



Construction Specification for Civil Works

CQS - Quality Control Requirements

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ORIGIN OF DOCUMENT, COPYRIGHT

This document was originally based on AUS-SPEC - Development Construction Specification CQC – Quality Control Requirements. Substantial parts of the original AUS-SPEC document have been deleted and replaced in the production of this Armidale Regional Council Construction Specification for Civil Works. The parts of the AUS-SPEC document that remain are still subject to the original copyright.

This document has been developed for use with the construction of civil works within the Armidale Regional Council local government area.

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REVISIONS: CQC – QUALITY CONTROL REQUIREMENTS

REVISION	CLAUSES AMENDED	AMENDMENT DETAILS	DATE
0		Original Issue	25/09/2023

GENERAL

CQC.01 DEFINITIONS

The Works – Defined as follows:

- **Developer Infrastructure Works** - work includes subdivisions and any public infrastructure work associated with an approved Development in the ARC local government area requiring a construction certificate.
- **Contracted Works** – infrastructure work undertaken by a Principal Contractor or subcontractor formally appointed by ARC and supervised by ARC.
- **Internal Works** - infrastructure work undertaken by ARC’s day labour workforce.

The Works

ARC Representative – Defined as follows:

- **Developer Infrastructure Works** – Nominated ARC officer(s) for the approved Development.
- **For Contracted Works** – the Superintendent.
- **For Internal Works** – ARC Asset Owner.

ARC Representative

Constructor – Defined as the organisation responsible for construction of the Works and the Principal Contractor as defined in the *Work Health and Safety Act 2011*.

Constructor

CQC.02 SCOPE

This Specification is for the quality control testing and survey by the Constructor; including the minimum test frequencies to be employed to demonstrate conformance to the requirements of the Armidale Regional Council (ARC) Construction Specifications (“the Specifications”).

Testing and Survey

This Specification will apply as the default requirements where quality control testing and survey, including minimum test frequencies, have not been specified in specific Specifications.

Default when testing requirements not specified in other specifications

CQC.03 LOTS

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

Lots shall be chosen by the Constructor but shall be within the limits given in Annexure CQC-B. In general, the size of the lot shall not exceed one (1) day’s output for each work process designated for lot testing.

Lot Size

The lot numbers shall be used as identifiers on all surveys and test results.

Lot Numbers

The Constructor shall determine the bounds of each lot before sampling and shall identify each lot clearly.

Lot Identification

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

Lot Boundaries

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

Test Results

CQC.04 SAMPLING AND TESTING

All compliance inspections and tests shall be based on lots.

Lots

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 Specifications, the Constructor shall nominate appropriate frequencies for the ARC Representative’s approval.

Lot Sizes Frequency of Testing

Sampling shall not be restricted to locations dimensioned or otherwise defined for setting out the works in the approved design drawings or Specification, but shall be undertaken in a random or unbiased manner, as approved by the Developer's Representative, at any location within the works to demonstrate its compliance with the Specification.

Sampling Locations

Where Test Methods are nominated in the 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

In special circumstances, the ARC Representative may accredit a laboratory that is not NATA registered for specific tests or inspection procedures.

Special Accreditation

The Constructor 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

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

For quality control of processes other than compaction of layers of earthworks, flexible pavement and asphalt, the sampling locations will be proposed by the Constructor and will require the approval of the Developer's Representative.

Sampling Locations

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

CQC.05 SURVEYING

Surveying Control shall include all measurement, calculation and record procedures necessary to:

Requirements

- (a) set out the works;
- (b) verify conformance to the design plans and Specification in relation to dimensions, tolerances and three dimensional position; and
- (c) determine lengths, areas or volumes of materials or products, where required for measurement of work.

The Constructor shall engage 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

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

Equipment

Sampling for conformance verification purposes shall not be restricted to the locations used to set out the works.

Sampling Locations

The Constructor shall submit a Survey Conformance Report to the Developer's Representative 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

CQC.06 RECORDS

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

The Constructor shall submit all conformance records to the Developer's Representative for inspection and approval. If requested by the ARC Representative, the Constructor shall provide copies of the records and test results.

