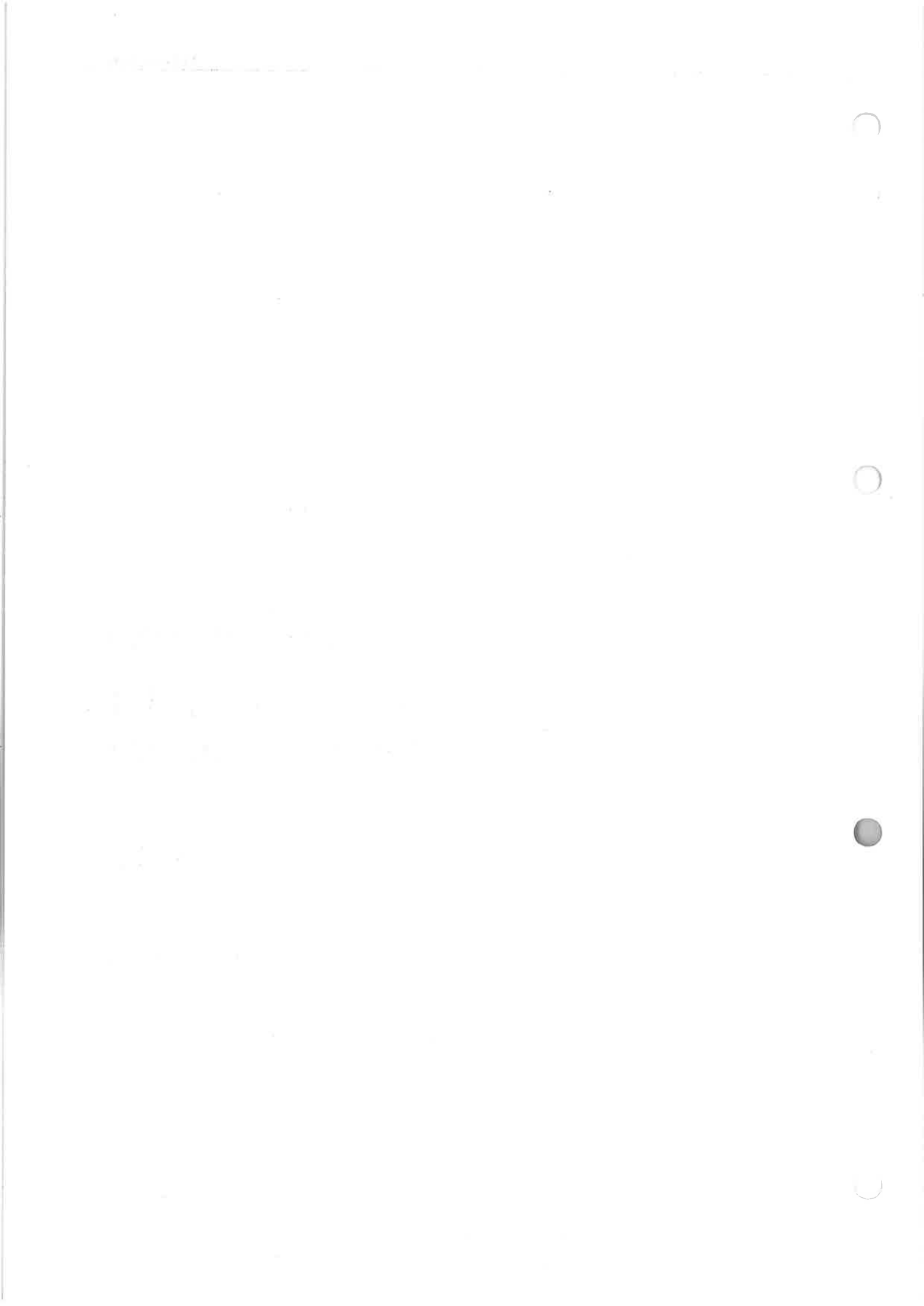


**DEVELOPMENT  
CONSTRUCTION  
SPECIFICATION**

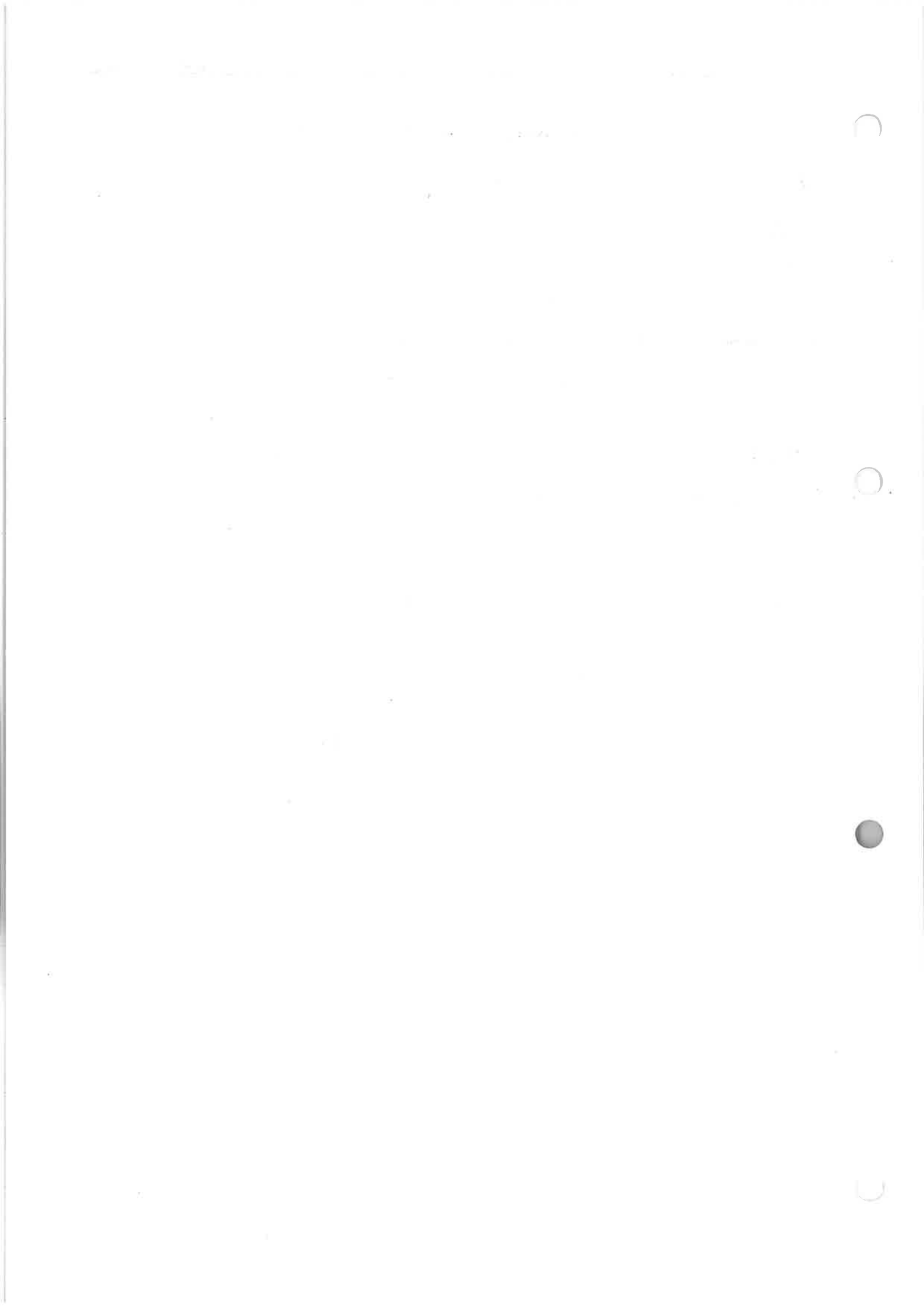
**C241**

**STABILISATION**



## 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. This Specification covers the supply and incorporation of stabilising binders with material in a nominated pavement course or subgrade materials (including materials for the selected material zone, selected backfill and other subgrade layers), at specified locations in the work and the spreading, compaction, trimming and curing of such materials.
3. This Specification specifies 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	Blended Stabilising Agent Hydrated Lime (pugmill) Quicklime (in-situ)
SUBGRADE ZONE OR LAYER Selected Material Zone  Other Subgrade Layers	Blended Stabilising Agent Hydrated Lime (pugmill) Quicklime (in-situ)  Blended Stabilising Agent Hydrated Lime (pugmill) Quicklime (in-situ)
Selected Backfill Zone	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 Specification C242 - FLEXIBLE PAVEMENTS, or as indicated on the Drawings.

