
SECTION 307 - IN SITU STABILISATION OF PAVEMENTS WITH CEMENTITIOUS BINDERS

307.01 DESCRIPTION

This section covers the requirements for in situ stabilisation of existing pavements by addition of cement, blended cement, lime, or other supplementary cementitious materials. The requirements relate to mix design, preparation of existing pavement materials, lime pre-treatment of pavement materials with high plasticity, supply of cementitious binders, construction plant, and spreading, mixing, and compaction of pavement layers.

Refer to Section 290 for Lime Stabilisation of Earthworks Materials in cases where lime stabilisation is required to improve the strength or reduce the swell potential of an earthworks material.

307.02 DEFINITIONS

Available Lime

The amount of Calcium Oxide (CaO_2) or Calcium Hydroxide (Ca(OH)_2) contained in Quicklime or Hydrated Lime respectively.

Available Lime Index (ALI)

The Calcium Oxide or Calcium Hydroxide content of quick lime or hydrated lime respectively, expressed as a percentage of the total mass of lime determined in accordance with AS 4489.6.1.

Cementitious Binder

A cementitious material capable of being uniformly mixed into a granular pavement material to bind the particles together to increase its strength. Cementitious binders include Portland cement (AS3972) Type GP or blended cement Type GB, or a blend of ground granulated blast furnace slag (GGBFS, AS3582.2), hydrated lime (AS1672.1), fly ash (AS3582.1), alkali activated slag or other pozzolanic material supplied in accordance with this specification.

Deep-Lift Stabilisation

Pavement stabilisation carried out in a single layer in excess of 250 mm thick. Typically, deep lift stabilisation requires a high spread rate of slow setting cementitious binder and heavy compaction equipment to produce a fully bound pavement layer.

Density Decay Correction Factor

A factor derived to calculate the field density ratio from a laboratory determined reference density where compaction of the test sample has occurred after the maximum allowable working time has expired.

Design Distribution Rate of Available Lime

The spread rate of pure Calcium Oxide or Calcium Hydroxide.

Fly Ash

A fine powder of pozzolanic material extracted from the flue emissions produced from the burning of black coal.

Hydrated Lime

Hydrated lime is a powdered form of lime consisting primarily of calcium hydroxide, also referred to as slaked lime.

Lime

Lime is either Hydrated Lime (Calcium Hydroxide) or Quick Lime (Calcium Oxide).

Lime Spreading Rate

The required spread rate of lime determined from the Design Distribution Rate of Available Lime corrected for the ALL of the lime to be used.

Maximum Allowable Working Time

The maximum allowable working time for the cementitious binder as specified or as determined in accordance with the relevant Test Method or Code of Practice.

Pozzolan

A siliceous or alumino-siliceous material when finely ground can be mixed with lime or Portland cement to form a cementitious material.

Quicklime

Quicklime is a fine granulated powder consisting primarily of Calcium Oxide that can be readily slaked by the application of water after it has been evenly spread to form Calcium Hydroxide.

Reference Density

The reference density is the maximum dry density or the peak converted wet density determined in accordance with the appropriate test method, but adjusted for oversize material as appropriate.

Slag (Ground Granulated Blast Furnace Slag)

Ground Granulated Blast Furnace Slag (GGBFS) is a pozzolan produced by fine grinding of slag produced as a by-product from the smelting of iron ore.

Working Time

The time required to mix, fully compact and trim the stabilised pavement layer after the addition of cementitious binder.

307.03 CONFORMITY WITH DRAWINGS

Completed stabilised base and subbase layers shall conform within the following limits to the levels, lines, grades, thicknesses and cross sections shown on the drawings, or specified, or directed by the Superintendent.

(a) Surface Level**Base**

Surface level measurement shall be undertaken in lots not exceeding 4000 m² in accordance with the procedures specified in Section 173 - Examination and Testing of Materials and Work (Roadworks).

Unless otherwise specified in other Standard Sections or elsewhere, the surface level of the stabilised layer at subgrade level at any point shall not differ by more than 15 mm above or 25 mm below the specified level.