**Copies of
Records
Subdivider's
Cost**

ANNEXURE CQC-A – RANDOM SAMPLING

CQC-A1 GENERAL

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

which are generally rectangular in area.

CQC-A2 SAMPLING RATES

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 Specification.

CQC-A3 RANDOM SAMPLING LOCATIONS

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 (6) 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 (2) random numbers (between 1 and 6) for row and column in Table CQC-A1 and obtain random fraction R;
- (vi) Length co-ordinate for sample location in Sub-lot 1 = RL/n ;
- (vii) For sample location in next sub-lot:
Add L/n to previous length co-ordinate.
Add 1 (on a cycle of 6) to previous grid line.

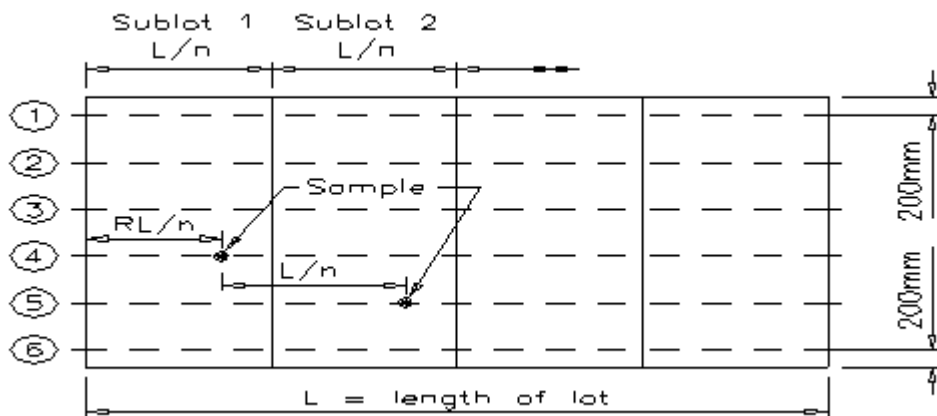


Figure CQC-A2 - Sampling Locations for Rectangular Lot

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

Table CQC-A1 - Table of Random Fractions

ANNEXURE CQC-B – MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES

CQC-B1 GENERAL

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

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

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

If there is any discrepancy between figures stated in the “Maximum Lot Size” and “Minimum Test Frequency” columns of this Specification, to figures stated in the associated “Test Method” documentation, the figures of this Specification will take precedence.

Order of Precedence

Contents of Annexure CQC-B

Item	Sub-Annexure	Required (*) for this Subdivision	Reference Specification	Sub-Annexure Heading
1	B1		C213	Earthworks
2	B2		C220 C221 C222 C223 C224	Stormwater Drainage Pipe Drainage Precast Box Culverts Drainage Structures Open Drains including Kerb & Gutter
3	B3		C230 C231 C232	Subsurface Drainage Subsoil and Foundation Drains Pavement Drains
4	B4		C241	Stabilisation
5	B5		C242	Flexible Pavements
6	B6		C244	Sprayed Bituminous Surfacing
7	B7		C245	Asphaltic Concrete
8	B8		C246	Sprayed Bituminous Surfacing (Polymer Modified)
9	B9		C261	Pavement Markings
10	B10		C262	Signposting
11	B11		C271	Minor Concrete Works
13	B12		C273	Landscaping
14	B13		C274	Masonry Walls
15	B14		C401	Water Reticulation
16	B15		C402	Sewerage System

