

TNZ B/02:2005

**SPECIFICATION FOR CONSTRUCTION OF UNBOUND
GRANULAR PAVEMENT LAYERS**

1. SCOPE

This specification shall apply to the construction of unbound granular pavement layers. The term pavement layer shall apply to any layer using sub-base or basecourse aggregates.

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

2. MAINTENANCE OF EXISTING SURFACE

Where the project consists of reconstruction or overlay of the existing pavement the existing surface shall be maintained from the date when the Contractor occupies the site or as specified in the contract documents. Should any potholes, ravelling or other faults develop, the affected area shall be made good by the Contractor to the standard existing when occupancy was given.

3. DIMENSIONS

Except as specified in clause 6, pavement layers shall be constructed of uniform thicknesses to their nominated surface levels and widths within the specified tolerances. When not contained by kerbing, feather edges shall be constructed as detailed in the cross-sections.

4. CONTROL OF CONSTRUCTION DIMENSIONS

Construction shall be controlled such that the finished dimensions are achieved within the tolerances specified in clause 5.

5. TOLERANCES (except smoothness)

5.1 Construction

Maximum variations from specified dimensions shall be:

(a) Width

Unconstrained	:	-20 mm +100 mm
Constrained	:	Zero

(b) Vertical

Pavement Layer	Between Pavement Centreline and Pavement Edge	
	Without Concrete Channel	With Concrete Channel
Sub-base course	-25 mm +5 mm	-25 mm +5 mm
Basecourse	-5 mm +15 mm	varies see note 1
Note 1: Tolerance	(i) at or close to the lip of channel	-5 mm +5 mm
	(ii) at other locations on pavement	-5 mm +15 mm

FIGURE 1: Maximum Vertical Variations

(c) Crossfall

The crossfall between any two points more than 2m apart, transverse to the centreline, shall not depart from the crossfall shown in the documents by more than 0.5%

Compliance with the above tolerances and the requirements of Clause 7.7 for surface shape and Clause 7.8 for surface finish shall be checked by the Contractor, as detailed in the Quality Plan, and records made available for inspection by the Engineer. However, measurement of crossfall should not be necessary unless there are indications that the requirements of this specification have not been met.

If the surface subsequently deteriorates such that finished surface levels may be affected then the contractor shall carry out further measurement of the construction dimensions to confirm compliance.

6. LEVELLING LAYERS

Where the existing surface is such that the thickness of pavement to be constructed varies by more than 70 mm, one or more levelling layers shall be constructed.

Levelling layers shall be constructed with a surface shape parallel to and below the top of the finished basecourse surface, with not less than zero thickness over the high spots in the existing surface and shall comply with the construction tolerances specified in clause 5.1(b) sub-base.

7. CONSTRUCTION OF PAVEMENT LAYERS

7.1 Supply of Aggregate to Site

The supply of aggregate to the site and any stockpiling or other movement prior to its placement on the road shall be controlled to prevent contamination or segregation. Contaminated or segregated aggregate shall not be used.

7.2 Placement of Aggregate

With the exception of levelling layers required by Clause 6, aggregate for the pavement layer shall be placed in layers of uniform thickness. The method used to place aggregate 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 m² and be of sufficient mass for the specified testing.

7.3 Layer Thickness

The average uncompacted thickness of any layer shall not be:

- (a) less than 2.5 times the maximum particle size of the aggregate except for tapers as specified in clause 7.4; or
- (b) more than 200 mm for the basecourse layer.

7.4 Tapers

(a) Sub-base or Levelling Layer Tapers

Where tapering of sub-base or levelling layer aggregates is necessary, the placement shall be extended to the least practicable thickness. Primary compaction of the layer shall still be necessary where the thickness is less than the minimum uncompacted thickness specified in clause 7.3(a). Taper areas of less than minimum uncompacted thickness shall be compacted in conjunction with subsequent pavement course or layer construction.

