289.5.4.1:2007 Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio.
- AS 1289.5.7.1:2006 Soil compaction and density tests - Compaction control test – Hilf density ratio and Hilf moisture variation. (Rapid method)
- AS 1289.6.1.2:1998 Soil strength and consolidation tests - Determination of the California bearing ratio of a soil - Standard laboratory method for an undisturbed specimen.
- AS 1348.1:2002 Road and traffic engineering - Glossary of terms
- AS 1742 Manual of uniform traffic control devices
- AS 1742.3:2009 Traffic control devices for works on roads

(c) Other

- Street Openings Conference -Guide to Codes and Practices for Street Openings, 2009

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 - VERSION 3.1. This is a **HOLD POINT**.
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.

**Traffic
Guidance
Scheme (HP)
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 inspecting 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, *Guide to Codes and Practices for Street Openings*, 2009

- (i) Bitumen and Concrete Paving - In accordance with the reinstatement provisions and sketches of the above guide.
- (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 - VERSION 3.1.

(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, prior to commencement of 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.

Set Out (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 relevant 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 relevant Utility Authorities 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 release of the hold point.

**Excavation
Level**
(HP)

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. This is a **WITNESS POINT**.

**Unsuitable
Material**
(WP)

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. This is a **HOLD POINT**.

**Work Near
Trees**
(HP)

5. The Contractor shall not cut tree roots exceeding 50mm in diameter without the approval of Council. This is a **HOLD POINT**. 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
(HP)

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. This is a **HOLD POINT**.

**Approved
Material
(HP)**

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. This is a **WITNESS POINT**.

**Backfill at
Trees (WP)**

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). This is a **WITNESS POINT**.

**Moisture
Content (WP)**

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. This is a **HOLD POINT**.

Testing (HP)

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 inspecting 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 inspecting 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.

Prepare Areas (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.
- 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.

Flexible Pavement

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. This is a **WITNESS POINT**. In any case the asphaltic material shall be removed and disposed of off-site by the Contractor.

**Remove
Temporary
Pavement
(WP)**

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 306-A. Subbase and base layers shall be supplied and installed in accordance with the Specification for FLEXIBLE PAVEMENTS - VERSION 3.1.

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**

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 - VERSION 3.1 or ASPHALTIC CONCRETE - VERSION 3.1, 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 $\pm 5\text{mm}$ 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. This is a **WITNESS POINT**.

**Remove
Temporary
Material
(WP)**

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 $\pm 2\text{mm}$.

Patches

(a) Concrete Footpaths, including Textured and Patterned

1. Concrete footpaths shall be constructed in 20 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 - VERSION 3.1, or BITUMINOUS COLD MIX - VERSION 3.1, 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 - VERSION 3.1.

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 shall be supplied by the Contractor and shall be of the same material, type, size and colour as the existing paving units.

**Damaged
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 inspecting 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. **Inspection (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. This is a **HOLD POINT**. **Submission (HP)**

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 - VERSION 3.1.
5. Segmental paving works are measured and paid in accordance with this Specification and not in the Specification for SEGMENTAL PAVING - VERSION 3.1.
6. Trenchless installation of utility services under driveways is measured and paid in accordance with the Specification for TRENCHLESS CONDUIT INSTALLATION - VERSION 3.1.

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 the utility 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 temporary 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 306-A.

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 306-A.

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 306-A.

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 306 - A

RESTORATION REQUIREMENTS

(TO BE COMPLETED BY COMPLIER)

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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ANNEXURE C306 - B

INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title/subclause	Requirement	Notice for inspection	Release by
PROVISION FOR TRAFFIC			
Traffic Guidance Scheme			
C306.04.2	Submit Traffic Guidance Scheme for approval	14 days before work is scheduled to commence	Superintendent – Council concurrence required
CLEARING			
Set Out			
C306.05(b).3 – Set Out	Present set out line	5 working days before work is scheduled to commence	Superintendent – Council concurrence required
EXCAVATION			
Trench Excavation			
C306.08.7 – Excavation Level	Submit trench or foundation excavation for approval	2 working days	Superintendent
Protection of Trees			
C306.09.4 – Work Near Trees	Obtain approval for duration of open excavations	7 days before work is scheduled to commence	Superintendent – Council concurrence required
C273.09.5 – Tree Roots	Obtain approval for cutting of roots exceeding 50mm in diameter	2 working days	Superintendent – Council concurrence required
BACKFILL			
Trench Backfill			
C306.11.1 – Approved Material	Obtain approval for nominated backfill material	7 days before work is scheduled to commence	Superintendent
Compaction			
C306.12.4 - Testing	Submit compaction test results	5 working days	Superintendent
RESTORATION			
General			
C306.13.3 – Prepare Areas	Call for inspection	5 working days	Superintendent – Council concurrence required
Cleanup			
C306.20.3 - Inspection	Present cleaned up restoration works for inspection	2 working days	Superintendent

ROAD OPENINGS AND RESTORATIONS - COONAMBLE

Work-As-Executed Drawings			
C306.21.1 - Submission	Submit drawings	Within 2 weeks of approval of the restoration works	Superintendent

Summary of WITNESS POINTS

Clause title/subclause	Requirement	Notice for inspection
EXCAVATION		
Trench Excavation		
C306.08.9 – Unsuitable Material	Remove unsuitable material and replace to specified slope and level	Progressive
BACKFILL		
Trench Backfill		
C306.11.5 – Backfill at Trees	Backfill to original ground surface	Progressive
Compaction		
C306.12.3 – Moisture Content	Obtain approval for any proposed variation to moisture content limits	Progressive
RESTORATION		
Carriageway Subbase and Base		
C306.15.1 – Remove Temporary Pavement	Obtain approval for any temporary material proposed to remain in place	Progressive
Pathways		
C306.17.2 – Remove Temporary Material	Obtain approval for any temporary material proposed to remain in place	Progressive



COONAMBLE SHIRE COUNCIL

DEVELOPMENT

CONSTRUCTION SPECIFICATION

C401

WATER RETICULATION

VERSION 3.1 – January 2022

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
VERSION 3.1	Inspection requirements added	C401.01.4	A	KD	12/04/10
	Specification VERSION 3.1 referenced, standards updated, WSA drawings	C401.02.1	M		
	PVC-M pipes allowed for potable water mains, PVC-O pipes allowed for recycled water mains	C401.04	M		
	Hold Point added	C401.06	M		
	DICL pipe use specified	C401.07	A		
	Steel pipe use limited, Hold Point added	C401.08	A		
	Hold Point added	C401.10	M		
	Hold Point added	C401.14.3	A		
	Specification reference VERSION 3.1	C401.22	A		
	Specification reference VERSION 3.1	C401.29	A		
	Specification reference VERSION 3.1	C401.30	A		
	Specification reference VERSION 3.1	C401.32.2	A		
	Hold Point added	C401.32.5	A		
	Water service sizes specified	C401.33	A		
	Specification reference VERSION 3.1	C401.34	A		
	Specification reference VERSION 3.1	C401.37.1	A		
	Specification reference VERSION 3.1	C401.37.12	A		

WATER RETICULATION - COONAMBLE

	Witness Point replaced by Hold Point	C401.39.2	A		
		C401.43.2	A		
	Hold Point added				
		C401.48.11	A		
	Hold Point added				
	Water Authority approval added	C401.49.2	A		
	Witness Point replaced by Hold Point	C401.52.4	A		
		C401.56	A		
	Hold Point added				
		C401-A	A		
	Hold Point added				
	Specification reference	VERSION 3.1			
	Annexure added				
	PE water service added	C401.32	A	DJ	March 2022

SPECIFICATION C401 – WATER RETICULATION – VERSION 3.1

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SPECIFICATION C401: WATER RETICULATION – VERSION 3.1**GENERAL****C401.01 SCOPE**

1. The Work to be constructed under this Specification consists of the construction of:
 - (a) Mains up to DN600 nominal size;
 - (b) Small pump stations.

Suitable Works
2. This Specification excludes the construction activities for:
 - (a) Reservoirs, including repainting of reservoirs;
 - (b) Treatment plants;
 - (c) Dams;
 - (d) Headworks, including bores and weirs;
 - (e) Dosing plant;
 - (f) Larger pump stations;

Exclusions
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 SUPPLY CODE OF AUSTRALIA except as otherwise specified herein.

Compliance with Standards
4. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C401-A.. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Water Authority to be obtained where stipulated in Annexure C401-A.

Inspections

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 SUPPLY 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 Supply 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, available within two weeks of close of tenders.

Currency

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 1141-Various	Methods for sampling and testing aggregates
AS 1141.22-2008	Wet/dry strength variation
AS 1141.23-2009	Los Angeles value
AS 1141.32	Weak particles (including clay lumps, soft and friable particles) in coarse aggregates
AS 1152:1993	Specification for test sieves
AS/NZS 1260	PVC pipes and fittings for drain, waste and vent applications
AS 1272:1974	Unsintered PTFE tape for thread sealing applications
AS 1281-2001	Cement mortar lining of steel pipes and fittings
AS 1289	Methods for testing soils for engineering purposes
AS 1289.4.3.1-1997	Soil chemical tests - Determination of the pH value of a soil - Electrometric method
AS 1289.4.4.1-1997	Soil chemical tests - Determination of the electrical resistivity of a soil - Method for sands and granular materials
AS 1289.5.4.1:2007	Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.6.1-1998	Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1:2006	Soil compaction and density tests - Compaction control test - Hilf density ratio and Hilf moisture variation (Rapid method)
AS 1349:1986	Bourdon tube pressure and vacuum gauges
AS/NZS 1359	Rotating electrical machines - General requirements
AS/NZS 1359.5:2004	Three-phase cage induction motors - High efficiency and minimum energy - performance standards requirements
AS 1432:2004	Copper tubes for plumbing, gasfitting and drainage applications
AS 1444:2007	Wrought alloy steels – Standard, hardenability (H) series and hardened and tempered to designated mechanical properties
AS/NZS 1477:2006	PVC pipes and fittings for pressure applications
AS 1554	Structural steel welding
AS 1554.1-2004	Welding of steel structures
AS 1565:1996	Copper and copper alloys – Ingots and castings
AS 1579:2001	Arc welded steel pipes and fittings for water and waste water
AS/NZS 1594:2002	Hot-rolled steel flat products
AS 1627	Metal finishing—Preparation and pre-treatment of surfaces
AS 1627.4:2005	Abrasive blast cleaning of steel
AS 1646:2007	Elastomeric seals for waterworks purposes
AS 1657:1992	Fixed Platforms, walkways, stairways and ladders – Design, construction and installation
AS/NZS 1680	Interior lighting
AS/NZS 1680.2.4:1997	Industrial tasks and processes
AS 1830:2007	Grey cast iron
AS 1939	Degrees of protection provided by enclosures for electrical equipment
AS 2032:2006	Code of practice for installation of UPVC pipe systems
AS 2033:2008	Installation of polyethylene pipe systems
AS 2129:2000	Flanges for pipes, valves and fittings
AS 2187-Various	Explosives - Storage, transport and use
AS/NZS 2280:2004	Ductile iron pressure pipes and fittings

AS 2419	Fire hydrant installations
AS 2419.2:1994	Fire hydrant valves
AS 2528:1982	Bolts, studbolts and nuts for flanges and other high and low temperature applications
AS/NZS 2566	Buried flexible pipelines
AS/NZS 2566.1:1998	Structural Design
AS/NZS 2566.2:2002	Installation
AS 2638	Gate valves for waterworks purposes
AS 2638.1-2002	Metal seated
AS 2638.2-2006	Resilient seated
AS 2837	Wrought alloy steels – Stainless steel bars and semi-finished products
AS/NZS 3000:2007	Electrical installations (Wiring rules)
AS/NZS 3008	Electrical installations – selection of cable
AS/NZS 3008.1.1:2009	Cables for alternating voltages up to and including 0.6/1 kV—Typical Australian installation conditions
AS 3439	Low voltage switchgear and control gear assemblies
AS/NZS 3500	Plumbing and Drainage
AS/NZS 3500.1:2003	Water services
AS/NZS 3518:2004	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 3600-2009	Concrete structures
AS 3578	Cast iron non-return valves for general purposes
AS 3681:2008	Guidelines for the application of polyethylene sleeving to ductile iron pipelines and fittings
AS 3688-2005	Water supply - Metallic fittings and end connectors
AS 3690:2009	Installation of ABS pipe systems
AS 3691	Solvent cement and priming (cleaning) fluids for use with ABS pipes and fittings
AS 3705-2003	Geotextiles - Identification, marking, and general data
AS/NZS 3750	Paints for steel structures
AS/NZS 3750.4:1994	Bitumen paint
AS/NZS 3750.19:2008	Metal primer - General purpose
AS/NZS 3862:2002	External fusion-bonded epoxy coating for steel pipes
AS/NZS 3879:2006	Solvent cements and priming fluids for use with unplasticized PVC (PVC-U and PVC-M) and ABS pipes and fittings
AS 3952:2002	Water supply—Spring hydrant valve for waterworks purposes
AS 3996:2006	Metal access covers, road grates and frames
AS/NZS 4020:2005	Testing of products for use in contact with drinking water
AS 4087:2004	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

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AS/NZS 4129:2008	Fittings for polyethylene (PE) pipes for pressure applications
AS/NZS 4130:2009	Polyethylene (PE) pipes for pressure applications
AS/NZS 4158:2003	Thermal-bonded polymeric coatings on valves and fittings for water supply purposes
AS/NZS 4321:2001	Fusion bonded medium density polyethylene coating & lining for pipes and fittings
AS 4331	Metallic flanges
AS 4331.1-1995	Steel flanges
AS 4441-2008	- Oriented PVC (PVC-O) pipes for pressure applications.
AS/NZS 4680:2006	Hot-dipped galvanised (zinc) coatings on fabricated ferrous articles
AS/NZS 4765:2007	Modified PVC (PVC-M) pipes for pressure applications
AS 4794:2001	Non-return valves – Swing check and tilting disc
AS 4795-2006	Butterfly valves for waterworks purposes
AS 4796-2001	Water supply - Metal bodied and plastic bodied ball valves for property service connection
AS 4809-2003	Copper pipe and fittings - Installation and commissioning
AS 4956-2008	Air valves for water supply
AS/NZS 5081:2008	Hydraulically operated automatic control valves for waterworks purposes
AS 6401-2003	Knife gate valves for waterworks purposes
AS 60529-2004	Degrees of protection provided by enclosures (IP Code)
AS 60947	Low voltage switchgear and control gear
AS 60947.5.1-2004	Control circuit devices and switching elements - Electromechanical control circuit devices

(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 Commerce
MEW E101 - Electrical Services Minimum Requirements
WS-SPEC - Technical Requirements (TRs) and Strategic products Specifications

NSW Department of Environment, Climate Change and Water
Specification for supply of recycled material for pavements, earthworks and drainage

Department of Services, Technology and Administration (NSW)
MEW E101 Electrical Services Minimum Requirements

Water Services Association of Australia (WSAA)
WSA 01 - Polyethylene Pipeline Code Standard Drawings
WSA 03 - Water Supply Code of Australia - Version 2.3
- Dual Water Supply Systems (a Supplement to the Water Supply Code of Australia) – Version 1.2

British Standard
BS 410 - Specification for test sieves
BS 410-1:2000 Test sieves of metal wire cloth
BS 410-2:2000 Test sieves of perforated metal plate
BS 3416-1991 Specification for bitumen-based coatings for cold application, suitable for use in contact with potable water

ASTM
ASTM A240/A240M:2010 Standard specification for chromium and chromium-nickel stainless steel plate, sheet and strip for pressure vessels and for general applications
ASTM A276:2010 Standard Specification for Stainless Steel Bars and Shapes

3. 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

4. Water Supply Code of Australia drawings shall be used in preference to PWS Standard Drawings held by NSW Department of Commerce

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 (UPVC) MODIFIED PVC (PVC-M) AND ORIENTED PVC (PVC-O) PIPES

1. (a) Unplasticised PVC (uPVC) pipes and fittings shall not be used.