Sub-Annexure B1

Specification C213 - Earthworks

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Stripping Topsoil	Surface Levels	10,000m ²	1 cross section per 25 metres	Survey
Excavation	Geometry	10,000m ²	1 cross section per 25 metres	Survey
Floor of Cuttings	Material Quality – CBR	5,000m ²	1 per 1,000m ² (Note 1)	AS 1289.6.1.1
	Compaction	10,000m ²	1 per 500m ²	AS 1289.5.4.1
Foundation for Embankments	Compaction	5,000m ²	1 per 500m ²	AS 1289.5.4.1
Embankments - General	Geometry	1 layer per 10,000m ²	1 cross section per 25 metres	Survey
	Material Quality – CBR	1 layer per 5,000m ²	1 per 800m ³	AS 1289.6.1.1
	Compaction/Moisture Content	1 layer 5,000m ²	1 per 200m ³	AS 1289.5.1.1 AS 1289.5.4.1
Road Carriageway Embankments - Select Zone	Geometry	1 layer per 10,000m ²	1 cross section per 25 metres	Survey
	Material Quality			AS 1289.6.1.1
	- Maximum Particle Size	10,000m ²	1 per 1,000m ³ (Note 1)	
	- CBR	10,000m ²	1 per 500m ³	
	Compaction/Moisture Content	1 layer per 5,000 m ²	1 per 200m ³	AS 1289.5.1.1 AS 1289.5.4.1
Fill Adjacent to Structures: Bridges, Retaining Walls and Cast-in-Situ Culverts	Material Quality			AS 1289.3.3.1
	- Maximum Particle Size	1 per structure	1 per 200m ³ (Note 1)	
	- Plasticity Index	1 per structure	1 per 200m ³ (Note 1)	
	Compaction/Moisture Content	1 per structure	1 per 2 layers per 50m ²	AS 1289.5.1.1, AS 1289.5.4.1

Note 1: Or part thereof, per lot.

Sub-Annexure B2

Specification C220 – Stormwater Drainage

Specification C221 – Pipe Drainage

Specification C222 – Precast Box Culverts

Specification C223 – Drainage Structures

Specification C224 – Open Drains including Kerb and Gutter

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 per batch	1 per type/size/class per batch	
Siting and Excavation	Geometry	1 drainage line per structure	1 per drainage line per structure	Survey
Foundation	Compaction	1 drainage line per structure	1 per 20 lineal metres (Note 1) or (Note 2)	AS 1289.5.4.1
Material surrounding Steel Structures	Material Quality - pH/Electrical Resistivity	1 drainage line per structure	1 per material	AS 1289.4.3.1 AS 1289.4.4.1
Bedding	Material Quality - Particle Size Distribution	1 per stage of the Works	1 per 200m ³ (Note 1)	AS 1141.11
	Compaction/Moisture Content	1 drainage line/structure	1 per layer, per 20 lineal metres or (Note 2)	AS 1289.5.4.1
Concrete Bedding or Lining	Geometry		1 cross section per 25 metres	Survey and 3 metre Straight Edge
Installation of Precast Units	Geometry	1 drainage line per structure	1 per drainage line per structure	Survey
Selected Backfill	Material Quality - Maximum Particle Size	1 per stage of the Works	1 per 100m ³ (Note 1)	AS 1289.3.3.1
	- Plasticity Index	1 per stage of the Works	1 per 100m ³ (Note 1)	
	Compaction/Moisture Content	1 drainage line per structure	1 per 2 layers per 50m ²	AS 1289.5.4.1
Rock Fill for Gabions / Wire Mattresses	Material Quality: - Wet Strength	1 per stage of the Works	1 per stage of the Works	AS 1141.22
	- Wet/Dry Strength Variation	1 per stage of the Works	1 per stage of the Works	AS 1141.22
Kerb and Gutter	Geometry		1 cross section per 25 metres	Survey and 3 metre Straight Edge

Note 1: Or part thereof, per lot.

Note 2: As approved by the ARC Representative.

