SECTION 16 - IN-SITU STABILISATION OF EXISTING PAVEMENT MATERIALS

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16.1 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, supply of cementitious binders, construction plant, and spreading, mixing, and compaction of pavement layers.

16.2 DEFINITIONS

Cementitious Binder

A cementing agent which binds the particles of a granular pavement material together to increase its strength.

Cementitious binders include Portland cement Type GP or blended cement Type GB, hydrated lime, quicklime, or a blend of ground granulated blast furnace slag (GGBFS), hydrated lime, fly ash, 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 using a high spread rate of very slow setting cementitious binder and use of heavy compaction equipment to produce a very strong fully bound pavement.

Density Decay Correction Factor

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

Equivalent Calcium Oxide Content

Equivalent calcium oxide content is the amount of calcium oxide, expressed as a percentage by mass, which:

(a) in quicklime produces calcium hydroxide after slaking with water;

(b) in hydrated lime is chemically proportional to the amount of calcium hydroxide available after slaking with water.

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.

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 which in itself possesses little or no cementitious value but which in finely divided form may be mixed with lime or Portland cement to form a cementitious material.

Quicklime

Quicklime is a granular form of lime consisting primarily of calcium oxide and which can be readily slaked.

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.

16.3 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

The level of the top of the stabilised layer shall not differ from the specified level by more than 20 mm.

(b) Thickness

The thickness of the stabilised layer at any point shall be not less than the thickness specified by more than 15 mm. The average thickness of the layer over any 100 m section for the full carriageway width shall be not less than the specified thickness as determined from measurements taken at intervals no greater than 20 m at the edges of the pavement layer, at all changes of gradient across the pavement and at intervals not exceeding 2 m across the pavement.

(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 layer shall be not less than the specified width by more than 50 mm and not greater than the specified width by more than 100 mm. The average width of the layer determined from measurements at 6 sites selected randomly over any 300 m shall be not less than the specified width.

(e) Shape

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

16.4 MATERIALS

(a) Cementitious Binders

(i) Cement

Cement shall be supplied by the Contractor and shall be General Purpose Portland Cement Type GP or Blended Cement Type GB complying with AS 3972. The Contractor shall nominate the type, brand and source of cement or blended cement.

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

(ii) Quicklime

Quicklime shall be supplied in accordance with AS 4889.1

The equivalent calcium oxide content of quicklime shall be not less than 60%.

The residue of quicklime after slaking shall not exceed 30%.

(iii) Hydrated Lime

Hydrated Lime shall not be used.

(iv) Slag/Lime Blend

Slag and lime may be used in blended combination as a stabilising additive. The requirements for lime shall be as specified in Clause 16.4(a)(ii) and (iii) 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.

Slag/lime shall be blended uniformly in the ratio of 85% slag to 15% lime unless laboratory testing indicates that superior strength is achieved by a different ratio. The Contractor shall provide evidence that the blend ratio has been met for all material supplied to the job. Slag/lime blend shall have a mortar bar 7 day compressive strength of 10 MPa and 28 day mortar bar compressive strength of 20 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.

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

Special blends of 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 16.4 (iv) above and the specified mix requirements.

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

(b) Water

Water shall be clear and substantially free from impurities such as oils, salts, organic substances acids, alkalis and vegetable substances. The amounts of chloride and sulphate shall each be no greater than 300 ppm.

(c) Pavement

The insitu 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.

16.5 PAVEMENT MATERIALS INVESTIGATION AND MIX DESIGN

(a) General

Unless otherwise specified, the Contractor shall produce a mix design for the insitu stabilised pavement material in accordance with VicRoads Test Methods and Codes of Practice. The aim of the mix design procedure under the Test Method for Determination of the Proportion of Additives to be added to Granular Pavement Materials Stabilised with Cementitious Binders 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 insitu material. The insitu 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 limits for the material to be stabilised after addition of any granular additive, if required, to correct the grading shall be in accordance with Table 16.5.1.