Subbase

If the cementitious stabilised material forms a subbase for an unbound flexible pavement or an asphalt pavement, the requirements for surface level of the subbase layer shall be as specified in Sections 304 or 407 unless specified otherwise.

(b) Depth of Stabilisation

The depth of cementitiously stabilised material as specified in Clause 307.16(a) shall not at any point be less than the specified thickness by more than 15 mm and the average thickness of the lot shall be not be less than the specified thickness.

(c) Alignment

The edges of the stabilised layer shall be not more than 50 mm inside, and not more than 100 mm outside, the specified offset from centreline or design line.

(d) Width

The width of the stabilised material shall not be less than the specified width by more than 50 mm.

(e) Shape

No point on the surface of the stabilised layer shall lie below a 3 m straightedge placed in any direction on the surface by more than 10 mm for the base and 15 mm for subbase.

307.04 MATERIALS

(a) Cementitious Binders

(i) Cement

Blended cement Type GB or for special purposes, General Purpose Portland Cement Type GP complying with AS 3972 shall be supplied by the Contractor.

The Contractor shall nominate the type, brand and source of cement proposed.

HP If Type GP is proposed, the Superintendent shall be first notified and evidence provided to show that the in situ stabilised material can be mixed and compacted to the specified density within the Maximum Allowable Working Time for Type GP Cement.

HP The use of any additive to the cement to change its properties shall be subject to prior approval by the Superintendent.

(ii) Lime

Quicklime and hydrated lime shall meet the requirements of AS 1672.

All quicklime and hydrated lime supplied to the job shall be provided with delivery docket showing the manufacturers reference number for the production lot and an Assigned ALI for each production week. The Assigned ALI shall be determined by averaging the six most recent test results for ALI. Test certificates for determination of the ALI shall be made available on request.

Lime shall be stored in a moisture free environment and shall be retested for compliance with AS 1672.1 if stored more than 14 days after receipt from the manufacturer.

(iii) Slag / Lime Blends

Slag and hydrated lime may be used in blended combination to produce a slow setting cementitious binder. The requirements for hydrated lime shall be as specified in Clause 307.04(a)(ii) above. Slag used shall be Ground Granulated Blast Furnace Slag (GGBFS) meeting the requirements of AS 3582.2. The Contractor shall nominate the type, brand and source of the GGBFS to be used.

Unless otherwise specified, slag/lime shall be blended uniformly in the ratio of 85% slag to 15% hydrated lime. If the blend is to be varied, the proportion of lime shall not be less than 10% but may be increased above 15% for materials with high plasticity provided that the minimum UCS requirements are met as specified in Table 307.053. The Contractor shall provide evidence that the blend ratio has been met for all material supplied to the job. An 85% slag to 15% lime blend shall have a mortar bar 7 day compressive strength of 10 MPa and 28 day mortar bar compressive strength of 16 MPa. The test shall be the same test specified in AS 3972 except that the cement to water ratio shall be adjusted to match the consistency of mortar produced for the compressive strength test for GB cement in accordance with the relevant Australian Standard Test Method.

(iv) Slow Cementitious Blends Incorporating Alkali-activated Slag or Fly Ash

Special blends of slow setting cementitious stabilising agents incorporating alkali-activated slag or fly ash which are not produced to meet the requirements of a GB cement may be used subject to the blend satisfying the mortar bar test requirement specified in Clause 307.04(iii) above and the specified mix requirements. The maximum binder working time shall be determined in accordance with the VicRoads Test Method to confirm that the binder is a slow setting binder as defined by Table 307.052.

Fly ash shall be supplied to meet the requirements of AS 3582.1.

(b) Water

Water added to the material shall be clear and substantially free from sediments and detrimental impurities such as oils, salts, acids, alkalis and vegetable substances. Water supplied from sources where dissolved salts are unknown or likely to be present shall be tested for electrical conductivity prior to use. The electrical conductivity shall not be more than 3500 $\mu\text{S}/\text{cm}$ and the amount of chloride and sulphate in any water used shall each be no greater than 300 ppm.

Water sources classified by the relevant water authority as potable water shall be exempt from this requirement.

(c) Pavement

The in situ pavement material to be stabilised shall be the existing surfacing and pavement material and any additional material placed over the existing pavement for mixing with the pavement below.