Sub-Annexure B3

Specification C230 – Subsurface Drainage

Specification C231 – Subsoil and Foundation Drains

Specification C232 – Pavement Drains

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Material Supply	Material Quality - Supplier's documentary evidence and certification of:			
	Pipe	1 per stage of the Works per size	1 per type/size	
	Filter Material			
	- Grading (Type A, B, C, D)	1 per stage of the Works per size	1 per type	AS 1141.11
	- Coefficient of Permeability (Type B)	1 per stage of the Works per size	1 per type	AS 1289.E5.1 ASTM-D2434-68
	- Grading Variation after Treatment (Type B)	1 per stage of the Works per size	1 per type	AS 1141.11
	- Wet Strength (Type C, D)	1 per stage of the Works per size	1 per type	AS 1141.22
- 10% Fines Wet / Dry (Type C, D)	1 per stage of the Works per size	1 per type	AS 1141.22	
	Geotextile	1 per the Works	1 per type	
Excavation - Trench Base	Line and Grade	1 per drainage line	1 per drainage line	Survey
	Compaction	1 per drainage line	1 per 200 lineal metres (Note 1) or (Note 2)	AS 1289.5.4.1
Bedding and Backfill	Compaction – Filter Material	1 per drainage line	1 per drainage line or (Note 2)	AS 1289.5.4.1
	Compaction – Selected Material	1 per drainage line	1 per 200 lineal metres (Note 1) or (Note 2)	AS 1289.5.4.1
	Compaction – Earth Backfill	1 per drainage line	1 per 200 lineal metres (Note 1) or (Note 2)	AS 1289.5.4.1

Note 1: Or part thereof, per lot.

Note 2: As approved by the ARC Representative.

Sub-Annexure B4

Specification C241 – Stabilisation

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 per stage of the Works	1 per 100t	AS 3972
	- Quicklime	1 per stage of the Works	1 per 100t	AS 3583.12
	· Available Lime (CaO content)	1 per stage of the Works	1 per 100t	RMS T432
	· Slaking Rate	1 per stage of the Works	1 per 100t	AS 1141.11
	· Particle Size Distribution	1 per stage of the Works	1 per stage of the Works	
	- Hydrated Lime	1 per stage of the Works	1 per 100t	AS 3583.12
	· Available Lime (CaOH ₂)	1 per stage of the Works	1 per stage of the Works	AS 3583.14
	· Residue on Sieving	1 per stage of the Works	1 per month	AS 3582.2
	- Ground Blast Furnace Slag	1 per stage of the Works	1 per month	AS 3582.1
	- Flyash	1 per stage of the Works	1 per month	
	- Blended Stabilising Agent	1 per stage of the Works	1 per stage of the Works	
- Water				
Chloride ion content	1 per stage of the Works	1 per stage of the Works	AS 3583.13	
Sulphate ion content	1 per stage of the Works	1 per stage of the Works	AS 1289.4.2.1	
Undissolved solids	1 per stage of the Works	1 per stage of the Works		
Mix Design	NATA certification - Supplier's documentary evidence and certification	1 mix	1 per mix	
Stationary Mixing Plant	Application rate of stabilising agent	1 day's production	1 per 100t	
	Compressive strength of product		1 per 400t	AS 1289.6.1.1
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	1 cross section per 25 metres	Survey
	Surface Quality		10 per 200 metre lane length (Note 1)	3 metre Straight Edge
	Average Layer thickness		1 per lot	
	Average Width		1 per lot	Measure/Survey
	Relative Compaction / Moisture Content		3 per lot	AS 1289.5.4.1

Note 1: Or part thereof, per lot.

Sub-Annexure B5

Specification C242 – Flexible Pavement

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 per stage of the Works		
	- Particle Size Distribution		1 per 1,000t	AS 1289.3.6.1
	- Fine Particle Size Distribution Ratio		1 per 1,000t	AS 1289.3.6.3
	- Liquid Limit		1 per 1,000t	AS 1289.3.1.1
	- Plastic Limit		1 per 1,000t	AS 1289.3.3.1
	- Plasticity Index		1 per 1,000t	AS 1289.3.3.1
	- Maximum Dry Compressive Strength		1 per 5,000t	RMS T114
	- Particle Shape		1 per 1,000t	AS 1141.14
	- Aggregate Wet Strength		1 per 5,000t	AS 1141.22
	- Wet/Dry Strength Variation		1 per 5,000t	AS 1141.22
	- Modified Texas Triaxial Classification		1 per stage of the Works	RMS T171
- Unconfined Compressive Strength (Modified)	1 per 5,000t	RMS T116		
- Unconfined Compressive Strength (Bound)	1 per mix design	RMS T131		
Placement	Geometry: Alignment & Level	1 layer per 2,000m ² or max 1 day's placement	1 cross section per 15 metres	Survey
	Width & Surface Trim	1 layer per 2,000m ² or max 1 day's placement	10 per selected 200 lineal metres (Note 1)	Measure and 3 metre Straight Edge
	Deflection Control - Benkelman Beam	1 layer per 5,000m ² or max 1 day's placement	4 per 1,000m ² minimum 10 per lot	RMS T160
	Compaction / Moisture Content	1 layer per 5,000m ² or max 1 day's placement	10 per 5,000m ² layer or 3 per lot if less	AS 1289.5.2.1 T130 AS 1289.5.4.1
	Dry Density Testing	1 layer per 5,000m ² or max 1 day's placement	10 per 5,000m ² layer or 3 per lot if less	AS 1289.5.8.1

