

# CAPRICORN MUNICIPAL DEVELOPMENT GUIDELINES

## STABILISATION

C241

# CONSTRUCTION SPECIFICATION



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**STABILISATION**

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**Keeping the Capricorn Municipal Development Guidelines up-to-date**

The Capricorn Municipal Development Guidelines are living documents which reflect progress of municipal works in the Capricorn Region. To maintain a high level of currency that reflects the current municipal environment, all guidelines are periodically reviewed with new editions published and the possibility of some editions to be removed. Between the publishing of these editions, amendments may be issued. It is important that readers assure themselves they are using current guideline, which should include any amendments which may have been published since the guideline was printed. A guideline will be deemed current at the date of development approval for construction works.

## 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.

**Scope**

3. This Specification provides the requirements for stabilisation of the types of pavement courses and subgrade zones or layers as shown in Table C241.01.1.

**Table C241.01.1 - Types of Pavement Courses, Subgrade Zones or Layers And Stabilising Binder**

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  Other Subgrade Layers	Cement Blended Stabilising Agent Quicklime (in-situ) Hydrated Lime (pugmill)  Cement Blended Stabilising Agent Quicklime (in-situ) Hydrated Lime (pugmill)
Selected Backfill Zone	Cement Hydrated Lime (pugmill)

4. The pavement course or subgrade zone or layer to be stabilised shall be as specified in the Specifications for FLEXIBLE PAVEMENTS C242, or as indicated on the Drawings.

**Associated Specifications**

5. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in Annexure C241B.

**Quality**

### C241.02 REFERENCE DOCUMENTS

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

**Documents  
Standards Test  
Methods**

#### (a) Council Specifications

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

#### (b) Australian Standards

- AS 1141.11 - Particle size distribution by dry sieving.
- AS 1289.5.7.1 - Compaction control test (Rapid method)
- AS 1289.5.8.1 - Determination of field density and field moisture content of a soil using a nuclear surface moisture-density gauge - Direct transmission mode.
- AS 1289.4.2.1 - Determination of the sulphate content of a natural soil and the sulphate content of the ground water - Normal Method.
- AS 1289.6.1.1 - Determination of the California bearing ratio of a soil - Standard laboratory method for a remoulded specimen.
- AS/NZS 2350.4 - Setting time of Portland and blended cements.
- AS 2350.9 - Determination of residue on the 45 micrometre sieve.
- AS 3582.1 - Fly ash.
- AS 3582.2 - Slag - Ground granulated iron blast furnace.
- AS 3583.3 - Determination of loss on ignition.
- AS 3583.6 - Determination of relative water requirement and relative strength.
- AS 3583.12 - Determination of available alkali.
- AS 3583.13 - Determination of chloride ion content.
- AS 3583.14 - Determination of insoluble residue content.
- AS 3972 - Portland and blended cements

#### (c) NSW RTA Test Methods

- T432 - Rate of Slaking of Quicklime

## INSPECTION, SAMPLING AND TESTING

### C241.03 MATERIALS PROPOSED FOR USE IN THE WORK

1. The Contractor shall provide a certificate from a laboratory with appropriate NATA registration stating that the stabilisation mix(s) submitted and the mix constituents comply with the mix nominated in Annexure C241A and that the stabilised material meets the requirements of the Specification for FLEXIBLE PAVEMENTS C242 if incorporated into the works as a pavement layer or alternatively the Specification for EARTHWORKS C213 or STORMWATER DRAINAGE GENERAL C230.

**Contractor's  
Responsibility**

**C241.04 MATERIALS USED IN THE WORK**

1. Regular inspection, sampling and testing of pavement and subgrade materials shall be undertaken by the Contractor while stabilisation is in progress in accordance with this Specification.

**Sampling and Testing**

**MATERIALS****C241.05 CEMENT**

1. The type of cement used as the stabilising agent or a constituent in a blended stabilising agent shall comply with AS 3972.

**Type**

2. If the Contractor proposes to use cement which has been stored for a period in excess of three months from the time of manufacture, the Contractor shall arrange a re-test, to ensure the cement still complies with AS3972, before the cement is used in the work. The cost of retesting cement, which has been stored for a period in excess of three months, shall be borne by the Contractor. Test results shall be forwarded to the Superintendent for approval at least 2 days in advance of usage of the material.

