NZ TRANSPORT AGENCY
WAKA KOTAHI

SPECIFICATION FOR THE MANUFACTURE AND CONSTRUCTION OF PLANT MIXED MODIFIED PAVEMENT LAYERS

1. SCOPE

This specification shall apply to the manufacture and construction of plant mixed aggregates to produce grader or paver laid pavement layers using cement, lime, bitumen emulsion or foamed bitumen. This specification shall apply to the construction of modified sub-base or basecourse layers.

The pavement layer shall be constructed in accordance with the levels, grades and cross-sections shown on the contract drawings.

The Contractor shall ensure that road users' vehicles are protected from deleterious effects of the binders used in construction at all times

2. TERMINOLOGY

Descriptions of the Terminology that is used in this specification are provided in the Notes to this Specification.

3. MATERIALS

Aggregates to be treated shall comply with the Project Specifications.

4. STABILISING AGENTS

4.1. Chemical Stabilising Agents

Chemical stabilising agents shall be either one, or a combination, of the following:

4.1.1. Lime

Lime shall comply with NZTA M/15.

4.1.2. Cement

Cement shall comply with NZS 3122 Specification for Portland and blended cements (general and special purpose) for:

- **General purpose Portland cement – Type GP;**
- **General purpose blended cement – Type GB; or**
- **Special purpose low heat cement – Type LW**

General purpose Portland cement, type GP, shall be used unless otherwise specified in the Contract documents.

Cement shall be stored and handled to provide protection against deterioration or contamination. Cement that is more than 3 months old, or is suspected of not being stored in a way that

protects it from deterioration, shall be tested for loss of ignition in accordance with AS 2350.2 or Appendix B of NZS 3122.

Type GP cement with a loss of ignition test result greater than 3.0% shall not be used.

Types GB and LH cement with a loss of ignition test result greater than that determined by the cement manufacturer shall not be used.

4.2. Bituminous stabilising agents

All bituminous stabilising agents shall be heated, stored and handled strictly in accordance with Roading NZ Code of Practice RNZ 9904 *The Safe Handling of Bituminous Materials used in Roading* [1], the manufacturer's requirements, and as set out in clause 7.3.3 of this Specification.

Bituminous stabilising agents shall be either of the following stabilising agents, and shall comply with the relevant specification:

4.2.1. Foamed bitumen

Foamed bitumen shall be produced from 80/100 or 180/200 penetration-grade bitumen as specified in the Project Specifications. The bitumen shall comply with TNZ M/1 and shall be able to achieve a minimum expansion of 10 times its original volume and a minimum half-life of 6 seconds. Refer to the definitions in the Notes to this Specification and RNZ Technical Note 001[2] for an explanation of expansion and half-life.

4.2.2. Bitumen emulsion

Bitumen emulsion shall be produced from 80/100 or 180/200 penetration-grade bitumen as specified in the Project Specifications. The bitumen shall comply with TNZ M/1. The bitumen emulsion shall be produced so that breaking of the bitumen emulsion occurs during compaction of the stabilised material, not before.

5. WATER

The Contractor shall be responsible for ensuring that the water for stabilisation, construction and curing of modified layers is free from impurities that may deleteriously affect the setting, hardening or strength of the stabilised material.

Water from sources other than public supply may have its suitability established to the satisfaction of the Engineer by repeating the final laboratory-based mix design tests with the water considered for use. The results of these mix design tests shall be greater than 90% of the final results from the mix design. In addition, work shall be stopped if any discolouration or residue is observed when adding or sprinkling water into or onto the material.

6. PLANT AND EQUIPMENT

All plant shall be purpose-built by a manufacturer having a demonstrable track record and manufacturing history for the equipment used. Plant and equipment not meeting this requirement shall not be used.