Note 1: Or part thereof, per lot.

Sub-Annexure B6

Specification C244 – Sprayed Bituminous Surfacing

The minimum test frequencies required for Specification C244 - Sprayed Bituminous Surfacing will be as detailed in the current version of TfNSW QA Specification R106 – Sprayed Bituminous Surfacing (with Cutback Bitumen) Annexure R106/L – Minimum Frequency of Testing.

Sub-Annexure B7

Specification C245 – Asphaltic Concrete

Dense Graded Asphalt Pavements - The minimum test frequencies required for Specification C245 – Asphaltic Concrete will be as detailed in the current version of *TfNSW QA Specification R116* – Heavy Duty Dense Graded Asphalt Annexure R116/L – Minimum Frequency of Testing.

Open Graded Asphalt Pavements - The minimum test frequencies required for Specification C245 – Asphaltic Concrete will be as detailed in the current version of *TfNSW QA Specification R119* – Open Graded Asphalt Annexure R119/L – Minimum Frequency of Testing.

Sub-Annexure B8

Specification C246 – Sprayed Bituminous Surfacing (Polymer Modified)

The minimum test frequencies required for Specification C246 - Sprayed Bituminous Surfacing will be as detailed in the current version of *TfNSW QA Specification R107* – Sprayed Bituminous Surfacing (with Polymer Modified Bitumen) Annexure R107/L – Minimum Frequency of Testing.

Sub-Annexure B9

Specification C261 – Pavement Markings

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 per stage of the Works	1 per stage of the Works or change in material	
	- Glass Beads	1 per stage of the Works	1 per stage of the Works or change in material	
	- Thermoplastic Material	1 per stage of the Works	1 per stage of the Works or change in material	
	- Raised Pavement Markers	1 per stage of the Works	1 per stage of the Works or change in material	
Paint Application	Wet Film Thickness	1 per stage of the Works	1 per site visit or change in pressure settings	AS 1580.107.3
	Application Rate of Glass Beads	1 per stage of the Works	1 per site visit or change in pressure settings	Annexure C261A
Thermoplastic Application	Cold Film Thickness	1 per stage of the Works	1 per site visit or change in pressure settings	Measure by micrometer
	Application Rate of Glass Beads	1 per stage of the Works	1 per site visit or change in pressure settings	Annexure C261A

Sub-Annexure B10

Specification C262 – Sign Posting

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 per stage of the Works	1 per stage of the Works, or change in material	
	- Aluminium Extrusion Backing	1 per stage of the Works	1 per stage of the Works, or change in material	
	- Retro-reflective Material	1 per stage of the Works	1 per stage of the Works, or change in material	
	- Non-reflective Paint	1 per stage of the Works	1 per stage of the Works, or change in material	
	- Non-reflective Sheet Material	1 per stage of the Works	1 per stage of the Works, or change in material	
	- Steel Sign Support Structures	1 per stage of the Works	1 per stage of the Works, or change in material	
Concrete Foundations	Refer Sub-Annexure B9 for C271 Minor Concrete Works			