307.05 PAVEMENT MATERIALS INVESTIGATION AND MIX DESIGN

(a) General

Unless otherwise specified in Clause 307.16(d) and (e), the Contractor shall produce a mix design for the in situ stabilised pavement material in accordance with VicRoads Code of Practice 500.16 and referenced VicRoads Test Methods. The aim of the mix design procedure is to improve the material grading if necessary, reduce the plasticity and to optimise the type and amount of cementitious binder required having regard to the chemical and physical properties of the in situ material. The in situ stabilised pavement material is required to meet the specified grading, plasticity and strength requirements, and contain a cementitious binder which will allow sufficient working time to mix, place, compact and trim the material before the initial set takes place.

(b) Grading and Plasticity Index

The final grading of the material to be stabilised after addition of any additional granular material, to correct the grading or to increase the thickness of the pavement shall be within the limits specified in Table 307.051.

If the Plasticity Index (PI) exceeds the limits specified in Table 307.051 the material shall be pre-treated with lime or modified with additional granular material using the design procedure described in the Test Method. If the material is to be pre-treated with lime to lower the PI, the quantity of lime additive used shall not be less than 1.5% by mass.

Table 307.051 - Grading and Plasticity Index Requirements

Sieve Size (mm)	53	37.5	19	4.75	0.425	0.075	PI (Max)
Base (% passing by mass)	100	85 - 100	60 - 100	40 - 70	20 - 40	5 - 25	10
Subbase and Sealed Shoulders (% passing by mass)	90 - 100	75 - 100	50 - 100	30 - 80	15 - 45	3 - 30	15

(c) Maximum Allowable Working Time

The type of cementitious binder added shall be selected on the basis of the maximum allowable working times specified in Table 307.052 and the minimum working time considered necessary to properly mix the material, trim and shape the surface to level and fully compact the layer to the specified density ratio.

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If the Contractor proposes to use an alternative cementitious binder to those included in Table 307.052, laboratory test results shall be produced to the Superintendent showing that the maximum allowable working time for the cementitious binder as determined in accordance with the VicRoads Test Method satisfies the required working time and the cement stabilised material using the alternative binder meets specified strength requirements.

Table 307.052 - Maximum Allowable Working Times after Mixing for Various Cementitious Binders

Cementitious Binder	Maximum Allowable Working Time (hours)	
	Construction between October and April ⁽¹⁾	Construction between May and September
Slow Setting Slag/Lime blends, Alkali Activated Slag and other Supplementary Cementitious Blends	8	12
Medium Setting Type GB Cements Cement/Slag blend (50% to 60% cement content) Cement/Fly Ash blend (70% to 80% cement content) Cement/Slag/Fly Ash blend (55% to 65% cement content)	3	5
Rapid Setting Type GP Cement	2	3
Lime		
Hydrated Lime and Quicklime	12	24

(d) Cementitious Binder Content and Unconfined Compressive Strength (UCS)

Table 307.053 specifies the limits for the minimum and maximum content of cementitious binder and the target UCS to be used to select the optimum cementitious binder content from test specimens prepared at a minimum of three different binder contents varying by not less than 0.5% by mass in accordance with referenced test methods.

Table 307.053 - Target UCS to be used to Select the Optimum Content of Cementitious Binder (7 days)

Type of Work	Cementitious Binder Content (% by mass)		Target 7 day UCS at modified compactive effort (MPa)		
	Min	Max	Slow Setting	Medium Setting	Rapid Setting
Material Modification	1.5 *	3.5	1.0	1.5	2.0
Fully bound (Deep-lift Stabilisation)	4.0	5.5	2.5	3.5	Not Applicable
Bound Subbase for Deep Strength Asphalt Pavements where Assigned Design Modulus is not more than 500 MPa	3.0	Not Applicable	2.5	3.5	5.0

* The Superintendent may agree to a cementitious binder content of less than 1.5% but at least 1% by mass if the UCS requirement at a binder content of 1.5% is more than 50% above the target UCS. If less than 1.5% by mass of cementitious binder is permitted, a minimum of two mixing runs shall be undertaken after spreading of cementitious binder and the minimum density ratio specified in Clause 307.13 shall be increased by one percentage point.