6.1. Plant for supply of stabilising agents

Stabilising agents shall be delivered to the mixing plant site in bulk tankers unless otherwise approved by the Engineer. Each bulk tanker shall be issued a *Certificate of Loading* that contains the following information:

- Tanker's identification details including certification number;
- Product identification: Name of the supplier;
- Batch number and date of manufacture ;
- Date, time and place of loading;
- Comments on the state of the tanker at the time of loading in terms of cleanliness, details of the previous load carried, and whether any residual product from the previous load remains;
- Details of any chemical or other substance added to the product before, during or after the loading procedure, if any; and
- Net weight of product before and after discharge into the cement storage vessel at the mixing plant.

When stabilising with foamed bitumen, the bulk delivery tanker shall, in addition to the above, include the following features:

- A thermometer that records the temperature at which the product was loaded;
- A built-in thermometer (calibrated within the last 6 months) and heating facilities to ensure that the bituminous stabilising agent is maintained within the handling and application temperatures specified.

The Certificate of Loading shall form part of the project quality plan.

6.2. Plant for transferring chemical stabilising agents

Transfer of all stabilising agents into the mixing equipment shall be undertaken in such a manner to ensure that no contamination of the environment occurs. Where pressurised lime or cement powder is transferred, release filters shall be utilised to contain dust.

6.3. Plant for batching and mixing

The batching and mixing plant shall be purpose-built by a manufacturer having a demonstrable track record and manufacturing history for the equipment used. Plant and equipment not meeting this requirement shall not be used.

The batching plant shall be calibrated as per the manufacturer's procedures every time it is moved and monthly thereafter.

The mixing plant shall be capable of consistently producing a uniform mixture to the proportions and tolerances given in clause 7.3.

As a minimum, the batching and mixing plant shall have the following features:

- A plant capacity that has adequate rating for maintaining a continuous mixing process and able to introduce the various stabilising agents to produce a final mix that is consistent with the specified proportions.
- A mechanical mixer of sufficient length, rotation and paddle design that ensures thorough mixing without segregation of the treated material.
- A system of nozzles that promotes a uniform application of water and/or fluid stabilising agent(s) across or along the flow of aggregate passing through the mixing process.

When stabilising, with foamed bitumen the mixing plant shall, in addition to the above, include the following features:

- A test nozzle capable of producing a replicate sample of the foamed bitumen being injected into the stabilised material to ensure that the required expansion and half-life qualities of the bitumen are being achieved.
- An electrically heated, self-cleaning nozzle system that promotes a uniform application of foamed bitumen across or along the full mixing chamber of treatment.
- A calibrated bitumen flow meter to control the injected bitumen in relation to the aggregate mass of material being stabilised.
- A power output reading of the mechanical mixer's drive unit that shall be capable of maintaining a mixing rate for continuous flow for the full range of plant output.
- For safety reasons bitumen cycled back to bulk units shall have specifically designed return line fittings. Return hoses shall not be routed through open hatches when pumped back into the bitumen tank.

7. CONSTRUCTION

7.1. Limitations

7.1.1. Weather limitations

Temperature

Work shall not be started if the temperature is below the temperature of the component set out in Table 1:

Table 1: Minimum working temperature for the stabilising process

Stabilising process	Component to measure	Min. temp. (°C)
Cement	Ambient air temperature	5
Lime	Ambient air temperature	10
Cement / Lime	Ambient air temperature	10

Bitumen emulsion	Stabilised material before compaction	20
Foamed bitumen	Stabilised material before compaction	20

If, during construction, the governing component's temperature drops below the limits set in Table 1 above, then no further work, other than compaction and finishing, shall be permitted.

Dryness - wind and rain

After mixing, plant mixed material shall be protected from the influence of weather. During stockpiling (if any) and transportation the material shall be covered to avoid drying below optimum moisture content or wetting from rainfall. Laying of plant mixed material shall not be undertaken during weather conditions that result in excessive drying or wetting of the material prior to compaction at the specified moisture content.

If, during construction, rain starts, no further work shall be permitted other than compaction and finishing.