Prohibited

(b) Series 2 modified PVC (PVC-M) pipe, Class PN 16 minimum with rubber ring joints, shall be used for potable water supply mains and potable water trunk mains up to 375 mm diameter;

Potable Water Supply Mains

(c) Series 2 PVC-O pipe, Class PN 16 minimum purple coloured with rubber ring joints shall be used for all recycled water reticulation mains and recycled water trunk mains up to 300 mm diameter..

Recycled Water Mains

2. Modified PVC (PVC-M) and oriented PVC (PVC-O) pipes and fittings for mains and suction pipes shall comply with AS/NZS 1477, AS/NZS 4441 and, AS/NZS 4765 as appropriate, 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. (WSA 03 Part 3, section 12.1)

Standard

3. PVC pipes and fittings for mains and suction pipes shall be installed in accordance with AS 2032, AS/NZS 2566.1 and WSA 03.

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

C401.05 ACRYLONITRILE BUTADIENE STYRENE (ABS)

1. ABS pipes and fittings shall not be used

Prohibited

2. Reserved

3. Reserved

C401.06 GLASS REINFORCED PLASTIC (GRP)

1. GRP pipes and fittings shall not be used except where the Water Authority has provided its concurrence to their use. This is a **HOLD POINT**.

GRP Pipe (HP)

- | | | |
|----|---|-------------------|
| 2. | Glass filament reinforced thermosetting plastics (GRP) pipes shall comply with AS 3571.2 and shall be of the class and size as shown on the Drawings and installed in accordance with AS/NZS 2566.1 and AS/NZS 2566.2 (WSA 03 Part 3, Section 12.1.). | Standard |
| 3. | Where storage beyond the times specified in WSA 03 is required, the Contractor shall provide protection for the pipes and fittings from ultra violet light and damage. | Protection |

C401.07 DUCTILE IRON CEMENT LINED (DICL) PIPE AND FITTINGS

- | | | |
|----|--|-----------------------------|
| 1. | Ductile iron cement lined (DICL) 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 and AS/NZS 2566.2. 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 |
| 4. | DICL pipe shall be used for potable water mains 450 mm diameter or greater and for all potable water rising mains. | Use |
| 5. | DICL recycled water approved pipe shall be used for recycled water mains 375 mm or greater and for recycled water rising mains. The recycled water mains and recycled water rising mains shall be purple striped or sleeved with polyethylene coloured purple (WSA 03 – NDW 2.3) | |

C401.08 STEEL PIPELINE AND FITTINGS

- | | | |
|----|---|--------------------------------|
| 1. | Steel pipelines and fittings shall only be used where the Water Authority has provided concurrence to their use. This is a HOLD POINT . | Steel Pipe (HP) |
| 2. | 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. (WSA 03 Part 3, section 12.1). | Standard |
| 3. | The Contractor shall wrap all unprotected joints in the trench with a petrolatum tape system approved by the Superintendent. | Corrosion Protection |
| 4. | The jointing system shall be rubber ring (elastomeric), complying with AS 1646, unless shown otherwise on the Drawings. | Joints |
| 5. | 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. (WSA 03 Part 3, section 12.1)

Insulated**C401.10 POLYETHYLENE (PE)**

1. Polyethylene pipe shall not be used except where the Water Authority has provided its concurrence to its use. This is a **HOLD POINT**.

PE Pipe (HP)

2. Polyethylene pipe shall comply with AS/NZS 4130 and shall be of the class and size as shown on the Drawings and installed in accordance with AS/NZS 2033. (WSA 03 Part 3, section 12.1.)

Standard

3. Jointing shall be by butt thermal fusion or by electrofusion couplings, or with mechanical fittings.

Jointing

4. Fittings shall comply with AS/NZS 4129.

Fittings

5. The Contractor shall provide pipe and fittings with minimum wall thickness and minimum internal diameter as shown on the Drawings.

Diameter

6. Where permitted, PE pipe shall be used on services not less than 20mm ID.

Limit on 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. (WSA 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. (WSA 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. Valves shall be closed by rotating the spindle in a clockwise direction | 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. This is a HOLD POINT . | Alternate Type (HP) |

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 WSA 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 Bermad Hydraulic 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
<div style="border: 1px solid black; padding: 2px; display: inline-block;">(HP)</div> |
| 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
<div style="border: 1px solid black; padding: 2px; display: inline-block;">(HP)</div> |

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 SUPPLY CODE unless directed otherwise by the Superintendent (WSAA 03 Part 3, section 21). The Contractor shall confirm the locations immediately prior to construction. (WSA 03 Part 3, section 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: (WSA 03 Part 3 WAT-100) | Minimum Cover |
| <ul style="list-style-type: none"> (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. Direction constitutes a HOLD POINT . | Special Protection (HP) |
| 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. (WSA 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. (WSA 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 (DICTL), 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. (WSA 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 - VERSION 3.1.

**Erosion
Control**

6. The Contractor shall take account of safety issues and possible wet weather effects to limit the extent of excavation left open. (WSA 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. (WSA 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-cohesive material is not readily available locally or where the Contractor can demonstrate that its use will not impede repair operations. (WSA 03 Part 3, section 14.)

Crusher Screenings

3. Pipes (excluding PVC 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

4. For PVC 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 Pipes

Sieve Size Aperture Width (AS 1152)	Equivalent BS Sieve Size (BS410)	Percentage Passing
9.5 mm	$\frac{3}{8}$ inch	100
6.7 mm	$\frac{1}{4}$ inch	90 - 100
425 μ m	No. 36	40 - 90
150 μ m	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 > 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. (WSA 03 Part 4, section 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° 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. (WSA 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: (WSA 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 – VERSION 3.1, 150mm minimum thickness as follows: (WSA 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 bulkhead

$$D = \frac{100}{G}, \text{ whereby}$$

$$L = 80 \times \text{Pipe length, m}$$

$$= 450 \text{ m max}$$

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. (WSA 03 Part 3, section 15.11.12.)

Type

2. The concrete shall comply with the Specification for MINOR CONCRETE WORKS – VERSION 3.1.

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 SERVICE CONNECTIONS

1. The Contractor shall provide service connections in accordance with the WATER SUPPLY CODE (WSA 03 Part 4 WAT-1108 and WAT-1109). PE Pipe may be used for service connections but must have tracer wire and road crossings are to be in a conduit.

Provision

2. Where the water services connect into a commissioned water main, the Contractor shall leave the water main exposed for a distance of 0.5 metres either side of the connection point. The connection of the service to the water main shall be performed by the Water Authority unless otherwise directed by Water Authority. This is a **HOLD POINT**.

**Connection by
Water
Authority (HP)**

3. Where the water services connect into an uncommissioned water main, the Contractor shall connect each service connection to the water main. The connection shall be made using either an "Obvalve" insulated main cock or a self-inserting main cock with an insulated tapping band.

**Connection by
Contractor**

4. Each service shall extend 500mm inside the lot boundary at the centre of the lot and shall terminate with a meter cock located 150mm above finished ground level. Dual services shall not be installed. Services are to be laid perpendicular, or radial on curved

**Service
Location**

alignments, to the reticulation mains.

5. Service sizes are to be provided for the domestic supply as follows

	Service Size	
	Drinking Water Supply	Raw Water Supply
Residential Lot	20 mm	20 mm
Unit sites - 3 – 6 units	25 mm	25 mm
7 – 12 units	40 mm	40 mm
13 – 50 units	65 mm	65 mm
51 – 100 units	100 mm	100 mm
Commercial Lot	40 mm minimum	40 mm minimum

**Domestic
Service
Locations**

6. Where a fire service is to be provided to a lot, Stop Valves are to be installed on each side of the tee for the fire service and on the fire service branch. The service for the domestic supply may be branched off the fire service provided the domestic service is not greater in diameter than the fire service.

Fire Service

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. (WSA 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 - VERSION 3.1, 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 - VERSION 3.1, 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 - VERSION 3.1 and have the following minimum dimensions: (WSA 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. (WSA 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 **HOLD POINT**. **Testing (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:
 - (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, e.g. 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. This is a **HOLD POINT**.

Alternative Test (HP)

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. (WSA 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. (WSA 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. This is a **HOLD POINT**.

Procedures (HP)

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. (WSA 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 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:
- 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 with AS 1289.5.4.1 for cohesionless materials
- Backfill to Subgrade Level with Non-Cohesive 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 AS 1289.5.7.1, 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 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.
- 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. (WSA 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

5. 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 SUPPLY CODE (WSA 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. (WSA 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***

AUS-SPEC #1

PUMP STATIONS

C401.43 PUMPS

1. Pump construction materials for centrifugal end suction pumps shall comply with **Materials** the following:

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 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 Water Authority's approval of the warranty is required prior to the release of the hold point. **Warranty (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 Polytetrafluoroethylene (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

- | | |
|--|--------------------------------|
| <p>7. The electrical characteristics of the SCA shall be:</p> <p>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)</p> | <p>Characteristics</p> |
| <p>8. All cables shall enter the SCA from below.</p> | <p>Cable Entry</p> |
| <p>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.</p> | <p>Switchgear Data</p> |
| <p>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.</p> | <p>Operation</p> |
| <p>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.</p> | <p>Factory Tests</p> |
| <p>12. Functional tests referred to in Schedule MEW E101 shall include electrical function tests as defined in AS 3439.</p> | <p>Functional Tests</p> |
| <p>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.</p> | <p>Packing</p> |
| <p>14. The Contractor shall be responsible for any damage that may occur during transit and unloading at site.</p> | <p>Damage</p> |
| <p>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.</p> | <p>Tools</p> |
| <p>16. The Contractor shall supply spare parts in accordance with the schedule supplied by the Superintendent.</p> | <p>Spare Parts</p> |
| <p>17. The Contractor shall supply and install control equipment that is compatible with the existing equipment.</p> | <p>Pump Control</p> |

C401.47 ELECTRICAL INSTALLATION

- | | |
|--|---|
| <p>1. The Contractor shall liaise with the Supply Authority for the electricity supply to the pump station site.</p> | <p>Liaison</p> |
| <p>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.</p> | <p>Contractor's Responsibility</p> |
| <p>3. The Contractor shall supply and install all cabling including consumer mains, motor, control and flow meter cables, conduits and electrical pits.</p> | <p>Cabling</p> |

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 50mm² 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 I. **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 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 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 **HOLD POINT**. **Notification**
(HP)
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 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**

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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.

2. The submission to the Superintendent of the above documentation constitutes a **HOLD POINT**. **Submission (HP)**

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

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CONSTRUCTION COMPLIANCE

C401.52 WORK-AS-EXECUTED DETAILS

- | | |
|--|--|
| <p>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. (WSA 03 Part 3, section 24).</p> | <p>Main Requirements</p> |
| <p>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.</p> | <p>Additional Detailed Requirements</p> |
| <p>3. The Contractor shall ensure that a Registered Surveyor certifies the plans showing location and alignment.</p> | <p>Survey</p> |
| <p>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. This is a HOLD POINT</p> | <p>Asset Register (HP)</p> |

SPECIAL REQUIREMENTS

C401.53 DISINFECTION OF WATER MAINS

- | | |
|--|--|
| <p>1. All new water mains are to be disinfected prior to acceptance by the Water Authority. Disinfection shall be by chlorination, after physical cleaning, and shall be carried out in the following sequence:</p> <p>(a) Flush main to remove all debris.</p> <p>(b) Isolate sections of the reticulation and commence filling the main with water to which sodium hypochlorite solution is added with a metering pump. One of the following rates can be used:</p> <p style="margin-left: 40px;">(i) 100 mg/L for a disinfection period of 3 hours</p> <p style="margin-left: 40px;">(ii) 50 mg/L for a disinfection period of 24 hours</p> <p>(c) Continue chlorine application until the entire main is filled and dose evenly the entire filling duration (to be estimated on site).</p> <p>(d) Operate all valves, hydrants, etc. Along the main during the disinfection period to ensure their proper disinfection.</p> <p>(e) Monitor the residual periodically at various points along the main. The residual should be not less than 50 mg/L for a dose rate of 100 mg/L and not less than 10mg/L for a dose rate of 50 mg/L at the end of the disinfection period. If the residual falls below the applicable level, flush to waste in accordance with Clause C401.44 and repeat the above procedure.</p> <p>(f) Wait for the appropriate time as specified by the dosage rates in (b).</p> <p>(g) Flush to waste with chlorinated water of approximately 0.5 mg/L free chlorine residual. Continue flushing until the free chlorine residual in the water leaving the main is approximately 0.5 mg/L.</p> | <p>Disinfection by Chlorination</p> |
|--|--|

(h) After final flushing and before main is placed in service, collect samples from the end of main for bacteriological analysis. In the case of extremely long mains, collect samples at various points along the main. Samples are to contain no faecal coliforms and less than 10 coliform organisms per 100ml.