**Storage in Excess of 3 months**

**C241.06 QUICKLIME**

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

**Properties**

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

2. The particle size distribution of the quick lime determined by AS 1141.11 shall comply with the following requirements in Table C241.06.1.

**Particle Size**

**Table C241.06.1 Particle Size Distribution of Quicklime**

AS Sieve	Per Cent Passing
13.2mm	100
9.5mm	96 - 100
4.75mm	70 - 100
2.36mm	0 - 90

**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.

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

- (a) Percentage of calcium hydroxide
- (b) Fineness - Percentage by mass passing the 45 micron sieve (AS 2350.9).
- (c) Source.

### C241.08 GROUND GRANULATED BLAST FURNACE SLAG

1. The ground granulated blast furnace slag shall conform to AS3582.2.

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

- (a) Fineness - percentage by mass passing the 45 micron sieve (AS 2350.9).
- (b) Relative strength (28 days) (AS 3583.6).
- (c) Source.

### C241.09 FLYASH

1. Flyash shall conform to AS3582.1.

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

- (a) Fineness - percentage by mass passing the 45 micron sieve (AS 2350.9).
- (b) Loss on ignition (AS 3583.3).
- (c) Source.

### C241.10 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 percent 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

### C241.11 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 **Proposed Equipment**



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.

**and  
Procedures**

2. Notwithstanding submission to the Superintendent of the Contractor's equipment and stabilisation procedures, the work shall meet all the Specification requirements, and Statutory Requirements for Work Place Health and Safety, and the Contractor shall perform such tests as specified as the work proceeds, to ensure compliance.

**Compliance  
Contractor's  
Cost**

3. Stabilisation of pavement materials shall not proceed during wet weather or if rain is imminent and likely to occur during any stage of the stabilisation process so as to significantly influence the resultant moisture content and uniformity of moisture content in the mix.

**Weather  
Conditions**

## **C241.12 APPLICATION OF STABILISING AGENT**

### **(a) Stationary Mixing Plant**

1. Application content of stabilising agent shall be monitored at the pug mill or equivalent plant utilised as approved by the Superintendent.

**Application  
Rate**

2. Spreading shall be carried out using the mechanical spreader nominated in the Work Plan and subsequently approved by the Superintendent. Annexure C241A nominates the cement content. The target spread rate shall be calculated and approved by the Superintendent.

**Measurement**

3. The achieved accuracy of agent content shall be  $\pm 10$  per cent of that nominated rate nominated in Annexure C241A.

### **(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.

**Application  
Process**

2. Spreading shall be carried out using the mechanical spreader nominated in the Work Plan and subsequently approved by the Superintendent. Annexure C241A nominates the cement content. The target spread rate shall be calculated and approved by the Superintendent.

**Spreading  
Rate**

3. The actual spread rate shall be within  $\pm 10$  per cent of the nominated rate. The Contractor shall verify this by testing the spread rate for each lot or 500m<sup>2</sup> of pavement treated (whichever is less) in each application of binder. Spread rate testing shall be performed by weighing the contents of a suitable 4 sided tray placed on the pavement and between the wheels of the mechanical spreader. The rate of stabilising agent spread shall be calculated by dividing the mass collected (kg) by the area of the tray (m<sup>2</sup>).

**Tolerances**

4. Where spreading vehicles are fitted with load cells, the Contractor shall ascertain the average spreading rate of the stabilising agent by dividing the mass of the stabilising agent spread per run by the area of the run. The Contractor shall record this data for each run and make it available to the Superintendent promptly. Such action will not cancel the Contractor's obligation to undertake prescribed testing of spread rate if required by the Superintendent.

**Load Cells**

5. The actual spread rate shall not exceed the approved rate by more than 10 per cent. The stabilising agent spread in excess of the approved 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

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shall not pass over the spread material until it has been mixed into the layer to be stabilised. **Traffic**

8. Any spillage of the stabilising agent on site or at any loading location related to the site shall be removed as soon as possible and within 24 hours of such spillage. **Spillage**

### C241.13 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 meet the Superintendent's requirements and shall be confirmed by monitoring the consistency of unconfined compressive strength, in accordance with AS 1289.6.1.1, with a pair of test specimens tested for each 400 tonnes of production. **Uniform Mixture Contractor's Cost**