7.1.2. Time limitations

The maximum time period, from mixing of the materials to completion of primary compaction of the modified layer, shall be determined by the type of stabilising agent(s) used, as follows:

- Cement: two (2) hours;
- Lime: four (4) hours;
- Bitumen emulsion: before the emulsion breaks;
- Foamed bitumen: four (4) hours.

Where two or more stabilising agents are used, the time limitation shall be that of the shorter of the individual agents. Where the time limit is exceeded, details of the remedial actions taken by the Contractor shall be submitted to the Engineer for approval.

7.2. Before mixing and laying commences

7.2.1. Initial Laboratory Testing

In the event that the contractor's proposed material(s) and stabilising agent(s) vary from the project specifications or there is no project specific mix design, the contractor shall be responsible for determining the optimum binder content(s) in accordance with NZTA T/19 to meet the designer's intent.

7.2.2. Surface preparation

Before any work commences, the surface on which the modified material is placed (the substrate) shall be prepared by:

- Cleaning all vegetation, detritus and other foreign matter;
- Removing any standing water;
- Repairing or replacing any damaged substrate sections or sections which do not comply with the specified requirements;

- Ensuring that the substrate layer is dry enough to prevent damage by the construction of the new stabilised layer;
- Accurately pre-marking the proposed longitudinal joint lines on the existing surface;
- Recording the location of all road hardware such as service covers, road marking and the like.
- Installing lift pegs if required by the Project Specifications;

Scarification of the existing seal layer(s), if specified by the Project Specifications, shall be carried out in such a way to end up with a particle size ≤ 50 mm.

The modified layer covered by these specifications shall not be used to make good deficiencies in shape or thickness; such improvements shall be achieved before commencing these operations. The level tolerance of TNZ F/1 shall apply to the substrate surface when constructing a sub-base and TNZ B/2 shall apply to the sub-base when constructing a basecourse with the plant mixed material. Any high spots that need to be removed (as directed by the engineer) shall be milled. The substrate shall be formed to final longitudinal and transverse shape, at an appropriate level so that the nominal compacted thickness of modified layer is achieved to the tolerances as specified in clause 8.2.

7.2.3. Production plan

Before start of work every day, the Contractor shall prepare a production plan detailing their proposals for the forthcoming day's work. This plan shall indicate:

- The overall layout of the length and width of pavement intended to be constructed during the day, provided in a sketch, broken into number of parallel joins in the optimum position required to achieve the stated width;
- An estimate of the time required for plant mixing the binder, stockpiling, transporting, spreading for grader shaping, or delivering to paver and compacting each fresh section. The layout sketch shall also show the time when the completion of each run is expected;
- The randomly determined location where samples will be taken to determine the target maximum dry density and optimum water content;
- Proposed water addition for the specified process, and the location at which any change is to be made within that sequence;
- The source and quantity of material to be supplied or recycled;
- The amount and type of stabilising agent, or agents, to be applied, to the respective materials;
- The proposed quality control testing programme;
- The proposed locations/timings of joints which, where possible, shall avoid joints on wheel paths;
- The number of passes to achieve primary compaction of the layer;

- Locations of existing services and mitigation/contingency plan to avoid conflict with the construction of the pavement operation;
- Other information as requested by the Engineer.

The Contractor's site representative shall keep the daily production plan on site at all times.

7.3. Plant Batching and Mixing

7.3.1. Handling and addition of aggregate

The supply of aggregate to the mixing site and any stockpiling or other movement of aggregate shall be controlled to avoid contamination and segregation. Contaminated or segregated aggregate shall be removed from site.

Where the Project Specification calls for material to be imported for the purpose of altering the particle size distribution of the modified material, or effecting mechanical modification, this material shall be kept strictly in a separate stockpile and introduced to the mixing plant by way of separate bins.

Aggregates shall be batched within 95-105% of the proportions approved by the Engineer.