307.06 COMMENCEMENT OF WORK

HP The Contractor shall not commence work until all mix design details have been presented to the Superintendent showing compliance with the requirements of Clause 307.05 and approval has been given for stabilisation work to proceed.

307.07 CONSTRUCTION PLANT

The Contractor shall provide construction plant meeting the following requirements and capability.

(a) Spreader for Cementitious Binder

Mechanical equipment specifically designed for the spreading of cementitious binder directly on to the prepared roadbed shall be used. The spreader shall be capable of accurately regulating the discharge of the cementitious binder such that the requirements of Clause 307.14 are met.

(b) Mixing Machine

A purpose built mixing machine designed for in situ stabilisation of roadworks shall be used to pulverise the existing pavement material and uniformly mix the material together with water and cementitious binder to the specified depth of stabilisation. Rotary hoes and other types of agricultural machinery shall not be used.

After pulverisation and mixing, all base material shall be capable of passing a 37.5 mm sieve and all subbase material shall be capable of passing a 53 mm sieve.

(c) Watering Plant

Watering plant or any purpose designed watering system incorporated within the mixing machine shall be capable of uniformly distributing sufficient water to hydrate any quicklime used for lime pre-treatment and if required, add more water to increase the moisture content to aid compaction.

(d) Compaction Plant

Compaction plant shall be of such mass as to be capable of compacting the stabilised layer to the minimum density ratio throughout the depth of the layer.

Where compaction is to be accepted on a procedural basis rather than by lot testing, the Superintendent and the Contractor shall agree on the number and minimum mass of rollers and the compaction routine to be used. If the compacted depth of layer exceeds 150 mm, the following items of compaction plant shall be used as a minimum requirement:

- a vibrating pad foot roller for initial compaction;
- a vibrating steel flat roller for densification;
- a multi wheel roller for finishing and sealing off the surface prior to trafficking.

307.08 CONSTRUCTION**(a) General**

Construction includes the pulverisation of any seal or asphalt surfacing, premixing of in situ materials, supply and spreading of any additional granular material, supply, spreading and mixing of cementitious binder into the in situ pavement material, and compaction, trimming and curing of the stabilised layer.

Unless otherwise specified, stabilisation work undertaken each day shall be completed across the full pavement width.

Stabilisation operations may continue during light rainfall if the moisture content of the in situ pavement material can be maintained below modified optimum moisture content.

Only sufficient area of pavement is to be pulverised that can be mixed and fully compacted in one day. For stabilised patching work which is to be trafficked or sealed immediately after completion of compaction, only sufficient pavement area shall be opened up to enable work to be completed within the maximum allowable working time specified in Table 307.052.

(b) Preparation of the Existing Pavement

The existing pavement shall be pulverised and mixed to the proposed depth of stabilisation prior to spreading of the cementitious binder. If significantly different in situ materials are present across the width of pavement to be stabilised, the Contractor shall use a system for cross blending materials as necessary, to produce a uniform material prior to addition of cementitious binder.

In locations where a pavement has been pre-treated with lime to dry the material out or lower the Plasticity Index, addition of further cementitious binder and remixing shall not commence until the following day.

The Contractor shall remove or re-pulverise lumps of asphalt or seal which would otherwise be retained on a 53 mm sieve. The volume any large size material removed from the site shall be replaced with an equivalent volume of suitable granular pavement material.

(c) Lime Pre-treatment

If the material to be stabilised is to be first pre-treated with lime to lower its plasticity, lime shall be spread uniformly over the prepared surface at the Lime Spreading Rate calculated using formula (i) or (ii) below.

