SECTION ELEVEN

INSITU LIME STABILISATION OF SUBGRADE

11.01 DESCRIPTION

This section covers the requirements for materials and construction for the insitu lime stabilisation of the subgrade. The requirements relate to preparation of soil, quality of lime, spreading and mixing of lime, and compaction of the stabilised layer.

11.02 DEFINITIONS

Quicklime*:*	Quicklime is a granular form of lime consisting primarily of calcium oxide and which can be readily slaked.
Hydrated lime:	Hydrated lime is a powdered form of lime consisting primarily of calcium hydroxide.
Equivalent calcium oxide content:	Equivalent calcium oxide content is the amount of calcium oxide, expressed as a percentage by mass, which: (a) in quicklime produced calcium hydroxide after slaking; (b) in hydrated lime is chemically proportional to the amount of calcium hydroxide available after slaking.

11.03 CONFORMITY WITH DRAWINGS

Lime stabilised layers shall be finished to conform within the following limits to the levels, lines, grades, thicknesses and cross sections specified or shown on the drawings:

(a) Level

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

(b) Thickness

The thickness of the lime stabilised layer at any point shall not be less than the thickness specified in Schedule 1 by more than 15mm. The average thickness of the layer as determined from measurements over any 100m on any lane shall be not less than the specified thickness.

(c) Alignment

Where the lime stabilised layer is placed against a boxing edge, the layer shall abut that edge. Where there is no edging, the edges of the lime stabilised layer shall be not deviate by more than 50mm from the designed offset from centreline or design line.

(d) Width

Other than between boxing edges, the width of the lime stabilised layer shall be not less than that specified or shown on the drawings.

(e) Shape

No point on the surface of the lime stabilised layer shall lie more than 15mm below a 3m straightedge laid in any direction, except across a crown.

11.04 MATERIALS

Materials supplied under the Contract shall comply with the following properties:-

(a) Quicklime

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

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

At the time of spreading, quicklime shall comply with the grading requirements specified in Table 11.041.

Table 11.041

AS Sieve Size (mm)	Test Value (% passing)
9.5	100
4.75	95-100
2.36	85-100

(b) Hydrated Lime

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

Bulk hydrated lime shall be dry and shall have been produced not more than 14 days before delivery.

At the time of spreading, hydrated lime shall comply with the grading requirements specified in Table 11.042.

Table 11.042

AS Sieve Size (mm)	Test Value (% passing)
4.75	100
0.600	95-100
0.075	85-100

Prior to procurement, the Contractor shall confirm to the Superintendent the source from which lime will be obtained.

(c) Water

Water shall be clear and substantially free from detrimental impurities such as oils, salts, acids, alkalis and vegetable substances.

11.05 CONSTRUCTION

(a) General

Construction includes the preparation of soil, spreading of lime, slaking of quicklime, mixing of lime and soil, and compaction, trimming and curing of stabilised soil.

(b) Preparation of Soil

The soil to be stabilised shall be scarified to a depth equal to the specified thickness of the stabilised layer.

Any stones larger than 75mm shall be removed from the scarified soil and the scarified soil shall be compacted sufficiently to provide a reasonably even surface.

Rotary hoes and other agricultural type machinery shall not be used.

(c) Spreading of Lime

Spreading shall not be carried out during windy periods if lime could be dispersed or become a nuisance or a hazard to persons, property or livestock.

Lime shall be spread uniformly over the prepared surface at a rate determined as follows:

$$\text{Spreading Rate} = \frac{\text{Specified distribution rate} \times 100}{\text{Equivalent calcium oxide content}}$$

The specified distribution rate is that rate specified in Schedule 1.

The Contractor shall check and record the uniformity of spreading of lime by placing mats with a plan area not less than 1m2 in the path of the spreading vehicle and dividing the mass of lime deposited on each mat by the plan area of the mat, or by other approved method.

Immediately following completion of spreading of lime, the Contractor shall check and record the average spread rate of lime by dividing the mass of lime spread by the area over which lime has been spread.

Slaking of quicklime or mixing of hydrated lime shall not commence without review by the Superintendent.