If the PI exceeds the limits specified in Table 16.5.1 the material shall be pre-treated with lime or modified with granular additive as 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 16.5.1 - 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
Sub-base and Sealed Shoulders (% passing by mass)	90 - 100	75 - 100	50 - 100	30 - 80	15 - 45	3 - 30	15

(c) Cementitious Binder Content and Unconfined Compression Strength (UCS)

The cementitious binder content and the UCS of laboratory prepared samples compacted using modified compactive effort shall meet the requirements of Table 16.5.2.

Table 16.5.2 - Cementitious Stabilising Agent Content and Minimum UCS Requirements (7 days)

Type of Work	Cementitious Stabilising Agent Content (% by mass)		Minimum 7 day Unconfined Compression Strength at modified compactive effort (MPa)		
	Min	Max	GP Cement	GB Cement	Slag/Lime blends
Material Modification	2.0	3.0	2	1.5	1
Fully bound (Deep-lift Stabilisation)	4.5	5.5	Not Applicable	3.5	2.5

(d) 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 16.5.3 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.

If the Contractor proposes to use an alternative cementitous binder to those included in Table 16.5.3, 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 16.5.3 - 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
Type GP Cement	2	3
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
Slag/Lime Blend (85% slag / 15% lime)	8	12
Lime	12	24

Note 1: If the ambient temperature within the period from October to April on any day is less than 15° C, the May to September maximum allowable working times may be applied.

16.6 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 16.5 and approval has been given for stabilisation work to proceed.**

16.7 CONSTRUCTION PLANT

(a) General

The Contractor shall provide and operate sufficient spreading, mixing, watering and compaction plant to complete the work in accordance with the requirements of this specification having regard to the maximum allowable working time for the type of cementitious binder, time of year, and the thickness of the layer being stabilised as specified in Table 16.5.3.

(b) 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 16.14 are met.

(c) Stabilisation Machine

The pulverisation and mixing of pavement material together with water and cementitious binder shall be carried out by a purpose designed machine for insitu stabilisation of road pavements. Rotary hoes and other types of agricultural machinery shall not be used. The stabilising machine shall be capable of pulverising the existing pavement and mixing the cementitious binder uniformly throughout the layer. After pulverisation and mixing, all material shall be capable of passing a 53 mm sieve.

(d) Watering Plant

Watering plant shall be capable of uniformly distributing water in a fine spray either by a water cart or by a purpose designed system capable of spraying sufficient quantity of water at a uniform rate directly into the chamber of the stabilising machine.

(c) Compaction Plant

Unless otherwise specified 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.

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

Where compaction is to be accepted on a procedural basis rather than lot testing, and if not otherwise specified, the Superintendent and the Contractor shall agree on the number and minimum mass of rollers and the compaction routine to be used.

16.8 CONSTRUCTION

(a) General

Construction includes the pulverisation of any seal or asphalt surfacing, premixing of insitu materials, supply and spreading of any additional granular material, supply, spreading and mixing of cementitious binder into the insitu 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 insitu 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 16.5.3.

HP Stabilisation work shall not commence until the boxing has been checked for correct levels.

(b) Preparation of the Existing Pavement

The existing pavement shall be pulverised and mixed to proposed depth of stabilisation prior to spreading of the cementitious binder.

In locations where a pavement has been pretreated with hydrated lime to dry the material out or lower the Plasticity Index, addition of further stabilising agent and remixing shall not commence until the following day.

The Contractor shall remove or re-pulverise lumps of asphalt or seal which are 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 material.

(c) Spreading of Cementitious Binder

Spreading shall not be carried out during windy periods where airborne stabilising agent could be a hazard to persons, property or livestock.

The Design Spread Rate is determined by the mix design (% of cementitous binder) carried out in accordance with Clause 16.5 and Table 16.8.1 below.

Table 16.8.1 Design Spread Rate for Binder Kg/m²
(Weight of pavement materials assumed at 2.0 T/m³)

% Lime/ Cement	Compacted Depth (mm)					
	100	150	200	250	300	350
	Kg/m²	Kg/m²	Kg/m²	Kg/m²	Kg/m²	Kg/m²
2	4.0	6.0	8.0	10.0	12.0	14.0
3	6.0	9.0	12.0	15.0	18.0	21.0
4	8.0	12.0	16.0	20.0	24.0	28.0

The cementitious binder shall be spread uniformly over the prepared surface at the Spread Rate set out below.