- (i) Where hydrated lime has been used in the laboratory testing to determine the Design Distribution Rate of Available Lime and it is proposed to use quicklime at the job site, the Lime Spreading Rate shall be determined from:

$$\text{Lime Spreading Rate} = 0.76 \times \frac{\text{Design Distribution Rate of Available Lime}}{\text{ALI of Lime to be Used (\%)}}$$

- (ii) Where the same type of lime (hydrated lime or quicklime) is to be used at the job site as has been used in the laboratory tests to determine the Design Distribution Rate of Available Lime, the Lime Spreading Rate shall be determined from:

$$\text{Lime Spreading Rate} = \frac{\text{Design Distribution Rate of Available Lime}}{\text{ALI of Lime to be Used (\%)}}$$

If quicklime is used it shall be slaked with sufficient water to allow full slaking to take place prior to mixing. Full slaking will be deemed to have been achieved when all quicklime that has been spread has changed from a cream coloured granulate to a fine white powder and there is a cessation of rising vapours.

Mixing of quicklime into the pavement material shall not commence until full slaking has been achieved.

(d) Spreading of Lime or Cementitious Binder

Spreading shall not be carried out at times when lime or cementitious binder could become air borne or dispersed in such a way as to become a nuisance or a hazard to persons, property or livestock.

Immediately following completion of spreading, the Contractor shall check and record the Average Spreading Rates and the Uniformity of Spread in accordance with Clause 307.15. If the required Spreading Rate for lime or cementitious binder exceeds 15 kg/m², it shall be spread in two equal spreading runs with material from the first spread run being fully mixed into the pavement material prior to the second spreading run being undertaken.

The prepared pavement shall not be trafficked until the cementitious binder has been mixed into the pavement material.

(e) Mixing in Cementitious Binder

Mixing shall commence as soon as practical after spreading of the cementitious binder and shall continue until all pavement materials and cementitious binder are uniformly blended throughout the full depth of the stabilised layer.

The moisture content of the pavement material prior to addition of the cementitious binder shall be within the range 80% to 100% of the Modified optimum moisture content. Additional water shall be added to hydrate the cementitious binder.

For modified or deep-lift stabilisation, a minimum of two mixing runs shall be carried out. For deep-lift stabilisation, approximately half of the cementitious binder shall be spread in advance of each run. Unless otherwise specified, the depth of stabilisation or compacted layer thickness for stabilisation shall not exceed 350 mm.

(f) Compaction

Compaction of the stabilised layer shall commence immediately after mixing. Compaction equipment shall work as close as practicable behind the mixer to maximise the time available for compaction. Compaction and trimming shall be carried out in a continuous operation.

All compaction shall be completed within the times specified in Table 307.052 after addition of the cementitious binder.

Where necessary during compaction, the Contractor shall water the material to maintain the moisture content within 80% to 100% Modified optimum moisture content.

(g) Trimming

On completion of initial rolling, the stabilised material shall be trimmed to the specified surface tolerances. Light applications of water may be applied during this operation to replace evaporated moisture and to assist in rapid achievement of a tightly knit surface.

All surface irregularities which do not conform to the requirements of Clause 307.03 shall be rectified by the Contractor within the maximum working time for the cementitious binder used as specified in Table 307.052. Rectification beyond the maximum working time for the cementitious binder shall be carried out by replacing material with freshly stabilised material as necessary.

The material trimmed off shall be either cut to waste and if necessary, removed from site or, alternatively it may be transported to another location to be incorporated into a stabilised layer.

307.09 JOINTING

Longitudinal joints shall be avoided by completing a full carriageway width each day. If a longitudinal joint is required, because of rain or traffic control requirements, it shall be located at a lane line or in the centre of the carriageway. Transverse joints shall be formed where stabilisation operations have been halted for more than the time specified in Table 307.052 and at the end of each day's work.

Joints shall be formed by cutting back into the fully compacted previously stabilised material by a minimum of 300 mm which shall be remixed into the new work. Additional stabilising agent shall be added to the area of previously stabilised material to be remixed. Placement of additional cementitious binder shall be deemed to be part of the joint construction.

The level and shape of the surface at all joints shall be within the limits specified in Clause 307.03.

307.10 TEST ROLLING

Stabilised layers shall pass test rolling in accordance with Section 173, prior to acceptance of the layer.

Any unstable areas detected by test rolling shall be rectified.

307.11 MAINTENANCE OF THE STABILISED SURFACE PRIOR TO SURFACING OR OVERLAY

The Contractor shall keep the stabilised pavement surface moist and protected from damage by traffic or construction activities until either a further pavement layer or the bituminous surfacing is applied.