7.3.2. Addition of lime and/or cement

The stabilising agent shall be fed uniformly and measured by mass on a continuous basis to the specified application rate and tolerance set out in Table 2:

Table 2: Tolerance for feeding Lime and/or Cement

Test	Frequency	Tolerance
Continuous weigh auger and plant display reading	Continuous by plant operator	Within ± 5 % of the specified rate
Average usage test: Compare tonnes used (from delivery docket) with measured mixed quantity	Upon emptying the bulk tanker, where practical	Within ± 5 % of the specified rate

The type of binder(s) and application rate(s) shall be specified in the Project Specifications.

The Contractor shall record and keep records of the tonnage of lime and/or cement used per mixed quantity of material modified.

During the mixing operation the utmost care shall be exercised to ensure that all run-off is contained within the mixing site. In the

event of any binding agents entering any waterways the Engineer and the environmental authority for the region shall be notified immediately.

7.3.3. Addition of bituminous stabilising agents

Bituminous stabilising agents shall be sucked from the bulk tank during the plant mixing process. A system that controls the addition of bituminous stabilising agent in relation to the continuously calculated weight of the raw aggregate and to the tolerances set out in Table 3 shall be used.

Table 3: Tolerance for adding bituminous stabilising agents

Test	Frequency	Tolerance
Flow meter and Operator's display readings	Continuous by plant operator	Within ± 5 % of the specified rate
Average usage/use test: compare tonnes used (from delivery docket) with measured mixed quantity	Upon emptying the bulk tanker	Within ± 5 % of the specified rate

The type of binder(s) and application rate(s) shall be specified in the Project Specifications.

The Contractor shall record the tonnage of bituminous stabilising agent used during production mixing and shall keep these records as specified.

Any bitumen that has been heated above the maximum temperatures set out in Table 4 shall not be used and shall be removed from the site.

Table 4: Temperature limits for storage and application of bitumen

Material	Maximum storage temperature (°C)		Application temperature (°C) (within 2 hours of use)	
	> 24 hrs	< 24 hrs	Min	Max
80/100 Pen grade	125	175	175	190
180/200 Pen grade	120	170	170	185

The foaming characteristics, which are expansion and half-life,

shall be checked at the test nozzle of the stabilising plant mixer within five minutes of starting with each new bitumen tanker load (refer to NZTA T/19 for calculation). The minimum expansion and the minimum half-life shall be as specified in clause 4.2.1.

7.3.4. Addition of water

Sufficient water shall be added during the mixing process to ensure that the modified material is within 90 to 100 % of the material's optimum water content (OWC) during primary compaction. A system that continuously controls the water addition in relation to the aggregate(s) weight shall be used. Particular care shall be taken to prevent excessive wetting of the modified material.

The optimum water content (OWC) of the modified materials shall be determined by NZS 4402, test 4.1.3, *New Zealand vibrating hammer compaction test*.

The water content during compaction shall be in the range of 90% to 100% of the modified material's optimum water content (OWC).

7.3.5. Mixed material testing

Testing of the modified material shall be carried out in lots to allow confirmation of the design parameters. A lot is defined as a continuous batch for a specific pavement layer on a particular project. The volume of a lot shall not exceed 1000 m^3 or 250 linear metres of roadway whichever is the least.

During mixing, the contractor shall take a pair of representative samples at the mixing plant per lot or at a minimum of 2 pair of representative samples per day. These samples shall be placed in a sealed plastic bag and cured for 1 hour before compacting into a mould and testing the indirect tensile strength (ITS) of the mixed material according to NZTA T/19.

7.3.6. Grading of plant mix

Testing of the stabilised aggregate particle size distribution shall be carried out on site in lots taken behind the paver to ensure the post modified particle size distribution achieves the specified parameters. A lot is defined as a continuous batch for a specific pavement layer on a particular project. The area of a lot shall not exceed 1000 m^3 or 250 linear metres of roadway whichever is the least.

Wet sieve analysis will be completed within 4 hours after stabilizing, and consist of a minimum of 3 sample bags per lot.

The Engineer should then confirm whether any further modification to the stabilised material is required.

7.4. Loading, Transportation and Discharge

The mixed material shall be protected from the weather to maintain its moisture content during loading, stockpiling (if required), transport and whilst waiting discharge.