(i) If samples contain faecal coliforms and/or greater than 10 coliform organisms per 100ml, repeat disinfection procedures until satisfactory bacteriological results are obtained.

C401.54 DISINFECTION OF WATER STORAGE FACILITIES

1. All new water storage facilities are to be disinfected prior to acceptance by Council. Disinfection shall be by chlorination, after physical cleaning, and shall be carried out in accordance with the following:

Disinfection by Chlorination

(a) For new Concrete Reservoirs, remove all construction debris and then perform disinfection using one of the following disinfection methods detailed below:

Concrete Reservoirs

- (i) Mixing chlorine in storage in accordance with Clause C401.43.2; or
- (ii) Chlorinate inflowing water in accordance with Clause C401.43.3; or
- (iii) Direct application to surfaces of storage in accordance with Clause C401.43.4.

(b) For new Painted Steel Reservoirs, remove all construction debris and then perform disinfection using direct application to surfaces of storage in accordance with Clause C401.43.4, with the following provisions:

Painted Steel Reservoirs

- (i) Allow at least 14 days for curing of the paint; and
- (ii) The specified minimum retention time of 30 minutes shall not be grossly exceeded, i.e. No chlorine solutions should be left on the floor for more than one hour.

2. The disinfection of water storage facilities by mixing of chlorine in storage shall be carried out in accordance with the following:

Mixing of Chlorine in Storage

(a) Commence filling of the storage.

(b) Pour sodium hypochlorite solution into the incoming water in the storage near the inlet. Use a dose rate of 50 mg/L. All sodium hypochlorite shall be poured into the water in the storage when the water is no more than 1 m in depth, or no less than 300 mm in depth.

(c) Fill the storage to the overflow level. Leave for 24 hours.

(d) Residual should be not less than 10 mg/L after 24 hours. If the residual is less than 10 mg/L, flush to waste in accordance with Clause C401.44 and repeat above procedure.

(e) Drain and flush to waste with chlorinated water of approximately 0.5 mg/L free chlorine residual. Ensure chlorine residual is reduced to approximately 0.5 mg/L.

(f) Before storage is placed in service, collect samples from the facility for bacteriological testing. Ensure that samples are actually from the water that has been in the storage. Samples are to contain no faecal coliforms and less than 10 coliform organisms per 100 ml.

(g) If samples contain faecal coliforms and/or greater than 10 coliform organisms per 100 ml, repeat disinfection procedures until satisfactory bacteriological test results are obtained.

3. The disinfection of water storage facilities by chlorination of inflowing water shall be carried out in accordance with the following:

***Chlorination of
Inflowing
Water***

- (a) Add sodium hypochlorite solution to the water entering the storage with a metering pump, dose through an injection tube located in the inlet pipe near the storage. Use a dose rate of 50 mg/L.
- (b) Fill the storage to the overflow level with the dosed water and leave for 6 hours.
- (c) Residual should be not less 10 mg/L after 6 hours. If the residual is less than 10 mg/L, flush to waste in accordance with Clause C401.44 and repeat the above procedure.
- (d) Drain and flush to waste with chlorinated water of approximately 0.5 mg/L free chlorine residual. Ensure chlorine residual is reduced to approximately 0.5 mg/L.
- (e) Before storage is placed in service, collect samples from the facility for bacteriological testing. Ensure that samples are actually from the water that has been in the storage. Samples are to contain no faecal coliforms and less than 10 coliform organisms per 100 ml.
- (f) If samples contain faecal coliforms and/or greater than 10 coliform organisms per 100 ml, repeat disinfection procedures until satisfactory bacteriological test results are obtained.

4. The disinfection of water storage facilities by direct application to surfaces of storage shall be carried out in accordance with the following:

***Direct
Application to
Surfaces***

- (a) Apply a 200 mg/L of sodium hypochlorite solution to the surface of all parts of the storage that would be in contact with water when the storage is full to the overflow level, by coarse spraying or painting.
- (b) Leave for at least 30 minutes.
- (c) Hose down the surfaces to which the solution has been applied with potable water. Ensure that all chlorine spray is hosed off metal roof supports and sheeting.
- (d) Fill storage to the overflow level with chlorinated water of approximately 0.5 mg/L free chlorine residual.
- (e) Before storage is placed in service, collect samples from the facility for bacteriological testing. Ensure that samples are actually from the water that has been in the storage. Samples are to contain no faecal coliforms and less than 10 coliform organisms per 100 ml.
- (f) If samples contain faecal coliforms and/or greater than 10 coliform organisms per 100 ml, repeat disinfection procedures until satisfactory bacteriological test results are obtained.

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C401.55 DISPOSAL OF WASTE WATER

1. Care should be taken in the disposal of the waste solution as it may be toxic and aggressive. Dechlorination is required prior to discharge to reduce the chlorine residual to less than 0.5 mg/L. This can be achieved by either of the following methods:

Dechlorination

(a) Storage in a holding pond. The dechlorination of the solution will occur naturally by the application of sunlight. Public access to the pond shall not be permitted.

Holding Pond

(b) Chemical addition during discharge of waste water. The mass of chemicals required (kg) to neutralise various residual chlorine concentrations in 1 ML (1,000kL) of water shall be:

**Chemical
Addition**

Residual Chlorine Metabisulphate concentration mg/L	Sulphur Dioxide SO ₂ (gas)	Sodium Na ₂ S ₂ O ₅ (powder)
1	1.0	1.4
2	2.0	2.8
10	10.0	14.0
50	50.0	70.0

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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 - VERSION 3.1.
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 - VERSION 3.1.

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.

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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.

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ANNEXURE C401- A

INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title/subclause	Requirement	Notice for inspection	Release by
MATERIALS			
Glass Reinforced Plastic (GRP)			
C401.06.1 - Concurrence	Obtain concurrence for use of GRP pipes	14 days before scheduled delivery	Superintendent – Water Authority concurrence required
Steel Pipelines and Fittings			
C401.08.1 - Concurrence	Obtain concurrence for use of steel pipes and fittings	14 days before scheduled delivery	Superintendent – Water Authority concurrence required
Polyethylene (PE)			
C401.10.1 - Concurrence	Obtain concurrence for use of PE pipes	14 days before scheduled delivery	Superintendent – Water Authority concurrence required
VALVES AND HYDRANTS			
Air Valves			
C401.14.3 – Alternate Type	Submit any proposed alternate air valve types for approval	14 days before work is scheduled to commence	Superintendent – Water Authority concurrence required
PIPELINE CONSTRUCTION			
General			
C410.18.1 - Accreditation	Provide proof of accreditation	14 working days before work is scheduled to commence	Superintendent – Water Authority concurrence required
C410.18.2 – Alignment Changes	Provide details of any proposed alignment changes for approval	14 working days before work is scheduled to commence	Superintendent – Water Authority concurrence required
PIPELINE CONSTRUCTION			
Cover over Pipelines			
C410.20.2 – Special Protection	Obtain approval for reduced cover where not shown on approved Drawings	14 working days	Superintendent – Water Authority concurrence required
Pipe Bedding			
C401.26.1 – Approval	Submit excavated trench for approval	5 working days	Superintendent

Service Connections			
C401.32.2 – Connection by Council	Present cleaned up restoration works for inspection	2 working days	Superintendent – Water Authority concurrence required
PIPELINE TESTING AND RESTORATION			
Testing of Pipelines			
C401.37.1 - Testing	Pressure test mains	5 working days	Superintendent – Water Authority concurrence required
C401.37.12 – Alternative Test	Submit details for approval	5 working days	Superintendent – Water Authority concurrence required
Disinfection of Pipelines			
C401.39.2 - Procedures	Submit procedures for approval	5 working days	Superintendent – Water Authority concurrence required
Backfill and Compaction			
C401.40.1 - Notification	Present laid and jointed pipes for inspection prior to backfill	5 working days	Superintendent – Water Authority concurrence required
PUMP STATIONS			
Pumps			
C401.43.2 - Warranty	Submit warranty for approval	5 working days	Superintendent – Water Authority concurrence required
Electrical Installation			
C401.47.6 - Route	Submit route for approval	5 working days	Superintendent – Water Authority concurrence required
Testing and Commissioning of Pump Station			
C401.48.1 - Compliance	Submit test results	5 working days	Superintendent – Water Authority concurrence required
C401.48.11 - Notification	Advise intention to undertake commissioning	5 working days	Superintendent – Water Authority concurrence required
Practical Completion of Pump Station			
C401.49.2 - Submission	Submit documentation	5 working days	Superintendent – Water Authority concurrence required

CONSTRUCTION COMPLIANCE**Work-As-Executed Details**

C401.52.4 – Asset Register	Submit records	Within 2 weeks of practical completion	Superintendent – Water Authority concurrence required
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Summary of WITNESS POINTS

Clause title/subclause	Requirement	Notice for inspection
PIPELINE CONSTRUCTION		
Crossings		
C401.21.1 – Contractor's Responsibility	Obtain any relevant Authority requirements for road, creek or feature crossings	Progressive
PUMP STATIONS		
Electrical Compliance		
C401.45.5 - Approval	Arrange inspection by each relevant Authority	Progressive

AUS-SPEC #1



COONAMBLE SHIRE COUNCIL

COONAMBLE DEVELOPMENT
CONSTRUCTION SPECIFICATION

C402

SEWERAGE SYSTEM

VERSION 3.1 – JANUARY 2022

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.

AUS-SPEC #1

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
VERSION 3.1	RISS allowed, Sewer Authority defined	C402.01	A	KD	7/05/10
	Inspections	C402.01.6	A		
	Specification VERSION 3.1 referenced, standards and other references updated	C402.02.2			
	PVC pipe allowed	C402.04	M		
	Polypropylene pipe and polyethylene pipe allowed for VERSION 3.1	C402.05	M		
	DICL pipe use specified	C402.07	M		
	VC pipe prohibited in VERSION 3.1	C402.09	M		
		C402.11	M		
	Maintenance shafts permitted in VERSION 3.1	C402.14.1	M		
	Sewer Authority concurrence	C402.15.1	A		
	Hold Point added	C402.16.2	A		
	Hold Point added	C402.18	A		
	Specification VERSION 3.1 reference, Hold Point added	C402.20	A		
	Polypropylene pipe referenced, Witness Point added	C402.23	M		
	Polypropylene pipe and polyethylene pipe referenced	C402.23.6	A		
	Specification VERSION 3.1 referenced				

SEWERAGE SYSTEM - COONAMBLE

	Witness Point added	C402.24.2	A		
		C402.24.18	A		
	Witness Point added	C402.26.3	A		
	Specification VERSION 3.1 referenced	C402.29	A		
	Specification VERSION 3.1 referenced	C402.30	A		
	VERSION 3.1 specifications reference, Hold Point added	C402.32.1	A		
	VERSION 3.1 specifications referenced	C402.18.1	A		
	Hold Point added	C402.35.1	A		
	Specification VERSION 3.1 reference	C402.38.4	M		
	Maintenance shaft requirements reinserted for VERSION 3.1	C402.40.5	A		
	Sewer Authority referenced, Hold Point added	C402.41.5	A		
	Hold Point added	C402.45	A		
	Sewer Authority referenced, Hold Point added	C402.46.2	A		
	Hold Point added	C402.47.12	A		
	Hold Point added	C402.28.1	M		
	Sewer Authority concurrence	C402.49.1	A		
	Witness Point added	C402.50.2	M		
	Sewer Authority concurrence	C402.57.5	A		
	Hold Point added	C402.57.11	M		
	Witness Point replaced by a Hold Point	C402.61.5	A		
	Hold Point added	C402.62.1	A		
	Digital record reference, Hold Point added	C402.63.1	M, A		
	Requirements for temporary flushing amended and Hold Point added	C402.66	A, M		
	Specification Version 3.12 reference, Pay Item for Maintenance Shafts reinserted	C402-A	A		

Annexure added

SPECIFICATION C402 - SEWERAGE SYSTEM – VERSION 3.1

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SPECIFICATION C402: SEWERAGE SYSTEM – VERSION 3.1**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, and
 - (g) Reduced Infiltration Sewerage Systems (RISS).
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**
5. For the purpose of this specification COONAMBLE SHIRE Council is the Sewer Authority **Sewer Authority**
6. The Contractor shall give notice so that inspection may be made of all **HOLD POINTS** and **WITNESS POINTS** documented in this specification and tabulated in Annexure C402-A. Release of **HOLD POINTS** and **WITNESS POINTS** shall be made by the Superintendent, with the concurrence of the Sewer Authority to be obtained where stipulated in Annexure C402-A. **Inspections**

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 **Documents, Standards, Test**

access to, the documents required to comply with this Specification.

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 (WSA Part, Section).

Sewerage Code

(a) Council Specifications

C271	-	Minor Concrete Works - VERSION 3.1
C201	-	Control of Traffic - VERSION 3.1
C211	-	Control of Erosion and Sedimentation - VERSION 3.1

(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, available within two weeks of close of tenders.