307.12 PRELIMINARY TRIAL

If directed by the Superintendent, the Contractor shall carry out a preliminary trial of the proposed stabilising operation.

The trial shall determine:

- (a) the effectiveness of the construction plant;
- (b) the number of passes of the stabilisation machine necessary to achieve uniform pulverisation and mixing;
- (c) the field moisture content required to achieve specified compaction requirements;
- (d) the rolling routine required to meet specified compaction requirements.

The trial section shall be located within the Works area.

The length of the trial section shall be between 100 and 200 metres over the full width of the area proposed for stabilisation.

HP Stabilisation work shall not proceed outside the trial section until the Superintendent has reviewed all aspects of the stabilising operation. The Superintendent's review of the stabilising plant and procedures will be provided to the Contractor by the end of the next working week day after the trial's completion. If the Specification requirements are not met for this trial section, the Superintendent may direct that another trial section be stabilised or the rejected section be re-stabilised and presented for re-assessment.

307.13 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF COMPACTION AND STRENGTH

(a) General

(i) Lot Testing Requirements

Where a Scale A1, A2 or Scale B compaction standard is specified in Table 307.161, compaction is to be accepted by density testing in lots of similar material and work. Unless otherwise specified, the maximum lot size shall be the area of work completed on the same day up to 4,000 m² provided that the whole of the lot is essentially a uniform material similar to material used for the relevant mix design applicable to the lot. If the maximum binder working time requires the area or work to be completed in one day to split into sub-sections, each sub-section shall be treated as a separate lot.

If the material is too variable to be able to assign a single maximum dry density for the lot, a separate reference density shall be determined for each test site.

If a compaction Scale is not specified in Table 307.161, the Scale C compaction procedure shall be adopted.

The calculation of density ratio shall be based on Modified compactive effort of the laboratory prepared sample containing the design rate of cementitious binder.

The work shall be assessed for compliance with Scale A1 or A2, Scale B or Scale C requirements for testing and acceptance of compaction as specified in Clauses 307.13(b), (c) and (d) and Clause 307.16.

(ii) Determination of the Density Ratio

If it is not possible to transport extracted samples of mixed material to an established laboratory for determination of the reference density within the maximum working time of the cementitious binder, and the Superintendent agrees that establishment of a site laboratory for this purpose is not warranted, the following procedure shall be used to determine the Density Ratio:

1. measure field density on completion of compaction;
2. extract samples and transport to an offsite laboratory;
3. determine the reference density for the laboratory compacted samples as soon as practicable but not exceeding 24 hours;
4. determine the Density Ratio (DR) from -

$$DR = DR_t \times DDCF$$

Where: DR_t = Density Ratio calculated using the reference density determined at time (t)

$DDCF$ = Density Decay Correction Factor determined from Table 307.131 corresponding to time (t), the binder type and the time of year construction is being undertaken.

Table 307.131 - Density Decay Correction Factors

Time (t) from Addition of Binder to Completion of Laboratory Compaction (hours)	Cementitious Binder (construction between October and April)			Cementitious Binder (construction between May and September)		
	Slow Setting	Medium Setting	Rapid Setting	Slow Setting	Medium Setting	Rapid Setting
1 to 2	1	1	1	1	1	1
2 to 4	1	1	0.994	1	1	1
4 to 6	1	0.994	0.990	1	1	0.991
6 to 8	1	0.991	0.985	1	0.993	0.987
8 to 12	0.998	0.988	0.978	1	0.990	0.981
12 to 18	0.993	0.981	0.965	0.996	0.983	0.971
18 to 24	0.987	0.973	0.951	0.990	0.977	0.958

For individual jobs more than 10000 m² where the material to be stabilised is of a similar nature throughout, the Contractor shall determine and apply a job specific DDCF determined in accordance with the relevant Test Method specified in VicRoads Code of Practice 500.16.

(b) Scale A1 and A2 Requirements for Testing and Acceptance of Compaction

- (i) Scale A1 assessment shall be used where the in situ material is sufficiently consistent to be assigned a Maximum Dry Density for the lot.