(d) Slaking of Quicklime

Quicklime shall be slaked with sufficient water to allow complete hydration such that the material remains friable after slaking.

(e) Mixing

Where quicklime is used, mixing shall not commence until slaking is complete.

All lime spread shall be mixed into the soil to a depth equal to the specified thickness of the stabilised layer within 6 hours of spreading. Mixing shall proceed until all material other than stones can pass a 37.5mm AS sieve and at least 60% of such material can pass a 9.5mm AS sieve and the lime is uniformly mixed throughout the soil. Rotary hoes and other agricultural type machinery shall not be used.

Where the required degree of breakdown of the soil is not achieved on the day of commencement of mixing, the Contractor shall notify the Superintendent and any action to be taken shall be submitted to the Superintendent for review.

The moisture content shall be adjusted as necessary during the mixing process to maintain the moisture ratio greater than 85% as determined by test using Standard compactive effort. If optimum moisture content of the stabilised material has not been determined by compaction testing, it shall be determined on that faction of the material which passes the 19.0mm AS sieve.

(f) Compaction

Compaction shall be completed within 48 hours of the addition of lime.

(g) Trimming

The finished surface shall not be trimmed after completion of compaction.

(h) Treatment of High or Low Areas

Where on completion of compaction the level of any area differs by more than 20mm from the specified level, the Contractor shall notify the Superintendent and, any action to be taken shall be submitted to the Superintendent for review.

11.06 TEST ROLLING

The stabilised layer shall be so compacted that it is capable of withstanding, without visible deformation or springing, test rolling with either a smooth wheeled roller of mass not less than 12 tonne and load intensity on the rear wheels of not less than 6 tonne per metre of width, or a pneumatic tyred roller having tyres inflated to 700 kPa and being loaded to not less than 4.5 tonne per tyre, or such other roller as the Superintendent may approve.

Test rolling shall be carried out by the Contractor in the presence of and to the satisfaction of the Superintendent immediately following the completion of compaction.

11.07 REQUIREMENT FOR ACCEPTANCE OF COMPACTION

(a) General

Unless otherwise specified or approved by the Superintendent acceptance of work as far as compaction is concerned will be based on density testing of the work in lots. A lot will consist of a single layer of work which is considered by the Superintendent to have been constructed under essentially uniform conditions and to be essentially homogeneous with respect to materials and general appearance. The bounds of each lot to be tested will be defined by the Superintendent.

Unless otherwise directed or approved by the Superintendent, density testing will be carried out not less than 48 hours, and not more than 72 hours, after the addition of lime.

The lot will be inspected by the Superintendent and shall be test rolled in accordance with Section 11.06. Any unstable area detected by test rolling or any area which is otherwise deemed unsuitable by the Superintendent will be excluded from the lot by the Superintendent before testing commences. Excluded areas shall be rectified by the Contractor using methods agreed to by the Superintendent except that if the total of the excluded areas exceeds 20% of the area of the lot, the whole of the lot shall, unless otherwise approved or directed by the Superintendent, be ripped, reworked and represented for testing.

For each lot, sites for density testing will be selected on an essentially random basis.

11.08 CURING AND PROTECTION OF COMPACTED LAYERS

The surface of the compacted layer shall be kept sufficiently moist to make good any moisture loss, to lay, test and to maintain about the standard optimum moisture content until the succeeding layer is placed or until any subsequent pavement work under the Contract is commenced or until the Superintendent accepts and take responsibility for that area. Construction or other traffic shall not use a compacted layer without the approval of the Superintendent. The surface shall be kept in good order and condition and be kept free from contamination. Unless otherwise consented to by the Superintendent, placing and compacting of any subsequent layer under the Contract shall be carried out within 48 hours of notification of acceptance of the stabilised layer.

11.09 OCCUPATIONAL HEALTH AND SAFETY

The Contractor shall ensure that his employees are instructed concerning the hazards of working with lime and that safe working practices are observed. Personnel engaged in handling, spreading and mixing of lime shall wear suitable protective clothing such as overalls, boots, gloves, goggles and respirator and shall have access to skin protection cream, hand cleanser, clean water and towels.