

TWEED SHIRE COUNCIL

DEVELOPMENT CONSTRUCTION SPECIFICATION

C241

STABILISATION

VERSION 1.2

SPECIFICATION C241 - STABILISATION

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DEVELOPMENT CONSTRUCTION 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. This Specification is for 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 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)

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, or as indicated on the design plans.

Associated Specifications

STABILISATION

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

Quality

C241.02 REFERENCE DOCUMENTS

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

**Documents
Standards Test
Methods**

(a) Council Specifications

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

(b) Australian Standards

AS 1141.11	-	Particle size distribution by dry sieving.
AS 1289.5.7.1	-	Compaction control test (Rapid method)
AS 1289.5.8.1	-	Determination of field density and field moisture content of a soil using a nuclear surface moisture-density gauge - Direct transmission mode.
AS 1289.4.2.1	-	Determination of the sulphate content of a natural soil and the sulphate content of the ground water - Normal Method.
AS 1289.6.1.1	-	Determination of the California bearing ratio of a soil - Standard laboratory method for a remoulded specimen.
AS 2350.4	-	Setting time of Portland and blended cements.
AS 2350.9	-	Fineness of Portland fly ash cement.
AS 3582.1	-	Fly ash.
AS 3582.2	-	Slag - Ground granulated iron 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
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INSPECTION, SAMPLING AND TESTING

C241.03 MATERIALS PROPOSED FOR USE IN THE WORK

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

**Annexure
C241A**

**Subdivider'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 Subdivider while stabilisation is in progress in accordance with this Specification. | <i>Sampling and Testing</i> |
|----|---|------------------------------------|

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. | <i>Type</i> |
| 2. | Cement shall be from a source included in the New South Wales Government Quality Assurance Scheme at time of production. | <i>NSW QA Scheme</i> |
| 3. | The Subdivider shall nominate the brand and source of all cementitious materials. | <i>Nominated Brand and Source</i> |
| 4. | Documentary evidence of the quality and source of the cement shall be furnished by the Subdivider to the Certifying Engineer upon request at any time. | <i>Proof of Quality</i> |
| 5. | If the Subdivider proposes to use cement which has been stored for a period in excess of three (3) months from the time of manufacture, the Subdivider 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 (3) months, shall be borne by the Subdivider. Test results shall be forwarded to the Certifying Engineer for approval at least 2 days in advance of usage of the material. | <i>Storage in Excess of 3 months</i> |

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: | <i>Properties</i> |
| (a) | Available Lime The content of calcium oxide, determined by AS 3583.12, shall not be less than 85 per cent. | |
| (b) | Slaking Rate The active slaking time shall not be greater than twenty (20) minutes and the temperature rise on slaking, determined from the average of four (4) samples tested in accordance with Test Method T432, shall not be less than 40°C in six (6) 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. | <i>Particle Size</i> |

A. S. 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**
 - (a) Available Lime The content of calcium hydroxide, determined by AS 3583.12, shall not be less than 80 per cent.
 - (b) Form The material shall be in powder form.
 - (c) Residue on Sieving (Particle Size) The residue on a 300 micron sieve, determined by AS 3583.14, shall not exceed 2 per cent.

2. The properties which characterise the particular hydrated lime to be used in the stabilising agent submitted as part of the mix design are:
 - (a) Percentage of calcium hydroxide
 - (b) Fineness - Percentage by mass passing the 45 micron sieve (AS 2350.9).
 - (c) Source.

C241.08 GROUND GRANULATED BLAST FURNACE SLAG

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

2. The properties which characterise the particular ground blast furnace slag to be used in the stabilising agent submitted as part of the mix design are: **Properties**
 - (a) Fineness - percentage by mass passing the 45 micron sieve (AS 2350.9).
 - (b) Relative strength (28 days) (AS 3583.6).
 - (c) Source.

C241.09 FLYASH

1. Flyash shall conform to AS3582.1.

2. The properties which characterise the particular flyash to be used in the stabilising agent submitted as part of the mix design are: **Properties**
- (a) Fineness - percentage by mass passing the 45 micron sieve (AS 2350.9).
 - (b) Loss on ignition (AS 3583.3).
 - (c) Source.

C241.10 BLENDED STABILISING AGENTS

1. The Subdivider may utilise a blended stabilising agent. The Subdivider 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 Subdivider who shall also arrange for sampling of the agent as required by the Certifying Engineer. **Requirements**
2. The mass of components of the nominated blended stabilising agent shall not vary by more than ± 3 per cent from the blend percentages nominated in the mix design described in Annexure C241A.
3. When a blended stabilising agent is produced from a combined grinding of components the following properties will characterise the particular stabilising agent blend: **Properties**
- (a) Source of each component.
 - (b) Fineness - percentage by mass passing the 45 micron sieve (AS 2350.9).
 - (c) Setting time (AS2350.4).