Segregation or contamination shall be prevented during all stages of

loading, stockpiling (if required), transport and discharge. Contaminated or segregated material shall not be used.

Stockpiling shall only be permitted if the time requirements of clause 7.1.2 are not exceeded.

7.5. Construction of Modified Pavement Layers

7.5.1. Placement of modified material

Immediately prior to placing the modified material the underlying substrate shall be moistened and kept moist but not excessively wet.

The modified material shall be spread by mechanical paver or grader to achieve the width and layer thickness as specified or shown on the Project Drawings after final compaction to the requirements of clause 8.1 of this Specification.

The method used to place the modified material, either by mechanical paver or grader, shall avoid segregation and be detailed in the Quality Plan. The Quality Plan shall specifically detail the steps that will be taken, including further testing, if segregation does occur.

The Engineer may require additional sampling and testing. Should the additional samples comply, the testing will be at the Principal's cost. These samples may be taken without the use of a sampling mat. The sample shall include all material within at least 50% of the layer thickness over an area of at least 0.7 m^2 and be of sufficient mass for the specified testing.

7.5.2. Layer thickness

The project specifications shall specify the thickness of modified layer required.

The depth of the layer shall be controlled by either lift stakes or electronic guided levelling guidance equipment. Maximum variation from the specified depth shall follow the requirements of clause 8.2.2.

The average uncompacted thickness of the modified layer shall be:

(a) not less than 150 mm or 3 times the maximum stone size, whichever is the greater; or

(b) not more than 250 mm

7.5.3. Joints

Unless stated to the contrary in the Project Specifications and where practical, longitudinal joints shall be planned to coincide with each change in crossfall across the road width.

Between paver runs a construction joint with an inclined rough face at less than 45 degrees from the vertical shall be made and kept moist. When operations are delayed or stopped for more than one hour then an inclined rough face at less than 45 degrees from the vertical shall be made in thoroughly compacted material.

The constructed area shall be squared off at the end of the day's production, and the location shall be recorded on the production plan for that day.

All joints shall be compacted and finished satisfactorily so that the final surface does not have permeable or loose patches.

The location of longitudinal joints must also consider prior and subsequent layers. The longitudinal joint must be at least two times the layer thickness away from the longitudinal joints (if any) of prior and subsequent layers.

The location of transverse joints must also consider prior and subsequent layers. The transverse joint must at be at least 5m from the transverse joints (if any) of prior and subsequent layers.

7.6. Compaction

Compaction shall be achieved by the minimum necessary number of passes of compaction plant, not by traffic. Details of plant shall be given in the Quality Plan.

At the outset of compaction the contractor shall undertake plateau density tests for the purpose of determining the practicality of both the OWC and the MDD mix design targets, the minimum, and possibly the maximum, number and type of roller passes required to achieve the MDD for the proposed compaction plant and stiffness of lower pavement 'anvil' beneath the layer to be compacted. The plateau tests shall be undertaken with compaction plant that is to be used for construction – which shall be appropriate for the depth and type of materials to be compacted. The plateau tests shall be undertaken to confirm the optimum pattern of static and vibratory passes for the unique site settings and shall be undertaken in an area where lower pavement stiffness is representative. Repeated plateau density tests shall be undertaken when the material to be compacted or lower pavement parameters change visibly.

Compaction plant shall include type (i) for primary compaction, and either or both type (ii) and (iii) for the final consolidation of the top portion of the layer, as defined below:

Type (i) Vibratory rollers with single vibrating drum

Type (ii) Smooth double drum roller

Type (iii) Pneumatic tyre roller (PTR) having a minimum weight when operating of not less than 7 tonnes, spread over at least seven rubber tyred pneumatic wheels.

Type (ii) and (iii) rollers may be replaced with a combination roller, which has one smooth drum at the one axle and rubber-tyre pneumatic wheels across the full width at the second axle of the roller.