(b) Basecourse and Finishing Layers Tapers

Where tapering of basecourse including finishing layer aggregate is necessary to provide a smooth transition from the new surface to an existing surface, placement of the basecourse or finishing layer shall be stopped at the minimum uncompacted thickness specified in clause 7.3(a). The Contractor shall then saw cut the existing seal at the tie-in (end of taper), remove existing pavement material and replace it with approved basecourse to an average uncompacted thickness of greater than 2.5 times the maximum particle size of the basecourse used.

7.5 Testing for Layer Compaction

Compaction shall be achieved by the minimum necessary number of passes of compaction plant and normal road traffic. Details of plant shall be given in the Quality Plan.

The Contractor shall be responsible for carrying out laboratory tests according to NZS 4402:1986, Test 4.1.3 to determine the maximum laboratory dry density at the optimum water content (OWC) of the aggregate used. The Solid Density of the aggregate tested shall be determined according to NZS 4407:1991, Test 3.7. The tests shall be undertaken on material that is representative of that used in construction and a grading for the material tested shall be supplied with the results.

(a) Greenfield Sites

During construction, the Contractor shall undertake plateau density tests for the purpose of determining the maximum dry density. The plateau density tests shall be undertaken on 100m test strips using a variety of compaction plant typical of that to be used on site. Testing shall be at OWC.

Compaction shall be achieved by the minimum necessary number of passes of compaction plant, and compaction plant shall include type (i) for primary compaction, and either or both types (ii) and (iii) for the final consolidation of the surface, as defined below:

Type (i): Vibratory rollers with either double or single vibrating drum.

Type (ii): Any non-vibrating smooth, steel-tyred roller.

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

The Maximum Dry Density (MDD) for construction shall be the higher of the maximum laboratory dry density at optimum water content (OWC) and the plateau density at optimum water content (OWC).

(b) Overlay Sites

The Maximum Dry Density (MDD) for construction shall be the maximum laboratory dry density at optimum water content (OWC).

The Contractor shall determine the minimum number of roller passes required to produce pavement layer compaction as required in clause 7.6 at OWC and make the information available to the Engineer. It shall be the responsibility of the Contractor to achieve the specification requirements.

(c) Final consolidation

Final consolidation, compaction of the surface layer and the required surface finish shall be obtained using a combination of compaction plant and, if permitted by the Engineer, use by normal road traffic.

7.6 Acceptance Criteria for Pavement Layer Compaction

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

Compaction testing of the 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 m².

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 Figure 2. In preference to random selection the Engineer may carry out any testing for uniformity to determine the location of density tests. The Maximum Dry Density shall be determined for each layer at minimum

frequency of one Maximum Dry Density per 5,000m² of material laid. If the aggregate source, face at the source, or processing method is changed then a new Maximum Dry Density shall be determined and the Engineer informed.

Values	Sub-basecourse Pavement Layer	Basecourse Pavement Layer
Mean Value	≥ 95	≥ 98
Minimum Value	≥ 92	≥ 95

FIGURE 2: Mean and Minimum Value of Pavement Layer Compaction as Percentage of Maximum Dry Density

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 determination at the Engineers discretion. Should all of the additional testing find the same results as the Contractors testing, the testing shall be at the Principal's cost.

7.7 Surface Shape

The surface shape of the completed pavement layer shall be such that, when all loose aggregate is removed, it conforms to the shape specified within the tolerance in clause 5.1. The standard of smoothness shall be such that there is no point in the surface that 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 longitudinal smoothness of the final surfacing layer shall comply with the maximum NAASRA roughness¹ value detailed in the specific contract requirements. This may be determined by the use of instruments that have been calibrated to NAASRA roughness.

7.8 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

¹ NAASRA roughness is a measure of road surface ride. Usually expressed as NAASRA counts/km.

- exposed to the surface;
- held in place with a matrix of smaller aggregates
- The smaller aggregate is held firmly in place by fine material;
- 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. FEATHER EDGES

Where detailed, feather edges shall be constructed as part of each layer to true shape and line in accordance with this specification.

The compaction criteria given in clause 7.6 do not apply to these areas, but the surface shall be able to withstand a moving wheel load of up to 4 tonnes without displacement.