#### (b) In-situ

1. Mixing equipment shall be purpose built for the process of in-situ mixing of road making materials. It shall be capable of mixing to the depth specified for the layer to be stabilised and of distributing the stabilising agent uniformly through the full depth and over the whole area of the layer to be stabilised. A minimum of 2 passes of the mixing equipment is required. As mixing blades or tynes wear they shall be replaced so as to maintain mixing efficiency consistent with that demonstrated during the trial section. The mixing equipment will be capable of supplying a calibrated amount of water to the mixing bowl in 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 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. **Additional Mixing Contractor's Cost**

### C241.14 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**

- The nominated Field Working Period shall be provided in Annexure C241A for the stabilising agent approved for the works. The Nominated Field Working Period shall be based on laboratory tests determining the time from mixing until such time as the calculated Wet Density for modified compaction procedures **Based on Laboratory Tests**

decreases by more than 2 percentage points. This testing shall be undertaken the contractor utilising AS 1289.5.7.1 and samples of the materials representative of those to be utilised in the works.

- A maximum field working period of 2 hours shall apply for cement stabilised material.

2. The Contractor will complete the compaction process within the Nominated Field Working Period unless specific approval otherwise.

**Compaction  
within Field  
Working  
Period**

**C241.15 TRIMMING AND COMPACTION**

1. After mixing the layer shall be trimmed and compacted in accordance with the Specification for FLEXIBLE PAVEMENTS C242 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 C241.17 (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 only 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. 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 C241.17 (b). When required by the Superintendent, survey results shall be provided to confirm that the pavement layer thickness remains within tolerance after secondary trimming.

**Secondary  
Trimming**

**Contractor's  
Cost**

3. All trimmed material having been cut to waste shall be used as fill or spoiled.

**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 C241.17 (a). This testing will be undertaken immediately prior to sealing or prior to the agreed practical completion for any work component.

**Straight Edge  
Test**

5. The stabilised layer shall be compacted over the entire area and depth so that the relative compaction determined by AS 1289.5.7.1 is not less than as detailed in the Specification for FLEXIBLE PAVEMENTS C242, EARTHWORKS C213 or STORMWATER DRAINAGE GENERAL C220 as appropriate.

**Compaction**

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

**Test Method**

7. The maximum wet density (standard compaction) will be determined by sampling immediately after the determination of field density and testing will be undertaken within 2 hours of sampling. A determination of maximum wet density (standard compaction) representing the full layer depth is required for each sampling location when calculation of relative compaction is undertaken.

**Wet Density**

8. The field density may be determined by in-situ sand replacement testing or by single probe Nuclear Density Meter in direct transmission mode in accordance with AS 1289.5.8.1.

**In-Situ Dry  
Density**

**C241.16 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 C241.17. **Finish**

**C241.17 TOLERANCES****(a) Levels and Surface Trim**

1. The surface level after primary trimming shall be within a tolerance of +30mm and +10mm of the levels shown on the Drawings. **Primary Trimming**

2. The surface level after secondary trimming shall be within a tolerance of +15mm and -15mm of the levels shown on the Drawings. **Secondary Trimming**

3. The pavement surface after secondary trimming and immediately prior to sealing shall be of a quality such that deviation under a 3 metre straight edge does not exceed 12mm.

**(b) Layer Thickness**

1. The final thickness of the stabilised layer at any point shall be within a tolerance of +20mm and -10mm of the nominated layer thickness. **Minimum Thickness**

2. The average thickness of the layer in a lot shall be determined from measurements of six randomly selected locations over any 200m length of a lot. The average thickness shall not be less than that required to meet the specified final thickness tolerances after trimming. **Average Thickness**

3. The layer thickness shall be measured at the edges of the stabilising run before compaction commences. The layer thickness shall be measured relative to the finished design level. **Method of Measurement**

**(c) Width**

1. The width measured at any point of the stabilised layer shall be not less than the specified width as shown in the Drawings by more than 50mm. **Minimum Width**

2. The average width of the layer shall be determined from measurements at 3 sites selected at random by the Superintendent over any 200m length of a lot and shall be not less than the specified width. **Average Width**

**C241.18 CURING**

1. The Contractor shall submit to the Superintendent details of the proposed method **Notice**

of curing as part of the Work Plan.