Currency

AS/NZS 1111	-	ISO metric hexagon commercial bolts and screws
AS 1111.1-2000		Bolts
AS 1111.2-2000		Screws
AS/NZS 1112	-	ISO metric hexagon nuts, including thin nuts, slotted nuts, and castle nuts
AS 1152:1993	-	Specification for test sieves
AS/NZS 1260:2002	-	PVC-U pipes and fittings for drain, waste and vent applications
AS 1272:1974	-	Unsintered PTFE tape for thread sealing applications
AS 1289		Methods for testing soils for engineering purposes
AS1289.5.4.1-2007		Soil compaction and density tests - Compaction control test – Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1:2006		Soil compaction and density tests - Compaction control test – Hilf density ratio and Hilf moisture variation (Rapid Method)
AS 1349:1986	-	Bourdon tube pressure and vacuum gauges
AS 1444	-	Wrought alloy steels – Standard, hardenability (H) series and hardened and tempered to designated mechanical properties
AS/NZS 1477:2006		PVC pipes and fittings for pressure applications
AS 1565:1996	-	Copper and copper alloys – Ingots and castings
AS 1579:2001	-	Arc welded steel pipes and fittings for water and wastewater
AS/NZS 1594	-	Hot-rolled steel flat products
AS 1627	-	Metal finishing – Preparation and pre-treatment of surfaces
AS 1627.4-2005		Abrasive blast cleaning
AS 1646:2007	-	Elastomeric seals for waterworks purposes
AS 1657:1992	-	Fixed Platforms, walkways, stairways and ladders – Design, construction and installation
AS 1741:1991	-	Vitrified clay pipes and fittings with flexible joints – sewer quality
AS 1830:2007	-	Grey cast iron
AS 1939	-	Degrees of protection provided by enclosures for electrical equipment
AS 2032:2006	-	Code of practice for installation of uPVC pipe systems.
AS 2033:2008	-	Installation of polyethylene pipe systems
AS 2129:2000	-	Flanges for pipes, valves and fittings
AS/NZS 2280:2004		Ductile iron pressure pipes and fittings
AS 2528:1982	-	Bolts, studbolts and nuts for flanges and other high and low temperature applications
AS/NZS 2566	-	Buried flexible pipelines

AS/NZS 2566.1:1998	Structural Design
AS/NZS 2566.2:2002	Installation
AS 2837:1986	- Wrought alloy steels – Stainless steel bars and semi-finished products
AS/NZS 3000:2007	Electrical installations (Wiring Rules)
AS/NZS 3008	- Electrical installations – Selection of cables
AS/NZS 3439	- Low voltage switchgear and controlgear assemblies
AS/NZS 3518:2004	Acrylonitrile butadiene styrene (ABS) pipes and fittings for pressure applications
AS 3571:1989	- Glass filament reinforced thermosetting plastics (GRP) pipes – Polyester based – Water supply, sewerage and drainage applications
AS 3571.1:2009	Pressure and non-pressure drainage and sewerage (ISO 10467:2004, MOD)
AS 3571.2: 2009	Pressure and non-pressure water supply (ISO 10639:2004, MOD)
AS 3578	- Cast iron non-return valves for general purposes
AS 3681:1989	- Guidelines for the application of polyethylene sleeving to ductile iron pipelines and fittings
AS 3690:1989	- Installation of ABS pipe systems
AS 3972:1997	- Portland and blended cements
AS 3996:2006	- Metal access covers, road grates and frames
AS/NZS 4058:2007	Precast concrete pipes (pressure and non-pressure)
AS 4060:1992	- Loads on buried vitrified clay pipes
AS/NZS 4129:2008	Fittings for polyethylene (PE) pipes for pressure applications
AS/NZS 4130:2003	Polyethylene (PE) pipes for pressure applications
AS 4198:1994	- Precast concrete access chambers for sewerage applications
AS/NZS 4321	- Fusion-bonded medium-density polyethylene coating and lining for pipes and fittings
AS/NZS 4441:2008	Oriented PVC (PVC-O) pipes for pressure applications
AS/NZS 4680:2006	Hot-dip galvanised (zinc) coatings on fabricated ferrous articles
AS/NZS 4765:2007	Modified PVC (PVC-M) pipes for pressure applications
AS 4794:2001	- Non return valves – Swing check and tilting disc
AS/NZS 5065:2005	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

(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 (WSAA)

WSA 01	- Polyethylene Pipeline Code
WSA 02	- Sewerage Code of Australia – Version 2.3
WSA 04	- Sewerage Pumping Station Code – Version 2.1
WSA 05	- Sewer Inspection Reporting Code

Standard Drawings
 - SEWERAGE CODE OF AUSTRALIA drawings (WSA 03 Part 4) shall be used in preference to DPWS Standard Drawings held by NSW Department of Commerce

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 PVC (PVC-U) AND MODIFIED PVC (PVC-M) PIPE AND FITTINGS

1. Unplasticized PVC (PVC-U) pipe may be specified for sewer gravity mains of 150 mm and 225 mm diameter. The pipe shall be not less than Class SN 8.

PVC-U Pipes

2. PVC-M pipes shall not be used

**PVC-M Pipes
Prohibited**

3. Unplasticised PVC (PVC-U) pipes and fittings for gravity systems shall comply with AS/NZS 1260, shall utilise rubber ring (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**

4. Unplasticised PVC (PVC-U) pipes and fittings shall not be used for rising mains and suction pipes.

**PVC Pressure
Pipe
Prohibited**

5. 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 POLYPROPYLENE AND POLYETHYLENE PIPE AND FITTINGS

1. (a) Twin walled, corrugated polypropylene pipe with rubber ring joints shall be used for 225 mm diameter and larger trunk sewer gravity mains.

PP pipe

(b) Polyethylene pipe may be used for sewer gravity mains.

PE pipe

2. (a) Polypropylene pipe shall comply with AS/NZS 5065 and shall be of the class and size shown on the Drawings. (WSA 02 Part 2, Table 10.2).

Standards

(b) Polyethylene pipes and fittings shall comply with AS/NZS 4129 and AS/NZS 4130 and shall be of the class and size shown on the Drawings (WSA 02 Part 2, Section 10.4 and Table 10.1) and installed in accordance with AS/NZS 2033.

3. Jointing shall be by butt thermal fusion or by electrofusion couplings, or with

Jointing

compression fittings.

4. 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 not be used
2. Reserved
3. Reserved

**GRP Pipe
Prohibited**

C402.07 DUCTILE IRON CEMENT LINED (DICL) PIPE AND FITTINGS

1. Ductile iron (DICL) sewer approved pipes and fittings shall be used for all sewer rising mains and 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 (WSA 02 Part 2, Section 10.4 and Table 10.1).

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. (WSA 02 Part 2, Section 10.4 and Table 10.1)

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) unless shown otherwise on the Drawings.

Joints

C402.09 VITRIFIED CLAY

1. Vitrified clay (VC) pipes and fittings shall not be used

**VC Pipe
Prohibited**

C402.10 PREFORMED MAINTENANCE HOLES (MH)

1. Preformed maintenance hole components shall comply with AS/NZS 1477 for PVC, AS 2033 for PE and AS 4198 for concrete. (WSA 02 Part 2, Section 10.4 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 comply with AS/NZS 1477, AS/NZS 4441 or AS/NZS 4765 for PVC and AS 4198 for concrete. (WSA 02 Part 2 Section 10.4 Part 3 Section 19 and drawings, SEW 1314, 1316, 1317). These shall be only used where specified on the drawings.

Standard

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 3, Section 18, drawings SEW 1307, 1311, 1312).

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 Sewer Authority, 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 3, section 13.1, 13.2). Direction by the Superintendent constitutes a **HOLD POINT**.

Pipe Laying Method

(HP)

C402.16 COVER OVER PIPELINES

1. The minimum depth of cover to be provided over pipelines shall be as follows:
(WSA 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. Direction by the Superintendent constitutes a **HOLD POINT**.

**Special
Protection
(HP)**

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. (WSA 02 Part 3, section 17.13). 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. (WSA 02 Part 3, Section 15.3).

**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 3, 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. Direction by the Superintendent constitutes a **HOLD POINT**. 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. (WSA 02 Part 3, section 15).

**Contractor's
Responsibility
(HP)**

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. (WSA 02 Part 3, 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. (WSA 02 Part 3, 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. (WSA 02 Part 3, 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 – VERSION 3.1.

**Erosion
Control**

6. The Contractor shall take account of safety issues and possible wet weather effects to limit the extent of excavation left open. (WSA 02 Part 3, section 15.2)

**Limiting
Excavations**

C402.19 MINIMUM TRENCH WIDTH FOR PIPELINES

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. (WSA 02 Part 3, 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. (WSA 02 Part 3, 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, PP 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/PP/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

AUS-SPEC #1

Nominal Size of Pipe (mm)	Maximum Depth to Invert, Unlimited Width Trench (m)	Maximum Trench Width, Depths Greater than in Column (ii) (mm)
(i)	(ii)	(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/PP/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/PP/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. This is a **WITNESS POINT**.

**Special
Controls (WP)**

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. (WSA 02 Part 3, section 15.8, SEW-1201)

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. (WSA 02 Part 3, 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. (WSA 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/PP/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. (WSA 02 Part 3, section 14.1).

**Gravity
Sewers
Pipes other
than
PVC/PP/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, PP and PE

4. Pipes for DICL rising mains 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.

**DICL Rising
Mains**

5. For PVC/PP/PE pipes user for gravity mains, 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/PP/PE
Pipes**

Sieve Size Aperture Width (AS 1152)	Equivalent BS Sieve Size (BS 410)	Percentage Passing
9.5 mm	¾ 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/PP/PE Pipes

AUS-SPEC #1

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 - VERSION 3.1. 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. (WSA 02 Part 3, 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. This action constitutes a **WITNESS POINT**. If directed by the Superintendent, the Contractor shall oil valves and repack valve glands.

**Examination
(WP)**

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). (WSA 02 Part 3, 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 (WSA 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° 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. (WSA 02 Part 3, section 17.11). This is a **WITNESS POINT**.

Rising Main Identification (WP)

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)

AUS-SPEC #1

C402.25 CONNECTIONS TO MAINTENANCE HOLES AND STRUCTURES

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. (WSA 02 Part Section 18.10, and drawings SEW-1302, 1303, 1313).

Flexible Joints

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:

Maintenance Hole Location

- (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: (WSA 02 Part 3, section 23).

Tolerances

- (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.

3. The Contractor shall complete all necessary Works on "live" maintenance holes (that is, accesses to sewer system that is currently in service) unless shown otherwise on the Drawings or advised by the Superintendent. Where shown on the Drawings that work on "live" maintenance holes shall be performed by others, the Contractor's attention is drawn to the Conditions of Contract regarding the obligation of the Contractor to co-ordinate the Works with any simultaneous and/or adjacent work by others. The Contractor shall liaise with these Contractors and Authorities to avoid disruption, delays and possible conflict. All Works undertaken by the Contractor at "live" maintenance holes in delivering the Works under the Contract shall be at a cost to the Contractor. (WSA 02 Part 3, section 24).

Work on Live Maintenance Holes

AUS-SPEC #1

C402.26 JUNCTIONS AND PROPERTY CONNECTION SEWERS

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: (WSA 02 Part 3, section 17.7)

Location

- (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 - VERSION 3.1.

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 25m. (WSA 02 Part 3, 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. (WSA 02 Part 3, 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. (WSA 02 Part 3, 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: (WSA 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

$$D = \frac{100}{G}, \text{ whereby}$$

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 - VERSION 3.1, 150mm minimum thickness as follows: (WSA 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: (WSA 02 Part 1, Table 8.1)

Spacing

Concrete bulkhead

$$D = \frac{L}{G}$$

Concrete encasement (continuous) and concrete bulkhead

$$D = \frac{100}{G}, \text{ whereby}$$

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 - VERSION 3.1, 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 - VERSION 3.1, 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. This is a **HOLD POINT**.

Restrained Joints (HP)

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 - VERSION 3.1 and have the following minimum dimensions: (WSA 02 Part 3, 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. (WSA 02 Part 3, 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. This is a **HOLD POINT**.

Material Type**(HP)**

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 - VERSION 3.1 in relation to the supply and placement of concrete and steel reinforcement, formwork, tolerances, construction joints, curing and protection except as specified below. (WSA 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/m³ 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. (WSA 02 Part 3, 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. (WSA 02 SEW 1307).

Fixing**C402.38 PREFORMED MAINTENANCE HOLE 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. (WSA 02 Part 3, 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 (WSA 02 drawing 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 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. (WSA 02 Part 3, 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 Sewer Authority. This is a **HOLD POINT**. 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.

(HP)

(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. (WSA 02 Part 3, 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. This is a **HOLD POINT**.

Alternative Tests (HP)

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 m³/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: (WSA 02 Part 3, 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:

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

Time

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

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 Sewer Authority may approve in writing. Such approval constitutes a **Hold Point**.

**Sewer
Authority
Approval (HP)**

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 (i.e. 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. This is a **HOLD POINT**.

Method (HP)

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**

$$Q.I. = 0.65 (L_1 d_1 h_1 + L_2 d_2 h_2 + \dots L_n d_n h_n) + H_a$$

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. **Pressure Test (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:
 - (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, e.g. 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**

AUS-SPEC #1

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:

$$Q_1 = (0.000532 + \frac{C}{L_p}) D.L. (H)^{0.5}$$

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 – $\frac{L}{n}$ (m)

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 are 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. This is a **HOLD POINT**.

Alternative Tests (HP)

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 Sewer Authority prior to commencement of trench backfilling. (WSA 02 Part 3, section 21). This action constitutes a **HOLD POINT**. The Sewer Authority'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: (WSA 02 Part 3, section 21.1.2).

Backfill to Subgrade Level With Non-Cohesive Granular Material

(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 Level with Excavated Material

(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.

Backfill of Pavement Layers

(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

(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. (WSA 02 Part 3, section 22.3)

Compaction Tests

7. The Contractor may compact backfill by trench flooding only where:
- The ground and backfill material is cohesionless sand.
 - Water for flooding has been sourced at the site.
 - The process will not create mud which would be moved off site by vehicles or construction plant.
 - Additives are not used.

**Flood
Compaction**

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. (WSA 02 Part 3, section 25). This constitutes a **WITNESS POINT**.

**Original
Condition**

(WP)

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

Tunnelling

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.

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 Sewer Authority's approval of the warranty is required prior to the release of the hold point. **Manufacturer's Warranty (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 Polytetrafluoroethylene (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 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 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)**

C402.53 SWITCHGEAR AND CONTROL GEAR ASSEMBLY (SCA), CONTROLS

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. The Contractor shall provide an effective barrier to prevent gases from the wet well entering the SCA.

Barrier to Gases

5. Starter contactors shall have appropriate ratings for the proposed pumps to AC3.

Starter Contactors

6. All necessary terminals with terminal and cable numbers shall be supplied and installed in accordance with the Drawings. **Terminals**
7. 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**
8. 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 Superintendent).
 Earthing (M.E.N. system)
9. All cables shall enter the SCA from below. **Cable Entry**
10. 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**
11. 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**
12. The Contractor shall carry out of 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. The Superintendent shall be given seven (7) days notice of the proposed date of such tests. **Factory Tests**
13. Functional tests referred to in Schedule MEW E101 shall include electrical function tests as defined in AS 3439. **Functional Tests**
14. The Contractor shall pack the equipment for transport after satisfactory final factory inspection and tests, and after approval has been given by the Superintendent. The Contractor shall ensure 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**
15. The Contractor shall be responsible for any damage that may occur during transit and unloading at site. **Damage**
16. 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**
17. The Contractor shall supply spare parts in accordance with the schedule supplied by the Superintendent. **Spare Parts**
18. Automatic control of the pump station pumping equipment shall be by way of float switches/probes providing single pump duty operation unless shown otherwise on the drawings. The switches/probes will be compatible with those in use, if any, in the system. **Automatic Control**

19. The following wet well levels shall be used in the automatic control of the pump operation system:

Levels

- (a) Bottom Water Level (BWL)
- (b) Top Water Level (TWL)
- (c) Maximum Top Water Level (MTWL)
- (d) Flood Alarm Level (FAL)

20. In the event of a rise in water level to Maximum Top Water Level, the pumps will operate in accordance with the operating procedures for the pump station. The Superintendent shall advise the Contractor as to whether

**Pump
Operation**

- (a) The duty pump will cut out and the standby pump will operate, or
- (b) The duty pump will continue to operate and the standby pump will cut in parallel.