C241.11 WATER

1. Water shall be free from harmful amounts of materials such as oils, salts, acids, alkalis and vegetable substances. The water shall not contain more than: **Quality**
- (a) 600 parts per million of chloride ion, determined by AS 3583.13.
 - (b) 400 parts per million of sulphate ion, determined by AS 1289.4.2.1.
 - (c) 1 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

C241.12 GENERAL

1. The Subdivider shall submit details of the proposed equipment (including the mixing plant) and stabilisation procedures to be used in the work 14 days prior to commencement of the work. This submission, hereafter called the Work Plan, will nominate the sequence of operations, widths of stabilisation passes and provision for traffic if appropriate. **Proposed Equipment and Procedures**

STABILISATION

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|----|---|---|
| 2. | Notwithstanding submission to the Certifying Engineer of the Subdivider's equipment and stabilisation procedures, the work shall meet all the Specification requirements, and Statutory Requirements for Occupational Health and Safety, and the Subdivider shall perform such tests as specified as the work proceeds, to ensure compliance. Costs of such tests shall be borne by the Subdivider. | Compliance
Subdivider's
Cost |
| 3. | Stabilisation of pavement materials shall not proceed during wet weather or if rain is imminent and likely to occur during any stage of the stabilisation process so as to significantly influence the resultant moisture content and uniformity of moisture content in the mix. | Weather
Conditions |

C241.13 APPLICATION OF STABILISING AGENT

(a) Stationary Mixing Plant

- | | | |
|----|---|-----------------------------|
| 1. | Application rate of stabilising agent shall be monitored at the pug mill or equivalent plant utilised as approved by the Certifying Engineer. | Application
Rate |
| 2. | Application rate measured in kilograms per tonne of product shall be monitored and recorded for every 100 tonnes of production. | Measurement |
| 3. | The achieved accuracy of application rate shall be ± 10 per cent of the nominated rate nominated in Annexure C241A. | |
| 4. | The application rate shall not be allowed to exceed the nominated rate by more than 10 per cent. | Over Spread |

(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 Subdivider involving supply of stabilising agent within the mixing bowl of equipment the approval of the Certifying Engineer is required and a demonstration of the process at Subdivider's expense may be requested. | Application
Process |
| 2. | Spreading shall be carried out using the mechanical spreader nominated in the Work Plan and subsequently approved by the Certifying Engineer. Annexure C241A nominates the spread rate. | Spreading Rate |
| 3. | The actual spread rate shall be within ± 10 per cent of the nominated rate. The Subdivider shall verify this by testing the spread rate for each lot or 500m ² of pavement treated (whichever is less) in each application of binder. Spread rate testing shall be performed by weighing the contents of a suitable 4 sided tray placed on the pavement and between the wheels of the mechanical spreader. The rate of stabilising agent spread shall be calculated by dividing the mass collected (kg) by the area of the tray (m ²). | Tolerances |
| 4. | Where spreading vehicles are fitted with load cells, the Subdivider 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 Subdivider shall record this data for each run and make it available to the Certifying Engineer promptly. Such action will not cancel the Subdivider's obligation to undertake prescribed testing of spread rate if required by the Certifying Engineer. | Load Cells |
| 5. | The actual spread rate shall not exceed the nominated rate by more than 10 per cent. | Over Spread |
| 6. | Spreading shall not proceed during windy conditions which may cause loss of stabilising agent or cause nuisance or danger to people or property. | Wind |

- | | | |
|----|--|---------------------------------|
| 7. | Traffic or equipment not involved in spreading or mixing of the stabilising agent shall not pass over the spread material until it has been mixed into the layer to be stabilised. | Construction
Traffic |
| 8. | Any spillage of the stabilising agent on site or at any loading location related to the site shall be removed as soon as possible and within the same work shift of such spillage. | Spillage |

C241.14 MIXING**(a) Stationary Mixing Plant**

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|----|---|--|
| 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 Subdivider. | Uniform
Mixture
Subdivider'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 a 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 Subdivider shall carry out visual inspections during mixing to ensure uniform mixing is being achieved in the layer. Inspection results shall be recorded as cited in the Specification Part for Quality Requirements. The Certifying Engineer may require that additional passes by the mixing equipment be carried out to improve the visual uniformity of the mix and/or the moisture content. | Additional
Mixing |

C241.15 FIELD WORKING PERIOD

- | | | |
|----|---|-------------------|
| 1. | The time period from addition of water during the mixing process until the completion of compaction is nominated as the Field Working Period. This period will vary significantly with variations in the type of stabilising agent. | Definition |
|----|---|-------------------|

STABILISATION

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|----|---|---|
| 2. | The Nominated Field Working Period shall be provided in Annexure C241A for the stabilising agent approved for the works. The Nominated Field Working Period shall be based on laboratory tests determining the time from mixing until such time as the calculated Wet Density for modified compaction procedures decreases by more than 2 percentage points. This testing shall be undertaken utilising AS 1289.5.7.1 and samples of the materials representative of those to be utilised in the works. | Based on
Laboratory
Tests |
| 3. | The Subdivider will complete the compaction process within the Nominated Field Working Period unless specific approval is provided by the Certifying Engineer to an adjustment for site and seasonal conditions. | Compaction
within Field
Working Period |