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

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

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

## LIMITS AND TOLERANCES

### C241.19 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses of this Specification are summarised in Table C241.19.1 below:

**Table C241.19.1 - Summary of Limits and Tolerances**

Item	Activity	Limits Tolerances	Spec Clause
1.	<b>Quicklime</b>		
	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.	<b>Hydrated Lime</b>		
	a) Available Lime	>80% Calcium Hydroxide	C241.07
	b) Particle Size	<2% residue on a 300 micron Sieve	C241.07
3.	<b>Blended Stabilising Agents</b>	Blend percentages shall not vary by more than $\pm 3\%$ from those nominated in Annexure C241A	C241.10
4.	<b>Water</b>		
	a) Chloride ion content	<600 PPM Chloride ion	C241.10
	b) Sulphate ion content	<400 PPM Sulphate ion	C241.10
	c) Undissolved solids	<1 percent by mass of undissolved solids	C241.10
5.	<b>Application of Stabilising Agent</b>		
	a) Spread Rate or Incorporation Rate for in-situ plant.	Actual spread rate shall be within $\pm 10\%$ of the approved rate	C241.12
	b) Stabilising Agent Content for Stationary Mixing Plant	Actual content shall be within $\pm 10\%$ of the nominated content.	C241.12

Item	Activity	Limits Tolerances	Spec Clause
6.	<b>Trimming and Compaction</b>		
	a) Surface Level	After primary trimming be within +30mm and +10mm of levels shown on Drawings  After secondary trimming be within ±15mm of levels shown on Drawings	C241.17(a)
	b) Layer Thickness	Final thickness of layers shall not vary more than +20mm and -10mm of required thickness	C241.17(b)
	c) Shape	Shall not deviate more than 12mm under a 3m straight edge immediately prior to first sealing	C241.17(a)
7.	<b>Joints</b>		
	a) Longitudinal Overlap	> 75mm overlap of mixing runs	C241.16
	b) Transverse Overlap	> 2m overlap of transverse joints	C241.16
	c) Longitudinal Joints	Shall not be allowed within 0.5m of the centreline of a typical wheelpath	C241.16
8.	<b>Width</b>		
	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.	C241.17(c)

ANNEXURE

C241A STABILISATION MIX DESIGN

Type of Stabilising Agent .....  
.....  
.....

Nominal Percentage of Stabilising Agent by Mass ..... %

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

## C241B QUALITY CONTROL AND TESTING

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
<b>MANDATORY TESTING</b>				
Mix Design	NATA certification - Supplier's documentary evidence and certification	1 mix	1 per mix	
In-Situ Spreading	Spread rate	1 layer 1,000m <sup>2</sup>	1 per lot or 1 per 500m <sup>2</sup>	
Trimming and Compaction	Relative Compaction/Moisture Content	"	3 per lot	AS1289.5.7.1 AS1289.5.8.1
<b>AUDIT TESTING – IF ORDERED BY COUNCIL</b>				
Material Supply	Material Quality - Supplier's documentary evidence and certification of: - Cement - Quicklime Available Lime (CaO content) Slaking Rate Particle Size Distribution - Hydrated Lime Available Lime (CaOH <sub>2</sub> ) Residue on Sieving -Ground Blast Furnace Slag -Flyash -Blended Stabilising Agent - Water Chloride ion content Sulphate ion content Undissolved solids	1 contract  1 contract 1 contract 1 contract  1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract 1 contract	1 per 100t  1 per 100t 1 per 100t 1 per contract  1 per 100t 1 per contract 1 per month 1 per month 1 per month  1 per contract 1 per contract 1 per contract	AS3972  AS3583.12 T432 AS1141.11  AS3583.12 AS3583.14 AS3583.2 AS3583.1  AS3583.13 AS1289.4.2.1
Stationary Mixing Plant	Application rate of stabilising agent  Compressive strength of product	1 day's production  1 day's production	1 per 100t  1 per 400t	  AS1289.6.1.1
Trimming and Compaction	Geometry  Surface Quality  Average Layer thickness  Average Width	1 layer 2,000m <sup>2</sup> , max 1 day's placement  "  "  "	One cross section per 25m  10 per 200m lane length *  1 per lot  1 per lot	Survey  3m Straight Edge  Measure/Survey

\* Note: or part thereof, per lot.