*Associated Specifications*

**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 an undisturbed soil and the sulphate content of the ground water.
- 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) RTA Test Methods**

- T136 - Rate of Spread of Stabilising Agent
- T430 - Available Calcium Oxide or Calcium Hydroxide in Lime
- T432 - Rate of Slaking of Quicklime
- T433 - Determination of Sieve Residue of Fly Ash and Hydrated Lime
- T1004 - Quantitative Determination of Chloride Ion in Water where Chloride Content is more than 15 p.p.m.

**INSPECTION, SAMPLING AND TESTING**

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

1. The Developer shall provide to Council's Development Engineer a certificate from a laboratory with appropriate NATA registration stating that the mix or mixes submitted and the mix constituents comply with the mix nominated in Annexure C241A. It shall also state that the stabilised material meets the requirements of Specification C213 - EARTHWORKS if incorporated into the works as a pavement layer or alternatively Specifications C213 - EARTHWORKS or C220 - STORMWATER DRAINAGE - GENERAL.

**Developer's  
Responsibility**

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

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

**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 applicable at the time of Development Consent.

**Quality**

3. The brand and source of all cementitious materials shall be nominated a minimum of 14 days prior to stabilising work commencing.

**Nominated Brand and Source**

4. Documentary evidence of the quality and source of the cement shall be furnished to the Council's Development Engineer upon request at any time.

**Proof of Quality**

5. If it is proposed 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 arranged, to ensure the cement still complies with AS3972, before the cement is used in the work. Test results shall be forwarded to the Council's Development Engineer 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 Test Method T430, 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**

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**

- (i) Available Lime                      The content of calcium hydroxide, determined by Test Method T430, 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 Test Method T433, 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. A blended stabilising agent may be used. Mill and batch information that will make the blended stabilising agent traceable to the supplier's test results shall be obtained and provided to Council's Development Engineer upon request. The handling and storage requirements of the Supplier shall be complied with. Sampling of the agent as required by Council's Development Engineer shall also be arranged. **Requirements**



2. The components of the nominated blended stabilising agent shall not vary by more than  $\pm 3$  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 Test Method T1004.
- (b) 400 parts per million of sulphate ion, determined by AS 1289.D2.1.
- (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. Details of the proposed equipment (including the mixing plant) and stabilisation procedures to be used in the work shall be submitted a minimum of 14 days prior to commencement of the work. This submission, hereafter called the Work Plan, will nominate the sequence of operations, widths of stabilisation passes and provision for traffic if appropriate.

**Proposed Equipment and Procedures**

2. Notwithstanding submission to Council's Development Engineer of the details of equipment and stabilisation procedures, the work shall meet all the Specification requirements and such tests as specified shall be undertaken as the work proceeds, to ensure compliance.

**Compliance**

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 Council's Development 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**

## STABILISATION

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3. The achieved accuracy of application rate shall be <10 per cent of the nominated rate.
  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. **Application Process**
  2. Spreading shall be carried out using the mechanical spreader nominated in the Work Plan and subsequently approved by Council's Development Engineer. Annexure C241A nominates the spread rate. **Spreading Rate**
  3. The actual spread rate as determined by Test Method T136 shall be within  $\pm 10$  per cent of the nominated rate. Verification of this by testing the spread rate for each lot or 500m<sup>2</sup> (whichever is less) of pavement treated in each application of binder shall be undertaken. Spread rate testing shall be performed by weighing the contents of a suitable four 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 (in kgs) by the area of the tray (in m<sup>2</sup>). **Tolerances**
  4. Where spreading vehicles are fitted with load cells, the average spreading rate of the stabilising agent shall be determined by dividing the mass of the stabilising agent spread per run by the area of the run. This data shall be recorded for each run and made available to Council's Development Engineer promptly. Such action will not cancel the obligation to undertake prescribed testing of spread rate if required by Council's Development 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 24 hours 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 meet the requirements of Council's Development Engineer and may 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 **Uniform Mixture**

**(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 two 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. | <b>Equipment</b>         |
| 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.   | <b>Uniform Mixture</b>   |
| 3. | The procedure nominated in the Work Plan shall minimise disturbance of the distribution of stabilising agent spread in advance of the mixing process.   | <b>Disturbance</b>       |
| 4. | Council's Development 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  | <b>Additional Mixing</b> |