Sub-Annexure B11

Specification C271 – Minor Concrete Works

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Subgrade	Compaction	1000 lineal metres or 1000m ²	1 per 200 lineal metres or 200m ²	AS 1289.5.4.1
Gravel Subbase Construction	Compaction	1 day's placement	1 per 100 lineal metres or 100m ²	AS 1289.5.4.1
	Subbase Geometry	1 day's placement	1 per 25 lineal metres	3 metre 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 per stage of the Works	1 per mix type	
	Consistency – Slump	15m ³	1 per load	AS 1012.3 Method 1
	Compressive Strength (7 and 28 day)	15m ³	2 pairs per 15m ³	AS 1012.1 AS 1012.8 AS 1012.9
Concrete Placement	Finished Levels	15m ³	1 cross section per 15 metres	Survey and 3 metre Straight Edge
	Surface Dimensions	Single Fabrication	As required to confirm design dimensions	Measure
Backfilling	Material Quality			
	- Maximum particle size	1 per stage of the Works per material type	1 per 200m ³ or lot	
	- Plasticity Index	1 per stage of the Works per material type	1 per 200m ³ or lot	AS 1289.3.3.1
	Compaction	1 day's work or max 200m ²	1 per 200m ² or lot	AS 1289.5.4.1
Sprayed Concrete	Test Panels and Cores	1 per stage of the Works	3 test panels and 4 cores per mix design	AS 1012.4 AS 1012.9 AS 1012.14
	Compressive Strength Cores	15m ³	2 per 15m ³	AS 1012.4 AS 1012.9 AS 1012.14
	Curing Material Quality - Supplier's documentary evidence and certification	1 per stage of the Works	1 per production batch	

Sub-Annexure B12

Specification C273 – Landscaping

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Seed	Certification of Authenticity for the prescribed Mix	1 per stage of the Works	Certification for each production batch delivered	
Imported Topsoil	Material Quality			AS 4419
	- Ph	10,000m ²	1 per 500m ³	
	- Organic Content	10,000m ²	1 per 500m ³	
	- Soluble Salt Content	10,000m ²	1 per 500m ³	
Mulch for Planting	Material Quality	1 per stage of the Works	1 per stage of the Works	AS 4454

Sub-Annexure B13

Specification C274 – Masonry Walls

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Alignment	Set Out	Each wall	25 metre sections	Survey
Footing	Concrete Slump	Each wall	1 per load	AS 1012.3.1
	Concrete Strength	Each wall	1 per wall or 100m ³ (whichever is the lesser)	AS 1012.9
Concrete Grout	Strength	Each wall	As required by the ARC Representative	AS 1012.9
Backfilling	Drainage Layer Grading	Each wall	1 per wall	AS 1141.11
Foundations and Backfill	Compaction	Each wall or 200 lineal metres (whichever is the lesser)	3 per 200 lineal metres	AS 1289.5.4.1

Sub-Annexure B14

Specification C401 – Water Reticulation

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- uPVC Pipes	1 per stage of the Works	1 per stage of the Works	AS 2977
	- Ductile Iron Pipes	1 per stage of the Works	1 per stage of the Works	AS 2280 AS 2129
	- Copper Pipe	1 per stage of the Works	1 per stage of the Works	AS 1432
	- Polyethylene Pipe	1 per stage of the Works	1 per stage of the Works	AS 1159
	- Stop Valves	1 per stage of the Works	1 per stage of the Works	AS 2638 and AS 2129
	- Non-return Valves	1 per stage of the Works	1 per stage of the Works	AS 3578
	- Spring Hydrants	1 per stage of the Works	1 per stage of the Works	AS 3952
Siting and Excavation	Geometry	1 per line	1 per line	Survey
Bedding	Material Quality - Grading	1 per stage of the Works	1 per stage of the Works per source	AS 2032
Thrust and Anchor Blocks	Refer Sub-Annexure B9 for C271 Minor Concrete Works			
Concrete Encasement	Refer Sub-Annexure B9 for C271 Minor Concrete Works			
Chamber Covers and Frames	Geometry	1 per cover per frame	1 per cover per frame	Survey
Testing of Pipelines	Pressure testing	1 per line	1 per line	As specified C401.37
Backfill and Compaction	Compaction	1 per line	1 per 2 layers max 100m ² or (Note 1)	AS 1289.5.6.1 AS 1289.5.4.1 AS 1289.5.1.1
Switchgear and Control gear Assembly	Electrical function	each installation	1 factory test per installation	AS 3439
Commissioning of Pumping Station	Certification testing of electrical installation in accordance with relevant Australian Standards	each installation	1 per installation	

Note 1: As approved by the ARC Representative.