21. The Contractor shall supply and install control equipment that is compatible with the existing equipment.

Pump Control

C402.54 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, motor, control and flow meter cables, conduits and electrical pits.

Cabling

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 3000 and AS 3008

10. In addition to the requirements of the Supply Authority and MEW E101, the Contractor shall run the main earthing conductor 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 50mm² 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. **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 joined. **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**

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 **Compliance**

affecting the accuracy of the gauge.

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:

- (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.

**No Flow
Switches**

12. The knife gate valve shall be constructed in accordance with the following:

- (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.

**Knife Gate
Valve**

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. This is a **HOLD POINT**. **Sequence (HP)**
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 **HOLD POINT**. **Notification (HP)**
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 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**

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) 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.

C402.59 TELEMETRY

1. The Contractor shall make provision for equipment to link the pump station to the existing telemetry network to be provided by the Sewer Authority at the Contractor's expense. **Contractor's Cost**

2. The pump station shall be capable of being operated automatically by control signals from the existing or proposed 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**

C402.60 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.

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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.

AUS-SPEC #1

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 pipeline of a diameter more than 225 mm.

Special Precautions

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 Sewer Authority. The records shall be submitted to the Sewer Authority for acceptance. This action constitutes a **HOLD POINT**.

Asset Register (HP)

C402.62 DIGITAL RECORDS

1. The Contractor shall provide a digital recording of the internal condition of all mains. The digital recording shall be undertaken at the time of practical completion of the Contract. (WSA 02 Part 3, section 22.7). Sewer Authority. The records shall be submitted to the Sewer Authority for

Internal Condition (HP)

acceptance. This action constitutes a **HOLD POINT**.

SPECIAL REQUIREMENTS

C402.63 REQUIREMENTS FOR FLUSHING DEVICES FOR SEWERS

1. Until sewer is fully operational, sewers may require the use of temporary flushing devices to maintain self cleansing velocities within the sewers. Temporary flushing devices are to be installed and maintained by the developer until actual flows in the system are sufficient to accommodate self cleansing where directed on the approved plans. A bond will be required for this maintenance period. Water Authority concurrence is required to determine when self cleansing has been achieved. This is a **HOLD POINT**.

**Maintenance
Requirement
(HP)**

C402.64 RESERVED

C402.65 RESERVED

AUS-SPEC #1

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 - VERSION 3.1.
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 - VERSION 3.1.

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.

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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

APPENDIX C402- A

INSPECTIONS

Give notice so inspection may be made of the following:

Summary of HOLD POINTS

Clause title/Item	Requirement	Notice for inspection	Release by
PIPELINE CONSTRUCTION			
General			
C402.14.1 - Accreditation	Provide certification	5 working days prior to commencement	Superintendent - Sewer Authority concurrence
C402.14.2 - Alignment Changes	Submit any alternate proposal for approval	2 weeks prior to commencement	Superintendent - Sewer Authority concurrence
Location			
C402.15.1 - Location	Advise any proposed alternate laying method	5 working days	Superintendent
Cover over Pipelines			
C402.16.2 – Special Protection	Obtain direction where minimum cover cannot be achieved	1 working day	Superintendent
Earthworks			
C402.18.1 – Contractor's Responsibility	Seek direction where alterations to proposed excavations is required	5 working days	Superintendent
Pipe Bedding			
C402.23.1 - Approval	Obtain approval to lay	1 working day	Superintendent
Thrust and Anchor Blocks for Rising Mains			
C402.30.5 - Restrained Joints	Obtain consent for proposed restrained joints	5 working days	Superintendent - Sewer Authority concurrence
Wrapping of Pipelines			
C402.33.2 – Material Type	Seek approval of materials	5 working days	Superintendent
Covers and Frames			
C402.36.1 - Standard	Provide certification	5 working days	Superintendent
Preformed Maintenance Hole Systems			
C402.38.1 - Approval	Submit documentary evidence	5 working days	Superintendent

Clause title/Item	Requirement	Notice for inspection	Release by
PIPELINE TESTING AND RESTORATION			
Initial Test of Gravitation Sewers			
C402.40.5 – Ovality Testing	Submit proving tool for approval	5 working days	Superintendent – Sewer Authority concurrence
Initial Test of Maintenance Holes			
C402.41.4 - Alternative Tests	Provide proposed method of alternative testing	5 working days	Superintendent
Acceptance Test of Gravitation Sewers and Maintenance Holes			
C402.42.1 – As for Initial Test	Submit test documentation	5 working days	Superintendent - Sewer Authority concurrence
Hydrostatic Testing			
C402.45.3(c) – Sewer Authority Approval	Obtain approval for alternative test pressure	5 working days	Superintendent - Sewer Authority concurrence
Visual Inspection and Measurement of Infiltration			
C402.46.2 - Method	Submit method	5 working days	Superintendent - Sewer Authority concurrence
Testing of Rising Mains			
C402.47.1 – Pressure Test	Submission of test results	5 working days	Superintendent - Sewer Authority concurrence
Rectification	Seek direction as to rectification	3 working days	Superintendent
C402.47.12 - Alternative Tests	Submit proposed alternate test method for approval	5 working days	Superintendent - Sewer Authority concurrence
Backfill and Compaction			
C402.48.1 – Notification	Present the laid and jointed pipes for inspection	2 working days	Superintendent - Sewer Authority concurrence
PUMP STATIONS			
Pumps			
C402.50.2 - Manufacturer's Warranty	Provide written warranty	2 weeks prior to delivery	Superintendent – Sewer Authority concurrence
Electrical Installation			
C402.54.6 - Route	Obtain approval	2 weeks prior to laying	Superintendent
Testing and Commissioning of Pump Station			
C402.57.1 - Compliance	Provide test results	2 weeks prior to pre-commissioning	Superintendent – Sewer Authority concurrence

SEWERAGE SYSTEM - COONAMBLE

Clause title/Item	Requirement	Notice for inspection	Release by
C402.57.5 - Sequence	Obtain approval for sequence	2 weeks	Superintendent - Sewer Authority concurrence
C402.57.11 - Notification	Submit pre-commissioning test results and operation manuals prior to testing	5 working days	Superintendent
CONSTRUCTION COMPLIANCE			
Work-as –Executed Details			
C402.61.5 - Asset Register	Provide records	At time of practical completion	Superintendent - Sewer Authority concurrence
C402.62.1 - Internal Condition	Provide video records	At time of practical completion	Superintendent - Sewer Authority concurrence
SPECIAL REQUIREMENTS			
Requirements for Flushing Devices for Sewers			
C402.63.1 – Maintenance Requirement	Request confirmation of self cleansing flow	5 days	Superintendent – Sewer Authority concurrence

Summary of WITNESS POINTS

Clause title/Item	Requirement	Notice for inspection
PIPELINE CONSTRUCTION		
Crossings		
C402.17.1 – Contractor's Responsibility	Provide Authority requirements as requested	Progressive
Maximum Trench Width		
C402.20.5 – Special Controls	Supply method statement for any special construction control	Progressive
Laying and Jointing of Pipes		
C402.24.2 - Examination	Sling pipe for inspection if requested	Progressive
C402.24.18 – Rising Main Identification	Lay identification tape	Progressive
C402.24.19 - Ovality Testing	Provide ovality test results	Progressive
PIPELINE TESTING AND RESTORATION		
Initial Testing of Gravitation Sewers		
C402.40.1 - Compressed Air	Initial testing	Progressive
Restoration of Surfaces		
C402.49.1 - Original Condition	Obtain approval for imported turf	Progressive
PUMP STATIONS		
Electrical Compliance		
C402.52.5 - Approval	Obtain approvals from the relevant Authority	7 working days



COONAMBLE SHIRE COUNCIL

**COONAMBLE DEVELOPMENT
CONSTRUCTION SPECIFICATION**

CQC

**QUALITY CONTROL
REQUIREMENTS**

VERSION 3.1 – JANUARY 2013

QUALITY CONTROL REQUIREMENTS - COONAMBLE

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
VERSION 3.1	Special accreditation by PCA	CQC3.5	A	KD	30/06/10
	Blasting added to table	CQC-B1	A		
	Blasting added to table	CQC-B2	A		
	Test methods added	CQC-B6	A		
	Test methods and additional requirements added	CQC-B15	A		
	PVC-M, PVC-O and steel pipe added	CQC-B17	A		
	Polypropylene (PP) and steel pipe added	CQC-B18	A		
	Annexure added	CQC-C	A		
	Annexure added	CQC-D	A		

**SPECIFICATION CQC
QUALITY CONTROL REQUIREMENTS – VERSION 3.1**

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SPECIFICATION CQC QUALITY CONTROL REQUIREMENTS – VERSION 3.1

GENERAL

CQC1 SCOPE

1. This Specification covers the 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

QUALITY CONTROL REQUIREMENTS - COONAMBLE

5. In special circumstances the Principal Certifying Authority 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**

CQC6 CERTIFICATION

1. The Superintendent shall present to COONAMBLE SHIRE Council, a Certification Report for Construction Works which shall indicate the conformance of the works with the technical specifications, and will comprise the test results certificate set out in Annexure CQC-C, the Developer's Engineer's Certificate set out in Annexure CQC-D, and the Works as Executed documentation.

**Certification
Report**

2. The Certification Report for Construction Works shall be required at the completion of the construction works, and prior to the endorsement of any Subdivision Certificate, or in the case of building works which involve civil engineering construction, prior to the endorsement of the Occupation Certificate.

**Certificate
Submission**

3. The Developer's Engineer shall be a Civil Engineer, suitably experienced and qualified so as to be accepted as a member of the Institution of Engineers, Australia, or a suitably experienced Registered Surveyor. The Developer's Engineer shall submit a certificate indicating that the works have been constructed in accordance with the approved drawings and technical specifications.

**Developer's
Engineer**

CQC7 AUDIT

1. Council shall have the right of audit of all processes and documents related to the project construction. The Contractor, Superintendent and Accredited Certifier shall provide Council's Officers all reasonable assistance in inspecting records of construction and testing procedures.

Assistance

2. In order to provide for such audit, access to the premises of the Contractor, Superintendent and Accredited Certifier will be provided to Council on a 24 hour notice basis.

Access

MEASUREMENT AND PAYMENT

CQC8 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);
- (ii) Establish six grid lines within the lot, as illustrated in Figure CQC-A2;
- (iii) Throw a die to select a number between 1 and 6. This determines which grid line to use for the sample location in sub-lot 1;
- (iv) Throw die to select a group (1-6) in Table CQC-A1;
- (v) Throw die twice to select two random numbers (between 1 and 6) for row and column in Table CQC-A1 and obtain random fraction R;
- (vi) Length co-ordinate for sample location in Sub-lot 1 = RL/n ;
- (vii) For sample location in next sub-lot:-
Add L/n to previous length co-ordinate.
Add 1 (on a cycle of 6) to previous grid line.



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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	0.06645	0.11256	0.05278
	(5)	0.03184	0.69876	0.16676	0.43346	0.86992	0.03275
	(6)	0.15623	0.02905	0.72763	0.19095	0.80847	0.39729
(4)	(1)	0.72109	0.17970	0.22505	0.35561	0.98935	0.27818
	(2)	0.37348	0.19381	0.43331	0.75033	0.99963	0.42232
	(3)	0.12129	0.32386	0.56705	0.87165	0.84460	0.92955
	(4)	0.54948	0.08844	0.47061	0.78419	0.18731	0.93485
	(5)	0.15097	0.44967	0.48759	0.84161	0.19212	0.05146
	(6)	0.32360	0.66850	0.99382	0.94050	0.96449	0.96217
(5)	(1)	0.68091	0.54191	0.10910	0.94237	0.23161	0.15167
	(2)	0.97121	0.83626	0.70896	0.45296	0.69475	0.11264
	(3)	0.19723	0.98260	0.57429	0.94789	0.64457	0.20809
	(4)	0.84036	0.14095	0.29451	0.40256	0.34521	0.64924
	(5)	0.97500	0.98056	0.82276	0.97130	0.77329	0.89855
	(6)	0.83244	0.30828	0.06882	0.68471	0.71081	0.91649
(6)	(1)	0.75892	0.29685	0.70044	0.91238	0.53356	0.45239
	(2)	0.13229	0.19701	0.36074	0.32254	0.62045	0.26691
	(3)	0.34789	0.22179	0.91891	0.87651	0.91011	0.97469
	(4)	0.97211	0.68943	0.12831	0.50006	0.20793	0.61151
	(5)	0.24954	0.17809	0.56093	0.51524	0.69135	0.68967
	(6)	0.10062	0.11852	0.47089	0.64765	0.44644	0.35548

Table CQC-A1 - Table of Random Fractions

ANNEXURE CQC- B MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES

GENERAL

1. The maximum lot sizes and minimum test frequencies are separately specified for all major activities covered by the Technical Specifications as listed hereunder.
2. The requirements applicable to this Contract are identified with an asterisk indicating that only these details are attached in this Annexure.
3. Where material/product quality certification can be obtained from the supplier, tests listed per contract/separable part need not be repeated.