C241.16 TRIMMING AND COMPACTION

- | | | |
|----|---|--------------------------------|
| 1. | After mixing the layer shall be trimmed and compacted in accordance with the Specification for FLEXIBLE PAVEMENTS to produce a tight dense surface parallel with the finished wearing surface so that the levels do not vary from the design levels beyond the tolerance for primary trimming specified in Clause C241.18(a). | Level
Tolerance |
| 2. | Subsequent secondary trimming may be undertaken on one (1) 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. The Subdivider'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 Certifying Engineer survey results shall be provided to confirm that the pavement layer thickness remains within tolerance after secondary trimming. | Secondary
Trimming |
| 3. | All trimmed material having been cut to waste shall be used as fill or spoiled as directed by the Certifying Engineer. | 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 a 200 metre lane length or part thereof. Deviation of the surface from the bottom of a 3 metre straight edge placed in any direction will meet the tolerance shown in Clause C241.18(a). This testing will be undertaken immediately prior to sealing or prior to agreed practical completion for any work component. | Straight Edge
Test |
| 5. | The stabilised layer shall be compacted over the entire area and depth so that the relative compaction determined by AS 1289.5.7.1 is not less than as detailed in the Specification for FLEXIBLE PAVEMENTS, EARTHWORKS or STORMWATER DRAINAGE GENERAL as appropriate. | Compaction |
| 6. | To provide true relative compaction assessments the lots shall be sampled and tested within the Nominated Field Working Period in accordance with AS 1289.5.7.1. | Test Method |
| 7. | The maximum wet density (modified compaction) will be determined by sampling immediately after the determination of field density and testing will be undertaken within 2 hours of sampling. A determination of maximum wet density (modified compaction) representing the full layer depth is required for each sampling location when calculation of relative compaction is undertaken. | Wet Density |
| 8. | The field density may be determined by in-situ sand replacement testing or by single probe Nuclear Density Meter in direct transmission mode in accordance with AS 1289.5.8.1. | In-Situ Dry
Density |

C241.17 JOINTS

- | | | |
|----|--|----------------------------|
| 1. | Joints are defined in this Specification to comprise interfaces between work episodes that are separated in time by more than the nominal Field Working Period for the nominated stabilisation mix design. A longitudinal joint shall be considered to be a joint generally parallel to the road centreline. A transverse joint occurs when a length of work is terminated and extended at a later time after a period which exceeds the Nominated Field Working Period. | <i>Joint Type</i> |
| 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 wheel path. | <i>Cutting Back</i> |
| 3. | The level and shape of the joints shall be within the limits specified in Clause C241.18. | <i>Finish</i> |

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 design plans. | <i>Primary Trimming</i> |
| 2. | The surface level after secondary trimming shall be within a tolerance of +15mm and -15mm of the levels shown on the design plans. | <i>Secondary Trimming</i> |
| 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. | <i>Minimum Thickness</i> |
| 2. | The average thickness of the layer in a lot shall be determined from measurements of six (6) 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. | <i>Average Thickness</i> |
| 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. | <i>Method of Measurement</i> |

(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 design plans by more than 50mm. | <i>Minimum Width</i> |
| 2. | The average width of the layer determined from measurements at 3 sites selected at random by the Certifying Engineer over any 200m length of a lot and shall be not less than the specified width. | <i>Average Width</i> |

STABILISATION

C241.19 CURING

1. The Subdivider shall submit to the Certifying Engineer details of the proposed method of curing as part of the Work Plan. **Notice**
2. The stabilised work shall be protected against rapid drying out by keeping it continuously wet or damp during the period prior to the provision of a subsequent layer or the application of a prime or primer-seal. **Water Curing**
3. Water curing shall consist of frequent light uniform spraying that will not produce significant run off or flooding on sections of the area. Slurrying of the surface or leaching of the stabilising agent shall be avoided. **Caution**
4. Under this Specification provision for curing up to the period indicated in Annexure C241A shall be the responsibility of the Subdivider at cost to the Subdivider. **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 (20) minutes, and temperature rise on slaking not less than 40°C in six (6) minutes (for an average of four (4) 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

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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 design plans After secondary trimming be within ± 15 mm of levels shown on design plans	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 design plans with an average width always greater than that shown on the design plans.	C241.18(c)

Table C241.3 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

C241.21 RESERVED

C241.22 RESERVED

C241.23 RESERVED

ANNEXURE C241A

STABILISATION MIX DESIGN

(See Specification for FLEXIBLE PAVEMENTS C242.06)

Type of Stabilising Agent

Nominal Percentage of Stabilising Agent by Mass %

Spread Rate of Stabilising Agent (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 Subdivider's Curing (days)

Nominated Granular Material(s) (type)

Source of Nominated Granular Material