Any aggregate that is surplus as a result of the shaping of feather edges shall be removed from the works and will then not be included for payment purposes.

9. CROSSROADS AND PRIVATE WAYS

Unless otherwise stated, all intersecting roads and private vehicular accesses within the road reserve of the section of pavement being constructed shall be constructed and maintained in accordance with this specification.

10. RUNNING COURSE

10.1 General

On completion of the basecourse compaction, the Contractor may decide to use running course. If running course is used it shall be spread uniformly over the pavement surface and maintained until removed.

During working hours traffic shall be channelised by suitably defined traffic lanes with frequent transverse shifts of the defined lanes to obtain an even spread of traffic over the entire surface.

10.2 Material

The running course shall have a crushing resistance of not less than 130 kN when tested in accordance with NZS 4407: 1991, Crushing Resistance Test, Test 3.10. It shall be free from all non-mineral matter.

The grading of the running course shall conform with Figure 3 when tested in the same manner as required for the parent basecourse.

Test Sieve Aperture	Percent Passing
19 mm	100%
4.75 mm	60% maximum
600 μ m	23% maximum
75 μ m	8% maximum

FIGURE 3: Running Course Grading Limits

The quality of fines (those materials passing 75 μ m) shall be not less than that required for the basecourse below the running course when tested in accordance with the requirements for the basecourse. This requirement shall be waived for running course where its percentage passing 75 μ m sieve is less than 1.5% and the percentage passing the 150 μ m sieve is less than 2.0%.

10.3 Construction

The Contractor shall choose the particular grading, material source quantity and construction method for the running course so that:

- (i) the surface finish specified is obtained;
- (ii) if necessary, fine aggregate is available to fill small voids between the large aggregate on the surface of the basecourse;
- (iii) a uniform spread of running course is maintained to protect the pavement below; and
- (iv) the running course material does not compact on top of the basecourse to form a fixed layer.

Should the running course chosen not meet the above requirements, the Contractor shall remove the existing running course and lay a suitable running course.

11. DEFECTS TO BE REMEDIED

Any defects or damage of any nature occurring during the construction or maintenance of the pavement layer shall be made good immediately by the Contractor at his own expense. Where rutting or potholes occur in the unsealed pavement they shall be fixed by ripping and re-compacting.

12. PRESEALING REQUIREMENTS

Prior to sealing, the Contractor shall advise the Engineer that the pavement surface has been prepared in accordance with clause 7.8 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 7.7 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 m².

The degree of saturation 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 degree of saturation (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 rise between testing and sealing. (ie 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 the formula below.

$$\% \text{ saturation} = \frac{\text{dry density} \times \% \text{ water}}{1 - \frac{\text{dry density}}{\text{solid density of the particles}}}$$

Note: Recent research noted improved rut resistance with decreasing DOS. Pavements with a design traffic loading in excess of 5x10⁶ ESAs improve significantly with a DOS of less than 60% prior to sealing, for other roads a maximum DOS of 65% would be suitable. Where premature failures have been noted for a material the increased DOS requirements should be applied. Where the increased DOS requirements cannot be met consideration should be given to modification of the basecourse material (e.g. with lime or cement).

13. MAINTENANCE

Defects that develop in works carried out in this contract in the maintenance period shall be repaired by removal and reinstatement to standards required by the relevant specification together with the rectification of any contributing faults.

14. BASIS OF PAYMENT

If not otherwise addressed in the contract documents, the unit rates in the schedule shall include all miscellaneous items (eg lodgings, supervision, setting out, contingencies, conveyance of plant, and other incidental work, general overhead administration, maintenance).

14.1 Measurement Definition

For the purpose of payment for unbound granular pavement layers, the following definitions shall apply:

(a) Solid Measure Volume

The total compacted volume in cubic metres calculated from the dimensions shown in the drawings.

14.2 Pavement Layers

Payment for each of the pavement layers specified will be made on the volume of aggregate incorporated within the net outlines of the work specified, either solid measure volume or loose measure volume as scheduled.

The scheduled rate shall include allowance for supply, cartage, placing, watering, compaction, consolidation and obtaining specified surface finish.