Contents of Annexure CQC-B

Item	Sub-Annexure	Required (*) for this Contract	Reference Specification	Sub-Annexure Heading
1	B1		C213	Earthworks
2	B2		C220 C221 C222 C223 C224	Stormwater Drainage - Pipe Culverts, Box Culverts, Open Drains, Kerb & 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
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 500m ²	AS1289.5.4.1 or AS.1289.5.7.1
Blasting	Ground vibration / noise control	1 day's blasting	Continuous monitoring	
Foundation for Embankments	Compaction	5,000m ²	1 per 500m ²	AS1289.5.4.1 or AS. 1289.5.7.1
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	10,000m ²	1 per 1,000m ³ *	AS1289.6.1.1
	- CBR	10,000m ²	1 per 500m ³ *	
	Compaction/Moisture Content	One layer 5,000m ²	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	1 Structure	1 per 200m ³ *	AS1289.3.3.1
	- PlastiSHIRE Index	1 Structure	1 per 200m ³ *	
	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
Excavation by Blasting	Peak particle velocity	1 drainage line/ structure	1 per drainage line / structure	Measure
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 Compaction/Moisture Content	1 contract 1 drainage line/structure	1 per 200m ³ * 1 per layer, per 20 lin.m	AS1141.11 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 - PlastiSHIRE Index Compaction/Moisture Content	1 contract 1 contract 1 drainage line/structure	1 per 100m ³ * 1 per 100m ³ * 1 per 2 layers per 50m ²	AS1289.3.3.1 AS1289.5.7.1, AS1289.5.4.1
Rock Fill for Gabions/ Wire Mattresses	Material Quality: - Wet Strength - Wet/Dry Strength Variation	 1 contract 1 contract	 1 per contract 1 per contract	 AS1141.22 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 Filter Material - Grading (Type A, B, C, D) - Coefficient of Permeability (Type B) - Grading Variation after Treatment (Type B) - Wet Strength (Type C, D) - 10% Fines Wet/Dry (Type C, D) Geotextile	1 contract/size 1 contract/size 1 contract/size 1 contract/size 1 contract/size 1 contract/size 1 contract	1 per type/size 1 per type 1 per type 1 per type 1 per type 1 per type	AS1141.11 AS1289.E5.1 ASTM-D2434-68 AS1141.11 AS1141.22 AS1141.22
Excavation - Trench Base	Line and Grade Compaction	1 drainage line 1 drainage line	1 per drainage line 1 per 200 lin m*	Survey 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 Distribution	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
Mix Design	- 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	
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
	- PlastiSHIRE 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	T116
	- Unconfined Compressive Strength (Bound)	1 contract	1 per mix design	T131
	- Water-soluble Sulphate Content (%S by mass)		1 per 1,000t	AS1289.D21
	- Total Sulphur Content (%S by mass)		1 per 1,000t	AS1141.36
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	T160
	Compaction/Moisture Content/Dry Density Testing	One layer 5,000m ² - max 1 day's placement	10 per 5,000m ² layer or 3 per lot if less	AS1289.5.2.1, T130, 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	AS 2008
	- Refinery Cutback Bitumen	1 tanker load	1 per tanker load	AS 2157
	- Polymer Modified Binder	1 tanker load	1 per tanker load	AS 2341.21
	- Bitumen Adhesion Agent	1 delivery	1 per delivery	
	- Cutback Oils	1 delivery/ tanker	1 per delivery/tanker	AS 2758.2
	- 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	<p>Material Quality - Supplier's documentary evidence and certification of:</p> <ul style="list-style-type: none"> - Coarse & Fine Aggregates <ul style="list-style-type: none"> Grading Moisture Content Wet Strength Wet/Dry Strength Variation Particle Shape Fractured Faces Polishing Agg Friction Value - Mineral Filler - Bitumen Binder - Polymer Modified Bitumen <ul style="list-style-type: none"> ElastiSHIRE Recovery at 60°C Viscosity on ER at 60°C Torsional Recovery at 25°C Viscosity at 180°C - Bitumen Adhesion Agent <ul style="list-style-type: none"> Resistance to Stripping - Reclaimed Asphalt Pavement (RAP) - Bitumen Emulsion 	<ul style="list-style-type: none"> 1 week's production 1 week's production 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract or 1 month's production 1 refinery batching 1 production batch by supplier 1 contract 1 stockpile 1 contract 	<ul style="list-style-type: none"> 1 per day 1 per day)) 1 per) contract) or change in) material contract or 1 per month's production 1 per tanker load 1 per tanker load 1 per contract or change in material 1 per stockpile 1 per contract or change in material 	<ul style="list-style-type: none"> AS2758.5 AS1141.11 AS1289.2.1.1 AS1141.22 AS1141.22 AS1141.14 AS1141.18 AS1141.42 AS2357 AS2008 MBT.21 MBT.21 MBT.22 MBT.11 T230 or nominated equivalent AS1141.11 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 Moisture Content Grading Binder Content	C245.7 from Spec C245 Asphaltic Concrete as included as separate table below. Additionally, max lot size one 12 hr shift's production.	1 per truck load	Measure AS2891.10 AS2891.3.3 AS2891.3.1
	Resistance to Stripping	1 production mix	1 per mix per 5000t or once per month (whichever is the most frequent)	T640

QUALITY CONTROL REQUIREMENTS - COONAMBLE

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 month's production	1 per week	AS 3972
	Flyash	1 month's production	1 per month	AS 3582.1
	Water	1 contract	1 per contract	AS3583.13, AS1289.4.2.1
	Admixtures	1 month's production	1 per month	AS 1478
	Fine Aggregates (C248 only)			
	- Grading	1 week's production	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 week's production	1 per 200m ³ concrete*	AS1141.11
	- Moisture Content	1 week's production	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

QUALITY CONTROL REQUIREMENTS - COONAMBLE

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 Air Content Consistency - Slump Compressive Strength (7 day) Compressive Strength (28 day)	50m ³ 50m ³ 50m ³ 50m ³ 50m ³	1 per 50m ³ 1 per 50m ³ 1 per load 1 pair per 50m ³ 1 pair per 50m ³	Measure AS1012.4 Method 2 AS1012.3.1 AS1012.1 AS1012.8 AS1012.9 AS1012.1 AS1012.8 AS1012.9
Placement	Relative Compaction - Machine Placed - Hand Placed Thickness Geometry	50m ³ Area between 2 consecutive construction joints or 50m ³ (whichever is the lesser) 50m ³ 50m ³	1 per 50m ³ * 2 per lot 5m grid on plan area 1 cross section per 15m	AS1012.14 AS1012.14 Survey 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 Application Rate	1 contract 1 day's work	1 per production batch 1 per 1000m ² *	AS3799 AS1160
Joints	Sealant Material Quality Supplier's documentary evidence and certification Geometry	1 contract 50m ³	1 per production batch 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	<p>Material Quality - Supplier's documentary evidence and certification of:</p> <ul style="list-style-type: none"> - Bitumen (prior to emulsification) - Bitumen Emulsion <ul style="list-style-type: none"> · Residual Binder Content (Residue from Evaporation) - Mineral Aggregates <ul style="list-style-type: none"> · Degradation Factor · Los Angeles Value · Aggregate Wet Strength · Wet/Dry Strength Variation · Polished Aggregate Friction Value · Sand Equivalent - Mineral Filler - Combined Aggregate Grading 	<p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 month's production</p> <p>1 contract</p>	<p>1 per contract or change in material</p> <p>2 per bulk delivery</p> <p>1 per contract or 6 month period</p> <p>"</p> <p>"</p> <p>"</p> <p>"</p> <p>"</p> <p>"</p>	<p>AS2008</p> <p>AS1160, App.D</p> <p>AS1141.25</p> <p>AS1141.23</p> <p>AS1141.22</p> <p>AS1141.22</p> <p>AS1141.42</p> <p>AS1289.3.7.1</p> <p>AS2357</p> <p>AS1141.11, AS1141.12</p>
Mix Design - Nominated Mix	Approval of mix and NATA certification - Supplier's documentary evidence and certification	1 contract	1 per mix	
Production Mix	<p>Grading</p> <p>Residual Binder Content</p>	1 day's production or 50m ³ (whichever is the lesser)	<p>2 per 50m³*</p> <p>2 per 50m³*</p>	<p>AS2891.3.1</p> <p>AS2891.3.1</p>
Laying	<p>Levels</p> <p>Surface Quality</p>	<p>1 layer, max 200m³</p> <p>1 layer, max 200m³</p>	<p>1 cross section per 15m</p> <p>10 per 100m* lane length</p>	<p>Survey</p> <p>3m Straight Edge</p>

* 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 - Clay Segmental Paving Units - Bedding Sand · Grading - Joint Filling Sand · Grading	1 contract 1 contract 1 contract 1 contract	1 per contract 1 per contract 1 per contract or change in material 1 per contract or change in material	AS1141.11 AS1141.11
Base	Geometry Surface Quality	One layer 5000m ² , max 1 day's placement "	One cross section per 25m 10 per 200m ² or lot	Survey 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 Geometry Surface Quality	1 day's placement 1 day's placement 1 day's placement	All joints One cross section per 15m 10 per 200m ² or lot	Measure Survey 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	
	- PlastiSHIRE 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 C261-A
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 C261-A

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	AS 1743
	- Aluminium Extrusion Backing	1 contract	"	AS 1866
	- Retro-reflective Material	1 contract	"	AS 1743
	- Non-reflective Paint	1 contract	"	
	- Non-reflective Sheet Material	1 contract	"	
	- Steel Sign Support Structures			
	- Grade	1 contract		AS 1627.9
	- Protective Treatment	1 contract		AS 4680 & AS 1214
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 - pH - Organic Content - Soluble Salt Content	10,000m ² 10,000m ² 10,000m ²	1 per 500m ³ * 1 per 500m ³ * 1 per 500m ³ *	AS4419
Mulch for Planting	Material Quality	1 contract	1 contract	AS4454

* Note: or part thereof, per lot.

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: - PVC-M Pipes - PVC-O Pipes - Ductile Iron Cement Lined (DICL) Pipes - Steel Pipes - Copper Pipe - Polyethylene Pipe - Stop Valves Material - Non Return Valves - Spring Hydrants	1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract	1 per contract 1 per contract " 1 per contract " " " " 1 per contract	AS/NZS 4765 AS/NZS 4765 AS/NZS 2280 and AS2129 AS 1579 and AS/NZS 1594 AS1432 AS/NZS 4130 AS2638 and AS2129 AS3578 AS2544 or AS3952
Siting and Excavation	Geometry	1 line	1 per line	Survey
Bedding	Material Quality - Grading	1 contract	1 per contract per source	AS/NZS 2032
Thrust and Anchor Blocks	Refer Sub-Annexure B13			
Concrete Encasement	Refer Sub-Annexure B13			
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: - PVC-U Pipes Polypropylene (PP) Pipes - Ductile Iron Cement Lined (DICL) Pipes - Steel Pipes - Vitrified Clay Pipes - Precast Access Chambers	1 contract 1 contract 1 contract 1 contract 1 contract 1 contract	1 per contract " " " " "	AS/NZS 1260 AS/NZS 5065 AS2280 and AS2129 AS/NZS 2280 AS1741 AS/NZS 1477, AS 2033 or AS4198
Siting and Excavation	Geometry	1 line/ structure	1 per line/ structure	Survey
Bedding	Material Quality - Grading	1 contract	1 per contract per source	AS1152
Concrete Bedding	Refer Sub-Annexure B13			
Laying and Jointing of Pipes, Access Chambers, Structures	Geometry	1 line	1 per line	Survey
Thrust and Anchor Blocks	Refer Sub-Annexure B13			
Concrete Encasement	Refer Sub-Annexure B13			
Cast-in-situ Access Chambers	Material Quality - Tri-Calcium Aluminate Content - Fineness Index - Minimum Cement Content	1 contract 1 contract 1 contract	1 per contract per source " "	AS3972 AS3972 AS3972
Acceptance Test of Gravitation Mains and Access Chambers	- Compressed Air Testing - Hydrostatic Testing	1 line 1 per test length Test length = $\frac{1370\text{m}}{\text{pipeline dia. (mm)}}$	1 per line 1 per line	As specified C402.36 C402.37 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	

ANNEXURE CQC-C

COONAMBLE SHIRE COUNCIL

CONSTRUCTION CERTIFICATION REPORT

(To be completed by the Developer's Engineer)

Project Title: _____

Property Details (Lot/DP): _____

DA No / CDC No.: _____

Principal Certifying Authority: _____

Name and Address of Developer: _____

This certification report for construction works, carried out for the above project, indicates the conformance of the works with the technical specification and the approved drawings, and comprises:

- a) certification of the test results required by the technical specification;
- b) certification of the construction works; and
- c) works as executed documentation.

I certify that the sampling rates and sampling locations used during random sampling are in accordance with Technical Specification CQC - Quality Control Requirements.

I certify that maximum lot sizes, minimum test frequencies and test methods applied are in accordance with Technical Specification CQC - Quality Control Requirements.

I certify that I have viewed the test results and that the tested materials comply with the relevant technical specifications. A copy of all test results is attached to this certification report.

Signature: Date

Name:

Contact Phone:

Contact Postal Address:

QUALITY CONTROL REQUIREMENTS - COONAMBLE

Check List

MAXIMUM LOT SIZE AND MINIMUM TEST FREQUENCIES

		Check Completed By (initials)	Date	Not Applicable (tick)
1	Earthworks (Sub-Annexure B1)	_____	____ / ____ / ____	<input type="checkbox"/>
2	Stormwater Drainage (Sub-Annexure B2) -Pipe Culverts, Box Culverts, Open Drains including Kerb and Gutter, Drainage Structures.	_____	____ / ____ / ____	<input type="checkbox"/>
3	Subsurface Drainage (Sub-Annexure B3)	_____	____ / ____ / ____	<input type="checkbox"/>
4	Stabilisation (Sub-Annexure B4)	_____	____ / ____ / ____	<input type="checkbox"/>
5	Flexible Pavements (Sub-Annexure B5)	_____	____ / ____ / ____	<input type="checkbox"/>
6	Spayed Bituminous Surfacing (Sub-Annexure B6)	_____	____ / ____ / ____	<input type="checkbox"/>
7	Asphaltic Concrete (Sub-Annexure B7)	_____	____ / ____ / ____	<input type="checkbox"/>
8	Ready Mixed Concrete Production and Supply (Sub-Annexure B8)	_____	____ / ____ / ____	<input type="checkbox"/>
9	Mass Concrete Subbase (Sub-Annexure B9)	_____	____ / ____ / ____	<input type="checkbox"/>
10	Plain or Reinforced Concrete Base (Sub- Annexure B10)	_____	____ / ____ / ____	<input type="checkbox"/>
11	Bituminous Microsurfacing (Sub-Annexure B11)	_____	____ / ____ / ____	<input type="checkbox"/>
12	Segmental Paving (Sub-Annexure B12)	_____	____ / ____ / ____	<input type="checkbox"/>
13	Minor Concrete Works (Sub-Annexure B13)	_____	____ / ____ / ____	<input type="checkbox"/>
14	Pavement Markings (Sub-Annexure B14)	_____	____ / ____ / ____	<input type="checkbox"/>
15	Signposting (Sub-Annexure B15)	_____	____ / ____ / ____	<input type="checkbox"/>
16	Landscaping (Sub-Annexure B16)	_____	____ / ____ / ____	<input type="checkbox"/>
17	Water Reticulation (Sub-Annexure B17)	_____	____ / ____ / ____	<input type="checkbox"/>
18	Sewerage System (Sub-Annexure B18)	_____	____ / ____ / ____	<input type="checkbox"/>

ANNEXURE CQC-D

COONAMBLE SHIRE COUNCIL

ENGINEER'S CONSTRUCTION CERTIFICATION

(To be completed by the Developer's Supervising Engineer)

Project Title:

Property Details (Lot/DP):

DA No: / CDC No:

Name of Developer's Engineer:

Name and Address of Developer:

I certify that the construction works associated with the above mentioned development have been carried out in accordance with current standards of good industry practice and in accordance with the approved engineering design plans and the technical specification.