The rolling operation shall not extend beyond the width of the paved run unless the adjacent modified material has been placed and the time limitation of clause 7.1.2 is not exceeded.

Care must be taken with the use of the PTR with foamed bitumen mix as fines can be sucked to the surface by capillary action, thus changing the structure of the layer

8. ACCEPTANCE CRITERIA OF THE CONSTRUCTED LAYER

8.1. Compaction

The modified pavement layer shall be compacted to a uniform, dense, stable condition.

Compaction testing of the modified pavement layers shall be carried out in lots. A lot is defined as a section where the pavement layer appears homogeneous and evenly compacted. The area of a lot shall not exceed 1000 m^2.

The degree of compaction for each lot shall be determined by testing at least five randomly selected areas. The compaction requirements shall be met if the mean and minimum compaction values of the tests taken comply with the values in Table 5. In preference to random selection the Engineer may carry out any testing for uniformity to determine the location of density tests.

The Contractor shall be responsible for carrying out laboratory tests according to NZS 4402:1986, Test 4.1.3 to determine the maximum dry density (MDD) at the OWC of the modified material.

The Maximum Dry Density of the modified material shall be determined for each layer at a minimum frequency of one Maximum Dry Density per 5,000m^2 of material laid. If the aggregate source, processing method, or modified materials are expected to change then a new OWC and target MDD shall be determined.

Table 5: Mean and minimum degree of compaction for pavement layers as a percentage of Maximum Dry Density

Degree of Compaction	Pavement Layer	
	Subbase	Basecourse
Mean	≥ 95 %	≥ 98 %
Minimum	≥ 92 %	≥ 95 %

Where the Acceptance Criteria are based on laboratory results and cannot be met, the Engineer shall nominate an independent laboratory to repeat the laboratory tests and supervise a repeat of the Plateau Density test. Should the Criteria still appear unachievable the Engineer may accept the Plateau Density tests as the Maximum Dry Density. This process may be repeated for each MDD determined at the Engineer's discretion. Should the additional testing find the same as the Contractors testing, the additional testing shall be at the Principal's cost.

8.2. Construction Tolerances

8.2.1. Width

The maximum variation from the specified width shall be:

Unconstrained : -20 mm and + 100 mm

Constrained : Zero

8.2.2. Vertical

The maximum variation from the specified vertical surface of the

completed pavement layer shall be such that, when all loose aggregate is removed, it conforms to the vertical variations specified in Table 6.

Table 6: Maximum vertical variations

Pavement layer	Between pavement centre line and pavement edge (mm)	
	without concrete channel	with concrete channel
Sub-basecourse	- 25 mm + 5 mm	- 25 mm + 5 mm
Basecourse with Asphalt surfacing	- 15 mm + 5 mm	Varies, see Notes (i) & (ii)
Basecourse with Chipseal surfacing	- 5 mm + 15 mm	Varies, see Notes (i) & (iii)
Note: (i) at or close to the lip of channel – 5 mm + 5 mm (ii) at other locations on pavement –15 mm + 5 mm (iii) at other locations on pavement – 5 mm + 15 mm		

8.2.3. Crossfall

The crossfall between two points more than 2m apart, transverse to the centre line, shall not depart from the crossfall shown in the documents by more than 0.5%. Where the crossfall is not explicitly defined it shall not be less than the existing crossfall at start of construction.

No area of completed surface shall have any depression that will allow water to pond where the lateral or longitudinal fall is greater than 1%.

8.2.4. Surface Shape

The standard of smoothness shall be such that no point in the surface varies more than 10 mm from a 3 m straight edge placed on the road, and any deviation from the straight edge is gradual. No area of the completed surface shall have any depression that will allow water to pond where lateral or longitudinal fall is greater than 1%.

The vehicle ride provided by the final surfacing layer shall comply with the maximum roughness value specified in the Project Specification.