Sub-Annexure B15

Specification C402 – Sewerage System

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification of:			
	- uPVC Pipes	1 per stage of the Works	1 per stage of the Works	AS 1477
	- Ductile Iron Pipes	1 per stage of the Works	1 per stage of the Works	AS 2280 AS 2129
	- Vitrified Clay Pipes	1 per stage of the Works	1 per stage of the Works	AS 1741
	- Precast Access Chambers	1 per stage of the Works	1 per stage of the Works	AS 4198
Siting and Excavation	Geometry	1 per line per structure	1 per line per structure	Survey
Bedding	Material Quality - Grading	1 per stage of the Works	1 per stage of the Works per source	
Concrete Bedding	Refer Sub-Annexure B9 for C271 Minor Concrete Works			
Laying and Jointing of Pipes, Access Chambers, Structures	Geometry	1 per line	1 per line	Survey
Thrust and Anchor Blocks	Refer Sub-Annexure B9 for C271 Minor Concrete Works			
Concrete Encasement	Refer Sub-Annexure B9 for C271 Minor Concrete Works			
Cast-in-situ Access Chambers	Material Quality			
	- Tri-Calcium Aluminate Content	1 per stage of the Works	1 per stage of the Works per source	AS 3972
	- Fineness Index	1 per stage of the Works	1 per stage of the Works per source	AS 3972
	- Minimum Cement Content	1 per stage of the Works	1 per stage of the Works per source	AS 3972
Acceptance Test of Gravitation Mains and Access Chambers	- Compressed Air Testing	1 line	1 per line	As specified C402.42 C402.43
	- Hydrostatic Testing	1 per test length	1 per line	As specified C402.45
Backfill and Compaction	Compaction	1 per line	1 per 2 layers max 100m ² or (Note 1)	AS 1289.5.6.1 AS 1289.5.4.1 AS 1289.5.1.1
Switchgear and Control Gear Assembly	Electrical Compliance	each installation	1 factory test per installation	AS 3439
Commissioning of Pumping Station	Certification testing of electrical installation in accordance with relevant Australian Standards	each installation	1 per installation	

Sub-Annexure B16

Ready-Mixed Concrete Production and Supply

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	AS 3583.13, AS 1289.4.2.1
	Admixtures	1 month's production	1 per month	AS 1478
	Fine Aggregates (C248 only)			
	- Grading	1 week's production	1 per 200m ³ concrete (Note 1)	AS 1141.11
	- Moisture Content	Not Applicable	1 per day	
	- Sulphate Soundness	1 contract	1 per contract	AS 1141.24
	- 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 (Note 1)	AS 1141.11
	- Moisture Content	1 week's production	1 per day	
	- Wet Strength	1 contract	1 per contract	AS 1141.22
	- Wet/Dry Strength Variations	1 contract	1 per contract	AS 1141.22
	- Sulphate Soundness	1 contract	1 per contract	AS 1141.24
	- Particle Shape	1 contract	1 per contract	AS 1141.14
	- Fractured Faces	1 contract	1 per contract	AS 1141.18
	- 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 (Continued)	- 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	AS 1012.9
	Aggregate Moisture Content	1 contract mix	1 per mix per contract	
	Consistency - Slump	1 contract mix	1 per mix per contract	AS 1012.3.1
	Air Content	1 contract mix	1 per mix per contract	AS 1012.4 Method 2
	Shrinkage	1 contract mix	1 per mix per contract	AS 1012.13

Note 1: Or part thereof, per lot.

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