I certify that the completed works are in strict accordance with the development consent conditions and where a variance to the consent is found, written confirmation has been received from Council approving the variance prior to the commencement of construction.

I certify that the works as executed documentation provides an accurate representation of the constructed works and where a variation has occurred from the approved drawing the works as executed documentation clearly reflects the variation.

Engineer/Surveyor

Date

Qualifications

Contact Phone: _____

Contact Postal Address: _____



COONAMBLE SHIRE COUNCIL

**COONAMBLE DEVELOPMENT
CONSTRUCTION SPECIFICATION**

CQS

**QUALITY SYSTEM
REQUIREMENTS**

VERSION 3.1 – JANUARY 2022

QUALITY SYSTEM REQUIREMENTS - COONAMBLE

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
VERSION 3.1	Concurrence provisions added for release of Hold Points.	CQS4	A	KD	13/04/10
	Definitions of Principal Certifying Authority, Water Authority and Sewer Authority added	CQS5	A		
	Abbreviations added – PCA, SA, and WA	CQS14.3.2	A		
	Concurrence provision added	CQS-B	A		
	Additional categories added	CQS-C1	A		
	Blasting added	CQS-C2	A		
	Excavation by blasting added	CQS-C6	A		
	Standards added	CQS-C15	A		
	Protective treatment for signs, standards added	CQS-C17	A		
	PVC-M, PVC-O and steel pipe added	CQS-C18	A		
	Polypropylene (PP) and steel pipe added				

SPECIFICATION CQS

CONTRACT QUALITY SYSTEM REQUIREMENTS – VERSION 3.1

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QUALITY SYSTEM REQUIREMENTS - COONAMBLE

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CQS-B	METHOD STATEMENT REQUIREMENTS
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CQS-D	NONCONFORMANCE REPORT FORM

SPECIFICATION CQS QUALITY SYSTEM REQUIREMENTS – VERSION 3.1

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 environmental management systems auditing
Handbook HB 90.3	The Construction Industry Guide to ISO 9001:2000
NSW RTA (Q2-Q6)	Quality Management Systems specification
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. Where indicated, the Superintendent shall seek concurrence from the Council, Principal Certifying Authority, Water Authority or Sewer Authority (as applicable) before granting acceptance. The issue of a Nonconformance Report (NCR) or a Notice of Nonconformance (NNC) automatically creates a Hold Point.	HP
	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 non-conformance.	NCR

	Synonym or Abbreviation
Notice of Nonconformance	
Formal instruction from the Superintendent regarding product non-conformance 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.	<ul style="list-style-type: none"> - Process Audit - Technical Procedure Audit - Methods Audit
Principal Certifying Authority (PCA)	PCA
As defined in S 109E of the Environmental Planning and Assessment Act 1979)	
Product Audit	
An assessment of the conformity of the product with the specified technical requirements.	<ul style="list-style-type: none"> - 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

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
System
Requirements**

Sewer Authority

SA

COONAMBLE SHIRE Council is the Sewer Authority for COONAMBLE local government area

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.

Water Authority

WA

COONAMBLE SHIRE Council is the Water Authority for COONAMBLE local government area.

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
PCA	-	Principal Certifying Authority
QA	-	Quality Assurance
QAR	-	Quality Assurance Representative (Principal)
QM	-	Quality Manual
QMR	-	Quality Management Representative (Contractor)
QP	-	Quality Plan
QR	-	Quality Register
SA	-	Sewer Authority
SRD	-	System Requirement Description
WA	-	Water Authority
WP	-	Witness Point

QUALITY MANUAL AND QUALITY PLAN

CQS6 QUALITY MANUAL

1. The Company Quality Manual shall cover and include the requirements for 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

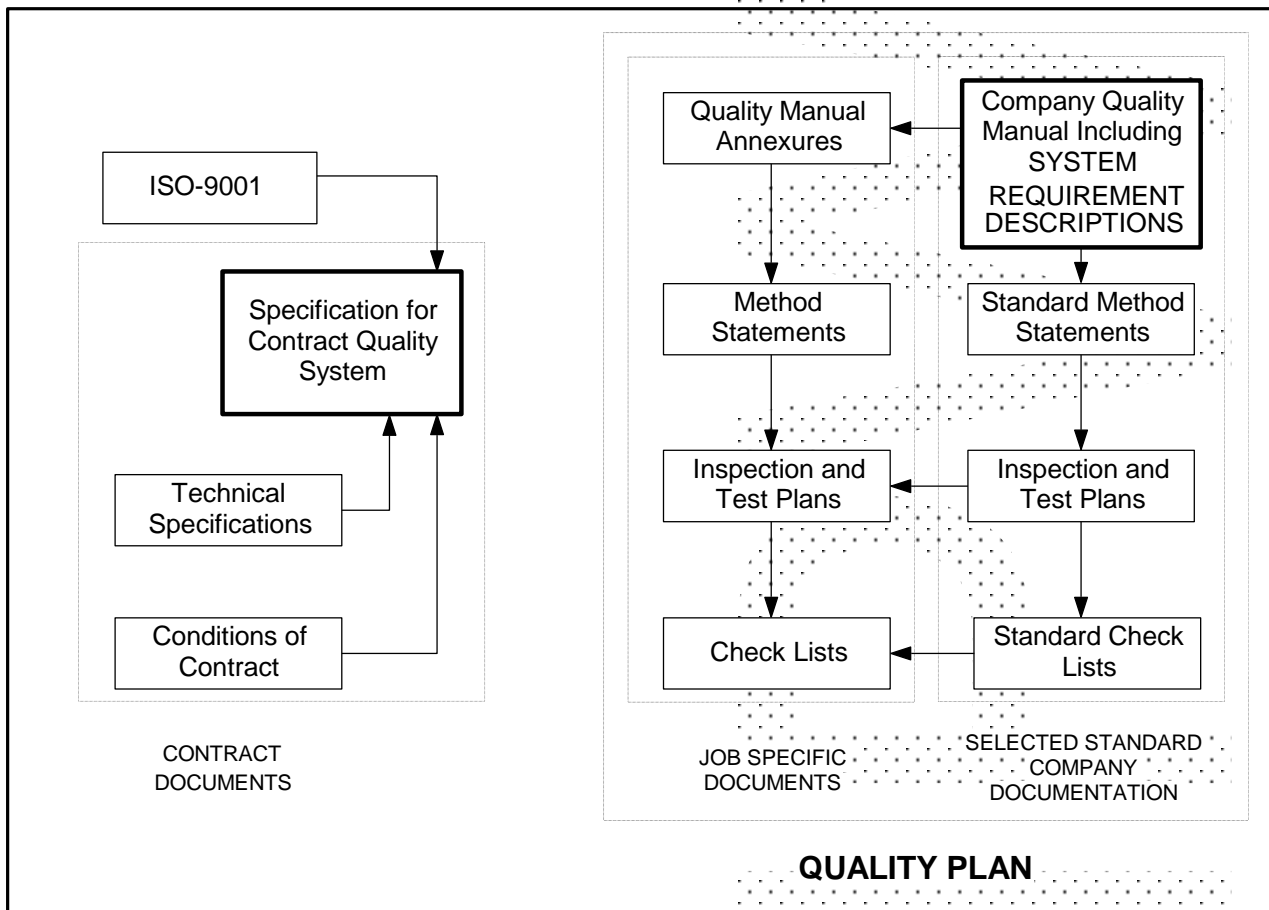


Figure CQS1 - Project Quality System Documentation

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.

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. **Clause 7.1, 7.5**
Documentation
2. The presentation of Method Statements may be either descriptive, in the form of flow charts or a combination of both. In either case it must be accompanied by a Check List which shall include the relevant inspection and test points, surveying control points and Hold Points and the officer responsible to verify each check point. **Presentation**
3. A system audit of each Method Statement shall be carried out by the Contractor whilst the process is in effect. **System Audit**

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

CQS11 DOCUMENT CONTROL

Clause 4.2.3, 4.2.4

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

CQS12 MEASURING AND TESTING EQUIPMENT

Clause 7.6

1. The Quality Plan shall include the latest NATA advice of the terms of registration and current signatories for the laboratories which will be providing the compliance test reports. *NATA Registration*
2. Inspection, testing and measuring equipment shall be capable of producing the precision and/or degree of accuracy specified in the referenced Test Methods and this shall be demonstrable by records of calibration. *Equipment Accuracy*

CQS13 PURCHASING

Clause 7.4

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*

CQS14 INSPECTION AND TEST PLANS

Clause 7.1, 8.1

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 *Sampling and*

QUALITY SYSTEM REQUIREMENTS - COONAMBLE

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.

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.

Superintendent'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. Where the Superintendent is required to obtain concurrence by the Council, PCA, Water Authority or Sewer Authority for an item, an alternative arrangement shall not be agreed without such concurrence.

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

CQS16 IDENTIFICATION

Clause 7.5.3

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 (e.g. pier or abutment number, pour number)
 - indication of conformance or nonconformance
 - summary of test results (e.g. characteristic value) and
 - location of test sites, test identification numbers and test results
- for nonconforming lots a new number, or numbers, shall be allocated to the resubmitted/subdivided lot(s), but reference shall be maintained to the original lot number.

Non-conforming Lots

CQS16.3 Lot Identification

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

Field Identification

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

Lot Boundaries

CQS17 TRACEABILITY

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

Reworking

5. With the exception of circumstances described in paragraph 3 above, a NCR will automatically create a HOLD POINT which shall apply until conformance has been achieved and the Superintendent has signed the Authorisation to Proceed. **Authorisation to Proceed**
6. The Superintendent will issue a Corrective Action Request (CAR) when he detects nonconformance to the Contractors Quality System or Methods. Unless specifically stated, this will not create a Hold Point. **CARs**
7. Where the Superintendent's inspections, surveillance or audits detect product nonconformance, he will issue a Notice of Nonconformance (NNC). This will immediately create a Hold Point and the Contractor is required to submit an NCR in accordance with this Clause. **NNCs**
8. In instances where there is a discrepancy between the test results obtained by the Superintendent and those provided by the Contractor, the results from the Superintendent shall prevail except where the Superintendent may determine a specific audit test procedure to resolve the discrepancy. **Inspection and Rectification**
9. The Contractor shall utilise the standard form for use as an NCR. This form is included as Annexure CQS-D to this specification. All actions shall be signed off by authorised representatives of the Contractor and Superintendent as applicable. **Standard Form**
10. The Contractor shall establish a suitable numbering and registration system for all NCRs and NNCs, including cross referencing as required. **Register of NCRs & NNCs**
11. The Contractor shall nominate a proposed disposition for any nonconformance within five working days or shall show cause to the Superintendent for any further delay. Under no circumstances will the deliberation on disposition of a nonconformance justify an extension of time to the Contract period. **Disposition in 5 Days**

CQS21 DISPOSITION OF NONCONFORMANCE

Clause 8.3

1. The Contractor shall advise the Superintendent in the NCR of the proposed disposition of the particular nonconformance. This proposed disposition will constitute corrective action for the lot or lots referred to in the NCR and may comprise one of the following: **Proposed Disposition**
- (a) propose additional works to bring the lot up to the specified standard; or
 - (b) replace all or part of the lot to bring it up to the specified standard; or
 - (c) request utilisation of a lot for a reduced level of service if such a clause exists in the relevant Technical Specification; or
 - (d) for incidental defects, request that the Superintendent accept the lot without alteration as an exception with or without alteration to the respective unit rates.
2. Any proposed disposition shall be subject to the approval of the Superintendent. Reworked/replaced lots shall be verified to conform to the specified requirements.

CQS22 CORRECTIVE ACTION

Clause 8.5.2

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.
2. Annexure CQS-A defines the method to be used for determining test locations of random sampling in each lot.
3. Annexure CQS-C lists the maximum lot sizes and minimum test frequencies for the specified activities.
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.

**Random
Sampling**

Test Locations

**Lot Sizes and
Test
Frequencies**

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

**Audit
Schedule**

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) continuous layer of earthworks
- (ii) selected subgrade zone
- (iii) flexible pavement layers
- (iv) asphalt layers
- (v) coring in concrete pavements

which are generally rectangular in area.

CQS-A2 SAMPLING RATES

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

CQS-A3 RANDOM SAMPLING LOCATIONS

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

- (i) Representing the lot as a rectangle, sub-divide the lot lengthwise into equi-area sub-lots in accordance with the number of samples selected (n).
- (ii) Establish six grid lines within the lot, as illustrated in Figure CQS-A2;
- (iii) Throw a 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-A1 and obtain random fraction R;
- (vi) Length co-ordinate for sample location in Sub-lot 1 = RL/n ;
- (vii) For sample location in next sub-lot:-
Add L/n to previous length co-ordinate.
Add 1 (on a cycle of 6) to previous grid line.