8.3. Surface finish

The basecourse surface finish, as distinct from the surface shape, shall present a tightly consolidated surface when swept in which:

- The large aggregate is held in place with a matrix of smaller aggregates;
- The smaller aggregate is held firmly in place by fine material; and
- The matrix does not displace under normal trafficking or sweeping.

The standard of sweeping shall be sufficient to remove all loose aggregate, dirt, dust, silt, and other deleterious matter.

8.4. Protection and Maintenance before Sealing

The Contractor shall protect and maintain the completed modified layer until the next layer or surfacing is applied. In addition to the curing of the modified layer by frequent light watering, maintenance shall include the repair of any damage to or defects in the layer, and shall be repeated as often as it is necessary. Any remedial grading after the time limitations set out in clause 7.1.2, shall be cut to waste. Any defects or damage of any nature, occurring during the construction or maintenance of the pavement layer before the seal is applied, shall be made good by the Contractor. Where rutting or potholes occur in the unsealed pavement, it shall be fixed by re-stabilising the layer with the addition of a suitable stabilising agent as directed by the Engineer.

The modified pavement layer shall be of a uniform consistency. All coarse segregated areas shall be removed. The edges of the holes so formed shall be painted with a cement / water slurry. The holes shall then be backfilled with modified granular material compacted to the required density and finished off to the required level. Such patches shall be cured as specified below. Any portion of the pavement layer which does not meet the specified requirements shall be corrected by methods approved by the Engineer at the Contractor's cost.

(a) Greenfield Sites

Where the modified layer is not being trafficked and there will be a waiting period prior to surfacing:

- The modified basecourse pavement layer shall be cured with CMS-1 emulsified bitumen complying with ASTM D2397-02 (Cationic Emulsified Bitumen) as a primer seal coat. The Contractor shall be responsible for designing the application rate of the prime coat in accordance with Austroads Sprayed Sealing Guide.
- The curing membrane shall be sprayed onto the completed layer once the requirements of clause 8.2 have been met. Before applying the curing membrane, the surface of the modified basecourse layer shall be thoroughly swept clean to produce a mosaic surface finish as described in clause 8.3. The final surface shall be slightly damp immediately prior to applying the curing membrane. The curing membrane shall be blinded out with a light application of Grade 5 sealing chip complying with TNZ M/6: 2004 (Sealing Chip) to prevent pickup on construction machinery tyres.

(b) Overlay Sites

Where the modified layer will be trafficked prior to sealing the construction work shall include:

- Channelling traffic, by the use of cones and flagmen, so that wheel loads are applied across the whole cross-section of road, and to avoid creating wheel paths, by vehicles tracking over the same line.
- Providing non-vibratory, secondary rolling (e.g. PTRs).

- **Providing additional running course (use clause 10 of TNZ B/2 as a guide).**
- **Keeping surface damp but not wet to prevent dry out and unravelling.**
- **Drag-broom the entire surface keeping a balanced distribution of running course.**

This work should continue for a minimum period of 24 hours working time before sealing.

8.5. Presealing requirements

Before sealing, the Contractor shall advise the Engineer that the pavement surface has been prepared in accordance with clause 8.3 although final sweeping may not have been performed. The Engineer shall be given the opportunity to inspect the site. Additional testing in accordance with clause 8.2.4 may be required at this time.

Water content testing of the basecourse layer shall be carried out in lots. A lot is defined as a section where the pavement layer appears homogeneous and evenly compacted. The area of a lot shall not exceed 1000 m^2.

The degree of saturation (DOS) for each lot shall be determined by testing at least five randomly selected areas. No area in a lot may exceed the requirements of this clause. The seal coat shall not be applied unless the water content at each test point of the basecourse layer is such that the DOS is less than 80%. Pavement layer compaction test results may be used for this purpose where the Engineer is satisfied that the water content has not had a chance to increase between testing and sealing (i.e. it has not rained or additional watering has not been applied to the pavement). The degree of saturation (% saturation or DOS) is defined in NZS 4402 : 1986 and may be calculated using formula 1 below.