(i) Lime:

The Spread Rate of lime shall be adjusted for equivalent calcium oxide content using the following formula as follows:

$$\text{Spread Rate} = \frac{\text{Design Spread Rate} \times 100}{\text{Equivalent Calcium Oxide Content}} \quad (\text{kg/m}^2)$$

(ii) Cement:

Spread Rate = Design Spread Rate (kg/m²)

Where quick lime is used, it shall be slaked with sufficient water to allow complete hydration such that the material remains friable after slaking.

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

(d) Mixing

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 deep-lift stabilisation where a fully bound stabilised layer is to be constructed, two mixing runs shall be carried out with approximately half of the cementitious binder being spread in advance of each run. Unless otherwise specified, the depth of stabilisation or compacted layer thickness for deep-lift stabilisation shall not exceed 350 mm. The cementitious binder used for deep-lift stabilisation shall have minimum working time of 8 hours.

HP Where lime and cement are both used, they shall not be mixed at the same time. An interval of 24 hours (min) shall be maintained between mixing of lime and subsequent mixing of cement.

(e) 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 16.5.3 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.

(f) 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 16.3 shall be rectified by the Contractor within the maximum working time for the cementitious binder used as specified in Table 16.5.3. 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.

HP The stabilised layer shall be checked for depth and approved by the Superintendent prior to the placing of any road pavement material.

16.9 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 16.5.3 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 16.3.

16.10 TEST ROLLING

Stabilised layers shall pass test rolling in accordance with the following procedure, prior to acceptance of the layer. The Contractor shall rectify any unstable areas detected by test rolling.

HP The Contractor shall submit to the Superintendent for review and approval a test rolling procedure to be used. The procedure shall include timing of the test, method of preparation for the test and extent of test rolling.

Plant to be used in the test rolling procedure shall comply with the following requirements:

(a) Static smooth steel-wheeled roller shall have a mass of not less than 12 tonnes and a load intensity under either the front or rear wheels of not less than 6 tonnes per metre of wheel width.
(b) Pneumatic tyred plant shall have a ground contact pressure under either the front or rear wheels of not less than 450 kPa per tyre. The area over which this ground pressure shall be applied shall not be less than 0.035 sq m per tyre.
(c) Water tanker with a load capacity of 12,000 litres.

HP **Test rolling shall be undertaken in accordance with the approved procedure in the presence of the Superintendent.**

Compliance with the test rolling requirements shall be when an area withstands test rolling without visible deformation or springing.

If directed by the Superintendent, the Contractor shall carry out further test rolling on the layer prior to it being covered by the succeeding layer. No additional payment will be made for any direction to carry out such further test rolling.

16.11 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.

16.12 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 50 and 100 metres over the full width proposed to be stabilised.

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.

16.13 REQUIREMENTS FOR TESTING &ACCEPTANCE OF COMPACTION & STRENGTH

(a) General

(i) Lot Testing Requirements

Where a Scale A or Scale B compaction standard is specified in Table 16.16, 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 10,000 m^2 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 material appears to vary significantly from the material used to assign the maximum dry density for the relevant mix design applicable to the lot, additional samples to assign a revised maximum dry density may be undertaken in accordance with the relevant VicRoads Test Methods. Alternatively, if the material is too variable to be able to assign a single maximum dry density for the lot, separate maximum dry densities shall be determined for each test site.

If a compaction Scale is not specified in Table 16.16, 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 A, Scale B or Scale C requirements for testing and acceptance of compaction as specified in Clauses 16.13(b), (c) and (d) and Clause 16.16.

(ii) Determination of the Reference Maximum Dry Density

Where it is not practical by use of a site laboratory to perform laboratory compactions for determination of reference maximum dry density before the specified maximum allowable working time has expired as specified in Table 16.5.3, one of the following alternative methods shall be used.

Method 1 - For continuous jobs up to 5000 m^2

Measure field density at the completion of compaction and extract samples for determination of the reference maximum dry density before expiry of the maximum allowable working time and place samples in a refrigerator or refrigerated container capable on maintaining the sample at a temperature of between 2°C and 8°C during transport and later storage in the laboratory until the material is compacted in the mould.