If a single maximum dry density can be assigned to the lot the work represented by the lot will be accepted as far as compaction is concerned if the characteristic value of density ratio obtained from six randomly selected test sites within the lot is not less than 95.0%.

If the characteristic value of density ratio of the lot is less than 95.0%, but greater than or equal to 90.0% the work represented by the lot may be accepted as far as compaction is concerned but payment for the whole of such work will be made at a rate calculated using the formula:

$$P = 6R_c - 470$$

where R_c is the characteristic value of density ratio of the lot and P is the rate of payment expressed as a percentage of the value of work represented by the lot provided that the value of P shall not exceed 100. For the application of this formula, the value of the work represented by the lot shall be calculated using the unit rate specified in Clause 307.16(b).

- (ii) Scale A2 assessment shall be used where in situ material is too variable to assign a Maximum Dry Density to the lot.

If the material is too variable to assign a single maximum dry density to the lot and requires separate maximum dry densities to be determined for each test site, the work represented by the lot will be accepted, as far as compaction is concerned, if the mean value of the density ratio obtained from three randomly selected test sites within the lot is not less than 97% with no individual value being less than 90%.

If the mean value of density ratio of the lot is less than 97%, but greater than or equal to 92%, the work represented by the lot may be accepted but payment for the whole of such work will be made at a rate calculated using the formula:

$$P = 6R_m - 482$$

where R_m is the mean value of density ratio of the lot and P is the rate of payment expressed as a percentage of the value of work represented by the lot provided that the value of P shall not exceed 100. For the application of this formula, the value of the work represented by the lot shall be calculated using the unit rate specified in Clause 307.16(b).

Work which has a mean value of density ratio of less than 92% shall be rejected and the Contractor shall submit a proposal to rectify the work to the Superintendent for approval.

(c) Scale B Requirements for Testing and Acceptance of Compaction

The work represented by the lot will be accepted as far as compaction is concerned if the mean of the individual density ratio test values from three randomly selected test sites for the lot is not less than 95.0%.

If the mean of the individual density ratio test values for the lot is less than 95.0% but greater than or equal to 90.0%, the work represented by the lot may be accepted as far as compaction is concerned but payment for the whole of such work will be made at a rate calculated using the formula:

$$P = 6R_m - 470$$

where R_m is the mean of the individual density ratio test values for the lot and P is the rate of payment expressed as a percentage of the value of work represented by the lot provided that the value of P shall not exceed 100. For the application of this formula, the value of the work represented by the lot shall be calculated using the unit rate specified in Clause 307.16(b).

(d) Scale C Requirements for Acceptance of Compaction

The Superintendent may direct the Contractor to construct a trial section of stabilised pavement as specified in Clause 307.10.

Acceptance of work will be based upon on compaction plant to be used, compaction routine and a density monitoring procedure using a nuclear gauge and proof rolling as specified or agreed between the Superintendent and the Contractor.

Any unstable areas within limits of work and depth of stabilisation detected by test rolling shall be rectified by the Contractor and re-presented for test rolling.

(e) Assessment of Compaction for Thick Layers

For compacted layers in excess of 200 mm thick, the Contractor shall measure the field density of the layer in two sub-layers of equal thickness in accordance with the relevant Test Method. At each test site the sub-layer with the lower of the two density test results shall be used in the calculation of the Characteristic or Mean Density Ratio for assessment of compaction in accordance with Clause 307.13.

307.14 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF SPREADING RATES

(a) Mat or Tray System

The average spreading rate of lime or cementitious binder shall be ascertained by dividing the mass of cementitious binder spreading by the area over which the cementitious binder has been spread. Where the average spreading rate is less than the specified or design spread rate, additional cementitious binder shall be spread to bring the average rate up to at least the design spread rate.

The Contractor shall check the uniformity of spreading rate of lime or cementitious binder at the frequency specified in Clause 307.15 by placing a minimum of three mats or trays with a plan area not less than 1 m² in the path of the spreading vehicle at an equal spacing of not less than 25% of the length of the spreading run. The spreading rate over each mat or tray shall be calculated by dividing the mass of lime or cementitious binder deposited on each mat or tray by the plan area of the mat or tray. Where the spread rate so determined for any mat or tray is less than the specified rate by more than 10%, additional cementitious binder shall be spread over the part or all of the area over which the lime or cementitious binder has been spread.