$$DOS_{(i)} = \frac{DD_{Corrected(i)} \times \left(MC_{NDM(i)} - \Delta MC_{Average}\right)}{1 - \frac{DD_{Corrected(i)}}{SD_{Agg}}}$$

Formula 1

Where: $DOS_{(i)}$ **= Degree of Saturation**

$DD_{Corrected(i)}$ **= Corrected NDM Dry Density at point i**

$MC_{NDM(i)}$ **= Moisture content measured by the NDM at point i;**

$\Delta MC_{Average}$ **= Project average water content correction to allow for the binder(s) in NDM reading.**

SD_{Agg} **= Solid Density of the aggregate's particles**

9. QUALITY PLAN

Compliance with the requirements of clauses listed in Table 7 shall be checked by the Contractor, included in the project's Quality Plan, and records made available for inspection by the Engineer.

Table 7: Summary of stabilisation tolerances

Construction / Stabilisation activity	Clause reference
Addition of aggregates	7.3.1
Addition of stabilising agents	7.3.2-7.3.3— Table 2&3
Addition of water	7.3.4
Strength testing (ITS)	7.3.5
Grading of plant mix	7.3.6.
Compaction	7.6 & 8.1
Construction Tolerances	8.2
Degree of Saturation before sealing	8.5

Measurements of crossfall should not be necessary unless indications are that the requirements of this specification have not been met. If the surface subsequently deteriorates so that finished surface levels may be affected, then the Contractor shall carry out further measurement of the construction dimensions to confirm compliance.

10. BASIS OF PAYMENT

If not included in the contract documents, the basis of payment shall be as follows:

All miscellaneous items, lodgings, supervision, setting out, contingencies, conveyance of plant, and other incidental work, general overhead administration and maintenance shall be incorporated in the unit rates listed in the schedule.

10.1. Preparation of surface (cubic metres / square metres)

If any special treatment is required to the existing substrate other than those described in this Specification, it shall be specified in the Project Specifications.

Payment will be made on the solid volume measured in cubic metres of inferior substrate removed and/or the area measured in square metres cleared to the satisfaction of the Engineer.

10.2. Supply and placing plant mix modified material

The units of measurement shall be square metres of completed modified layer, the quantity of which shall be calculated in accordance with the specified dimensions shown on the contract drawings.

The proportions and type of aggregate and stabilising agent, together with the nominal layer thickness, shall be specifically described in the payment item.

The scheduled rate shall include allowance for the supply of aggregate, supply and addition of all specified stabilising agents, water, mixing, transport, placing, compacting, trimming, and finishing to the specified tolerances including protecting and maintaining the work as specified and including the curing membrane.

10.3. Extra over or under clause 10.2 for the supply and mixing of cementitious stabilising agents (tonnes)

Extra or lesser payment for any section of the works specified in the Contract documents where the Engineer requires a variation to the amount of the cementitious stabilising agent that would have been used in clause 10.2 above, as specified in the original Project Specifications. Measurement shall be in tonnes (t) of agent.

The scheduled rate shall include allowance for supply and cartage of the cementitious stabilising agents.

10.4. Extra over or under clause 10.2 for the supply and mixing of bituminous stabilising agents (tonnes)

Extra or lesser payment for any section of the works specified in the Contract documents where the Engineer requires a variation to the amount of the bituminous stabilising agent that would have been used in clause 10.2 above, as specified in the original Project Specifications. Measurement shall be in tonnes of agent (t).

The scheduled rate shall include allowance for supply and cartage, heating to the specified temperature and, if necessary, the production of the bituminous stabilising agent.

REFERENCES

(1) Roading New Zealand. 2006. The safe handling of bituminous materials used in roading. (Status as at April 2006: Provisional) *RNZ Code of Practice 9904:2006*. Roading, NZ Inc., Wellington, New Zealand.

(2) Roading New Zealand. 2007. Foamed bitumen treated materials. *Roading NZ Technical Note 001.* Roading New Zealand Inc., Wellington. http://www.roadingnz.org.nz/pubs.html