**C241.15 FIELD WORKING PERIOD**

- |    |   |   |
|----|---|---|
| 1. | The Field Working Period is nominated as the time period from addition of water during the mixing process until the completion of compaction. This period will vary significantly with variations in the type of stabilising agent.   | <b>Definition</b>                             |
| 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. | <b>Based on Laboratory Tests</b>              |
| 3. | The compaction process will be completed within the Nominated Field Working Period unless Council's Development Engineer provides specific approval to an adjustment for site and seasonal conditions.  | <b>Compaction within Field Working Period</b> |

**C241.16 TRIMMING AND COMPACTION**

- |    |   |                         |
|----|---|-------------------------|
| 1. | After mixing the layer shall be trimmed and compacted in accordance with Specification C213 - EARTHWORKS 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).   | <b>Level Tolerance</b>  |
| 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. The site survey control methods as stated in the Work Plan are to 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 Council's Development Engineer survey results shall be provided to confirm that the pavement layer thickness remains within tolerance after secondary trimming. |                         |
| 3. | All trimmed material having been cut to waste shall be used as fill or spoiled as directed by Council's Development Engineer.   | <b>Trimmed Material</b> |
| 4. | Measurements with a 3 metre straight edge shall be taken at a minimum of 10   | <b>Straight Edge</b>    |

## STABILISATION

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.

**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 that detailed in Specifications C213 - EARTHWORKS or C220 - 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) is required for each sampling location when calculation of relative compaction is undertaken.

**Wet Density**

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

**In-Situ Dry Density**

### C241.17 JOINTS

1. Joints are defined in this Specification to comprise interfaces between work episodes that are separated in time by more than the nominal field-working period for the nominated stabilisation mix design. A longitudinal joint shall be considered to be a joint generally parallel to the road centreline. A transverse joint occurs when a length of work is terminated and extended at a later time after a period, which exceeds the nominated field-working period.

**Joint Type**

2. All longitudinal and transverse joints shall be formed by cutting back into the previously stabilised and fully compacted sections. A minimum longitudinal overlap of mixing runs shall be 75mm. Transverse joints shall be overlapped by a minimum of 2 metres. The material disturbed during cutting back shall be remixed at full depth and incorporated into the new work. No longitudinal joints shall be allowed within 0.5 metre of the centreline of a typical wheel path.

**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 +15 mm and -15 mm 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. The average thickness shall not

**Average Thickness**

be less than that required to meet the specified final thickness tolerances after trimming.

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 determined from measurements at 3 sites selected at random by Council's Development Engineer over any 200m shall be not less than the specified width.

**Average Width**

**C241.19 CURING**

1. The Work Plan shall contain details of the proposed method of curing and shall be submitted to Council's Development Engineer.

**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 runoff or flooding on sections of the area. Slurrying of the surface or leaching of the stabilising agent shall be avoided.

**Caution**

4. The curing period shall be as nominated in Annexure C241A.

**Curing Period**

## LIMITS AND TOLERANCES

### C241.20 SUMMARY OF LIMITS AND TOLERANCES

1. The tolerances applicable to the various clauses of this Specification are summarised in Table C241.3 below:

Item	Activity	Tolerances	Spec Clause
1.	<b>Quicklime</b>		
	a) Available Lime	>85% Calcium Oxide content (Test Method T430)	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). (Test Method T432)	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 (Test Method T430)	C241.07
	b) Particle Size	<2% residue on a 300 micron Sieve (Test Method T433)	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 (Test Method T1004)	C241.11
	b) Sulphate ion content	<400 PPM Sulphate ion (AS 1289.D2.1)	C241.11
	c) Undissolved solids	<1 percent by mass of undissolved solids	C241.11

Item	Activity	Tolerances	Spec Clause
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 nominated rate (Test Method T136)	C241.13
6.	<b>Trimming and Compaction</b>		
	a) Surface Level	After primary trimming be within +30 mm and +10 mm of levels shown on Drawings  After secondary trimming be within $\pm 15$ 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.	<b>Joints</b>		
	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.	<b>Width</b>		
	a) Width of Stabilised Layer	At any point, the width shall be not less than 50 mm 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**

**ANNEXURE C241.A**

**STABILISATION MIX DESIGN**

All details are to be determined by the Developer's consultant Engineer and submitted a minimum of 14 days prior to commencing any work on the site to Council's Development Engineer for Assessment.