(b) Continuous Weighing System

The mass of lime or cementitious binder spread over the pavement surface may be measured and recorded by a spreader fitted with a fully calibrated electronic weigh scale system capable of continuously measuring and recording the mass of lime or cementitious binder at intervals of not more than 100 m of forward travel. The Contractor shall have a current certificate of calibration for the computerised spreading equipment and shall produce evidence of the actual running spread rate when requested by the Superintendent.

307.15 MINIMUM TESTING FREQUENCY

The Contractor shall test the materials and the stabilised pavement layer at a frequency which is sufficient to ensure that the materials and work under the Contract comply with the specified requirements but not less than the frequency specified in Table 307.151.

Table 307.151

Test	Minimum Frequency of Testing
Available Lime / Available Lime Index	One test per production day at the point of manufacture.
Uniformity of Spreading Rate of Lime or Cementitious Binder	A mat or tray test (minimum of 3 mats or trays as specified in Clause 307.14(a)) for each separate continuous spreading run except where calibrated load cell computerised spreading devices are fitted with a system to continuously monitor the spread rate every 100 m.
Average Spread Rate of Lime or Cementitious Binder	Each continuous spreader run. Based on the total tonnage used for the run (kg) divided by the area covered (m ²).
Uniformity of Mixing	For each compaction lot – Visual inspection of six random test holes excavated for the full depth of the loose material after mixing of the binder and prior to commencement of compaction.
Characteristic or Mean Density Ratio	Every lot as defined in Clause 307.13(a).

307.16 SCHEDULE OF DETAILS

(a) Job Details **##Consultant to provide details**

Table 307.161

Road	Location		Layer	¹ Type of Work (Modification, Bound Subbase or Deep Lift)	Compacted Thickness of Stabilised Layer (mm)	² Depth of Additional Granular Material (mm)	Requirements for Acceptance of Compaction (Scale A1, A2, B or C)
	From	To					
##	##	##	##	##	##	##	

Notes on Table 307.161

1. Describe as:

Modification (material modification)

Bound Subbase (fully bound subbase for a Deep Strength Asphalt Pavement)

Deep Lift (fully bound deep lift stabilisation)

2. The amount of additional granular material to be spread and mixed in with the in situ material expressed as an equivalent compacted depth.

(b) ~~Unit rate for Assessment of Payment Deduction~~

~~The unit rate to be used to calculate the value of the work represented by the lot for application of payment deduction formulae specified in Clauses 307.13(b) and (c) shall be \$##/sq m (refer to Guide Notes).~~

- (c) Stabilised Mixture Design ~~##(strikethrough this clause if the design of the stabilised mixture has already been undertaken and spread rates for binder and any additional granular material is to be specified in Clauses 307.16(d) and (e) below):~~

The Determination of the Design Distribution Rate of Cementitious Binder and the grading of any additional granular material required to correct the grading of the material to be stabilised shall be determined in accordance with Clause 307.05.

- (d) Details of Stabilised Mix Design and Spreading Rates ~~##(strikethrough this clause if the Contractor is required to design the stabilised mixture and determine spread rates under Clause 307.16(c) above):~~

Table 307.162

Road	Location		Design Distribution Rate for Lime Pre-treatment (kg/m ²)	Type of Cementitious Binder	Spread Rate for Cementitious Binder (kg/m ²)	Spread Rate for Additional Granular Material (kg/m ²)
	From	To				
##.	##.	##.	##.	##.	##.	##.

- (e) Grading and Plasticity Requirements for Additional Granular Material ~~##(strikethrough this clause if additional granular material is not required or the Contractor is to determine the grading of additional granular material to satisfy mix design requirements):~~

Table 307.163

Material	Percentage passing by mass								PI (max)
	26.5	19	13.2	9.5	4.75	2.36	0.425	0.075	
##.	##.	##.	##.	##.	##.	##.	##.	##.	##.