Method 2 - For continuous jobs up to 5000 m^2

Measure field density on completion of compaction, extract samples and transport to an offsite laboratory and determine the maximum dry density of the laboratory compacted samples as soon as practicable.

The Reference Maximum Dry Density (RMDD) for calculation of the Density Ratio shall be determined from:

$$\mathbf{RMDD = DLC \times DDCF}$$

Where: DLC = Density of Laboratory Compacted Sample at time (t)
DDCF = Density Decay Correction Factor determined from Table 16.13.1 corresponding to time (t), the binder type and the time of year construction is being undertaken.

Method 3 - For continuous jobs more than 5000 m^2

Proceed as described in Method 2 but apply the relevant job specific density decay correction factor for the material and type of cementitious binder used as determined by the VicRoads Test Method.

Table 16.13.1 - 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)		
	Type GP Cement	Type GB Cement	Slag/Lime	Type GP Cement	Type GB Cement	Slag/Lime
1 to 2	1	1	1	1	1	1
2 to 4	1.006	1	1	1	1	1
4 to 6	1.010	1.006	1	1.008	1	1
6 to 8	1.015	1.008	1	1.013	1.007	1
8 to 12	1.023	1.012	1.002	1.019	1.010	1
12 to 18	1.036	1.019	1.007	1.030	1.017	1.004
18 to 24	1.052	1.028	1.013	1.044	1.024	1.010

(b) Scale A Requirements for Testing and Acceptance of Compaction

(i) Where 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:

$$P = 6R_c - 470$$

in which 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 Contractor shall submit a unit rate for cement stabilisation including any granular additive to calculate the value of work represented by the lot.

(ii) Where 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:

$$P = 6R_m - 482$$

in which Rm 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 Contractor shall submit a unit rate for cement stabilisation including any granular additive to calculate the value of work represented by the lot.

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 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:

$$P = 6R_m - 470$$

in which 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 Contractor shall submit a unit rate for cement stabilisation including any granular additive to calculate the value of work represented by the lot.

(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 16.10.

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) Unconfined Compressive Strength (UCS) for Fully Bound Deep-lift Stabilised Layers

The mean UCS shall be determined at the frequency specified in Table 16.15.1. The minimum mean UCS of core samples taken from the field after 7 days of field curing shall be more that 50% of the laboratory value specified in Table 16.5.2 for the type of cementitious binder used. If the lot represented by the UCS testing meets specified compaction requirements, but does not meet specified UCS requirements, a review of the mix design shall be undertaken and the mix shall adjusted as necessary. Further, if the mean UCS from three random core samples representing the lot after 28 days is less than 3 MPa, the lot shall be rectified or alternatively, the Superintendent may impose a penalty based on an assessment the loss of pavement life having regard to the reduced stiffness.

16.14 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF ADDITIVE CONTENT

(a) Mat or Tray System

The average spreading rate of 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 the spreading of cementitious binder at the frequency specified in Clause 16.15 by placing mats or trays with a plan area not less than 1 m^2 in the path of the spreading vehicle and dividing the mass of cementitious binder deposited on each mat 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 cementitious binder has been spread.

(b) Continuous Weighing System

The mass of 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 cementitious binder at intervals of not more than 100 m of forward travel. The recorded measurements of spread rate shall be made available to the Superintendent on request.

16.15 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 which is not less than that shown in Table 16.15.1.

Table 16.15.1

Test	Minimum Frequency of Testing
Equivalent Calcium Oxide Content of Lime	One test per production day
Uniformity of Spreading of Cementitious Binder	Three tests for each separate area of work except where calibrated load cell computerised spreading devices are fitted with a system to continuously monitor the spread rate every 100 m. 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.
Average Spread Rate of Cementitious Binder	Each separate area of works
Density Ratio	Every lot as defined in Clause 16.13(a)
Unconfined Compression Strength for Deep-lift Stabilisation (fully bound layer)	On three randomly selected core samples after 7 days field curing taken from the first lot presented for density testing and on three randomly selected cores taken from every fifth lot presented for density testing thereafter. (Cores shall be extracted to enable UCS testing to be completed before the expiry of the eighth day after construction.)

16.16 SCHEDULE OF DETAILS

Refer to Section 1 – Contract Specific Clauses and Schedules.