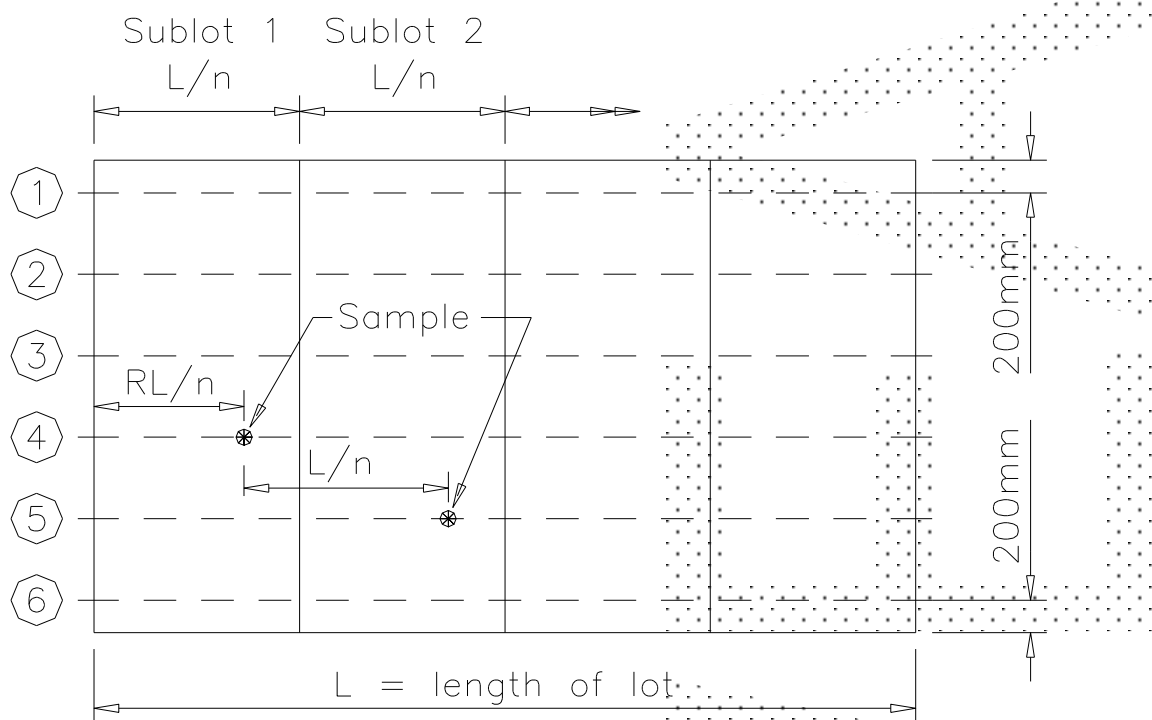


Figure CQS-A2 Sampling Locations for Rectangular Lot

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

Table CQS-A1 - Table of Random Fractions

ANNEXURE CQS-B METHOD STATEMENT REQUIREMENTS

CQS-B1 GENERAL

1. Method Statements are required to describe the key steps and sequence in the construction activities, how and by whom each step shall be undertaken and what materials and equipment shall be used. Method Statements may include a flow chart to clarify the sequence of key steps. One or more Method Statements may address a Construction Activity.
2. Each Method Statement will be supported by a Check List which shall identify relevant inspections, test points, materials requirements and Hold Points. Each requirement on the Check List will have an officer responsible identified and will require the nominated officer to sign off the requirement so indicating its satisfactory execution.
3. Method Statements and Check Lists shall be compatible with the appropriate Inspection and Test Plan. Check Lists will be completed for each lot of work during construction and compiled with other documents to comprise the Quality Register.
4. The Contractor shall submit Method Statements and Check Lists to describe the key steps in those Construction Activities listed below in Table CQS-B1 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
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
25		Trenchless Conduit Installation	C305
26		Road Openings and Restorations	C306
27		Water Reticulation	C401
28		Sewerage System	C402
29		Bushfire Protection	C501

ANNEXURE CQS-C MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES

GENERAL

1. The maximum lot sizes and minimum test frequencies are separately specified for all major activities covered by the Technical Specifications as listed hereunder.
2. The requirements applicable to this Contract are identified with an asterisk indicating that only these details are attached in this Annexure.
3. Where material/product quality certification can be obtained from the supplier, tests listed per contract/separable part need not be repeated.

Contents of Annexure 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 500m ²	AS1289.5.4.1 or AS1289.5.7.1
Blasting	Ground vibration / noise control	1 day's blasting	Continuous monitoring	
Foundation for Embankments	Compaction	5,000m ²	1 per 500m ²	AS1289.5.4.1 or AS1289.5.7.1
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 5,000m ²	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 - PlastiSHIRE 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
Excavation by Blasting	Peak particle velocity	1 drainage line / structure	1 per drainage line / structure	Measure
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	1 contract	1 per 200m ³ *	AS1141.11
	- Particle Size Distribution 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 *	
	- PlastiSHIRE 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 Filter Material - Grading (Type A, B, C, D) - Coefficient of Permeability (Type B) - Grading Variation after Treatment (Type B) - Wet Strength (Type C, D) - 10% Fines Wet/Dry (Type C, D) Geotextile	 1 contract/size 1 contract/size 1 contract/size 1 contract/size 1 contract/size 1 contract/size 1 contract	 1 per type/size 1 per type 1 per type 1 per type 1 per type 1 per type 1 per type	 AS1141.11 AS1289.E5.1 ASTM-D2434-68 AS1141.11 AS1141.22 AS1141.22
Excavation - Trench Base	Line and Grade Compaction	1 drainage line 1 drainage line	1 per drainage line 1 per 200 lin m*	Survey 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	<p>Material Quality - Supplier's documentary evidence and certification of:</p> <ul style="list-style-type: none"> - Cement - Quicklime <ul style="list-style-type: none"> · Available Lime (CaO content) · Slaking Rate · Particle Size Distribution - Hydrated Lime <ul style="list-style-type: none"> · Available Lime (CaOH₂) · Residue on Sieving - Ground Blast Furnace Slag - Flyash - Blended Stabilising Agent - Water <ul style="list-style-type: none"> Chloride ion content Sulphate ion content Undissolved solids 	<p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p>	<p>1 per 100t</p> <p>1 per 100t</p> <p>1 per 100t</p> <p>1 per contract</p> <p>1 per 100t</p> <p>1 per contract</p> <p>1 per month</p> <p>1 per month</p> <p>1 per month</p> <p>1 per contract</p> <p>1 per contract</p> <p>1 per contract</p>	<p>AS3972</p> <p>AS3583.12</p> <p>T432</p> <p>AS1141.11</p> <p>AS3583.12</p> <p>AS3583.14</p> <p>AS3583.2</p> <p>AS3583.1</p> <p>AS3583.13</p> <p>AS1289.4.2.1</p>
Mix Design	NATA certification - Supplier's documentary evidence and certification	1 mix	1 per mix	
Stationary Mixing Plant	<p>Application rate of stabilising agent</p> <p>Compressive strength of product</p>	<p>1 day's production</p> <p>1 day's production</p>	<p>1 per 100t</p> <p>1 per 400t</p>	<p>AS1289.6.1.1</p>
In-Situ Spreading	Spread rate	1 layer 1,000m ²	1 per lot or 1 per 500m ²	
Trimming and Compaction	<p>Geometry</p> <p>Surface Quality</p> <p>Average Layer thickness</p> <p>Average Width</p> <p>Relative Compaction/Moisture Content</p>	<p>1 layer 2,000m², max 1 day's placement</p> <p>"</p> <p>"</p> <p>"</p> <p>"</p>	<p>One cross section per 25m</p> <p>10 per 200m lane length *</p> <p>1 per lot</p> <p>1 per lot</p> <p>3 per lot</p>	<p>Survey</p> <p>3m Straight Edge</p> <p>Measure/Survey</p> <p>AS1289.5.7.1</p> <p>AS1289.5.8.1</p>

* 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	AS 2008
	- Refinery Cutback Bitumen	1 tanker load	1 per tanker load	AS 2157
	- Polymer Modified Binder	1 tanker load	1 per tanker load	AS 2341.21
	- Bitumen Adhesion Agent	1 delivery	1 per delivery	
	- Cutback Oils	1 delivery/ tanker	1 per delivery/tanker	AS 2758.2
	- 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	<p>Material Quality - Supplier's documentary evidence and certification of:</p> <ul style="list-style-type: none"> - Coarse & Fine Aggregates <ul style="list-style-type: none"> Grading Moisture Content Wet Strength Wet/Dry Strength Variation Particle Shape Fractured Faces Polishing Agg Friction Value - Mineral Filler - Bitumen Binder - Polymer Modified Bitumen <ul style="list-style-type: none"> ElastiSHIRE Recovery at 60°C Viscosity on ER at 60°C Torsional Recovery at 25°C Viscosity at 180°C - Bitumen Adhesion Agent <ul style="list-style-type: none"> Resistance to Stripping - Reclaimed Asphalt Pavement (RAP) - Bitumen Emulsion 	<ul style="list-style-type: none"> 1 wk's prod'n 1 wk's prod'n 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract or 1 month's production 1 refinery batching 1 production batch by supplier 1 contract 1 stockpile 1 contract 	<ul style="list-style-type: none"> 1 per day 1 per day)) 1 per contract) or change in material contract or 1 per month's production 1 per tanker load 1 per tanker load 1 per contract or change in material 1 per stockpile 1 per contract or change in material 	<ul style="list-style-type: none"> AS2758.5 AS1141.11 AS1289.2.1.1 AS1141.22 AS1141.22 AS1141.14 AS1141.18 AS1141.42 AS2357 AS2008 MBT 21 MBT 21 MBT 22 MBT 11 T230 or nominated equivalent AS1141.11 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 Moisture Content Grading Binder Content	C245.7 from Spec C245 Asphaltic Concrete as included as separate table below. Additionally, max lot size one 12 hr shift's production.	1 per truck load.	Measure AS2891.10 AS2891.3.3 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 month's production	1 per week	AS 3972
	Flyash	1 month's production	1 per month	AS 3582.1
	Water	1 contract	1 per contract	AS3583.13, AS1289.4.2.1
	Admixtures	1 month's production	1 per month	AS 1478
	Fine Aggregates (C248 only)			
	- Grading	1 week's production	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 week's production	1 per 200m ³ concrete*	AS1141.11
	- Moisture Content	1 week's production	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 production 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	<p>Material Quality - Supplier's documentary evidence and certification of:</p> <ul style="list-style-type: none"> - Bitumen (prior to emulsification) - Bitumen Emulsion <ul style="list-style-type: none"> · Residual Binder Content (Residue from Evaporation) - Mineral Aggregates <ul style="list-style-type: none"> · Degradation Factor · Los Angeles Value · Aggregate Wet Strength · Wet/Dry Strength Variation · Polished Aggregate Friction Value · Sand Equivalent - Mineral Filler - Combined Aggregate Grading 	<p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 contract</p> <p>1 month's prod'n</p> <p>1 contract</p>	<p>1 per contract or change in material</p> <p>2 per bulk delivery</p> <p>1 per contract or 6 month period</p> <p>"</p> <p>"</p> <p>"</p> <p>"</p> <p>"</p> <p>"</p>	<p>AS2008</p> <p>AS1160, App.D</p> <p>AS1141.25</p> <p>AS1141.23</p> <p>AS1141.22</p> <p>AS1141.22</p> <p>AS1141.42</p> <p>AS1289.3.7.1</p> <p>AS2357</p> <p>AS1141.11; AS1141.12</p>
Mix Design - Nominated Mix	Approval of mix and NATA certification - Supplier's documentary evidence and certification	1 contract	1 per mix	
Production Mix	<p>Grading</p> <p>Residual Binder Content</p>	1 day's production or 50m ³ (whichever is the lesser)	<p>2 per 50m³*</p> <p>2 per 50m³*</p>	<p>AS2891.3.1</p> <p>AS2891.3.1</p>
Laying	<p>Levels</p> <p>Surface Quality</p>	<p>1 layer, max 200m³</p> <p>1 layer, max 200m³</p>	<p>1 cross section per 15m</p> <p>10 per 100m* lane length</p>	<p>Survey</p> <p>3m Straight Edge</p>

* 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	
	- PlastiSHIRE 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 C261-A
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 C261-A

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	AS 1743
	- Aluminium Extrusion Backing	1 contract	"	AS 1866
	- Retro-reflective Material	1 contract	"	AS 1743
	- Non-reflective Paint	1 contract	"	
	- Non-reflective Sheet Material	1 contract	"	
	- Steel Sign Support Structures		"	
	-			
	Grade	1 contract		AS 1627.9
	Protective Treatment	1 contract		AS 4680 & AS 1214
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 Authentic SHIRE for the prescribed Mix	1 contract	Certification for each production batch delivered	
Imported Topsoil	Material Quality - pH - Organic Content - Soluble Salt Content	10,000m ² 10,000m ² 10,000m ²	1 per 500m ³ * 1 per 500m ³ * 1 per 500m ³ *	AS4419
Mulch for Planting	Material Quality	1 contract	1 contract	AS4454

* Note: or part thereof, per lot.

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: - PVC-M Pipes - PVC – O Pipes - Ductile Iron Pipes - Steel Pipes - Copper Pipe - Polyethylene Pipe - Stop Valves Material - Non Return Valves - Spring Hydrants	1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract	1 per contract 1 per contract " 1 per contract " " " " 1 per contract	AS/NZS 4765 AS/NZS 4765 AS/NZS 2280 and AS2129 AS 1579 and AS/NZS 1594 AS1432 AS/NZS 4130 AS2638 and AS2129 AS3578 AS2544 or AS3952
Siting and Excavation	Geometry	1 line	1 per line	Survey
Bedding	Material Quality - Grading	1 contract	1 per contract per source	AS/NZS 2032
Thrust and Anchor Blocks	Refer Sub-Annexure C13			
Concrete Encasement	Refer Sub-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: - PVC-U Pipes - Polypropylene Pipes - Ductile Iron Cement Lined (DICL) Pipes - Steel Pipes - Precast Access Chambers	1 contract 1 contract 1 contract 1 contract 1 contract	1 per contract " " " "	AS/NZS 1260 AS/NZS 5065 AS2280 and AS2129 AS 1579 and AS/NZS 1594 AS/NZS 1477, AS 2033 or AS4198
Siting and Excavation	Geometry	1 line/structure	1 per line/structure	Survey
Bedding	Material Quality - Grading	1 contract	1 per contract per source	AS 1152
Concrete Bedding	Refer Sub-Annexure C13			
Laying and Jointing of Pipes, Access Chambers, Structures	Geometry	1 line	1 per line	Survey
Thrust and Anchor Blocks	Refer Sub-Annexure C13			
Concrete Encasement	Refer Sub-Annexure C13			
Cast-in-situ Access Chambers	Material Quality - Tri-Calcium Aluminate Content - Fineness Index - Minimum Cement Content	1 contract 1 contract 1 contract	1 per contract per source " "	AS3972 AS3972 AS3972
Acceptance Test of Gravitation Mains and Access Chambers	- Compressed Air Testing - Hydrostatic Testing	1 line 1 per test length Test length = 1370m pipeline dia.(mm)	1 per line 1 per line	As specified C402.36 C402.37 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	

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: