

NZTA B02: 2025

Specification for the Construction of Unbound Granular Pavement Layers

DISCLAIMER

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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 but does not include maintenance patching or dig outs.

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

2 Referenced Documents

2.1 General

The related documents shall be the most recent publication of the document unless a publication date is specifically referenced in this specification.

2.2 NZ Transport Agency

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|-----|--------------|--|
| (a) | NZTA M03 | Specification for Sub-Base Aggregate |
| (b) | NZTA M04 | Specification for Basecourse Aggregate |
| (c) | NZTA T03 | Procedure for the Determination of Road Surface Texture |
| (d) | NZTA T24 | Procedure to Determine the Plateau Maximum Dry Density for Pavement Layers |
| (e) | NZTA T28 | Test Method for the Determination of the Dry Density and Water Content Relationship of Aggregate |
| (f) | NZTA T29 | Procedure for the Random Selection of Test Sites Within a Lot |
| (g) | NZTA Z01 | Minimum Standard for Quality Management Plans |
| (h) | NZTA Z08 | Standard for Inspection, Sampling and Testing |
| (i) | NZTA TM 7003 | Roughness Requirements for Finished Pavement Construction |

2.3 Standards New Zealand

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|-----|-------------------|---|
| (a) | NZS ISO/IEC 17025 | General Requirements for the Competence of Testing and Calibration Laboratories |
| (b) | NZS 4402 | Methods of Testing Soils for Civil Engineering Purposes |
| (c) | NZS 4407 | Methods for Sampling and Testing Road Aggregates |
| (d) | AS/NZS ISO 9001 | Quality Systems – Requirements |

2.4 Other

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| (a) | Civil Contractors New Zealand: Industry Guidance for Basecourse Preparation for Road Construction |
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3 Definitions

- Sub-base aggregate. The material laid on the subgrade below the base either for the purpose of making up additional pavement thickness required, to prevent intrusion of the subgrade into the base, or to provide a working platform
- Basecourse aggregate. One or more layers of material usually constituting the uppermost structural element of a pavement and on which the surfacing may be placed. It may be composed of fine crushed rock, natural gravel, broken stone, stabilised material, asphalt or Portland cement concrete
- Running course aggregate. Running course aggregate is a temporary layer applied to the finished basecourse surface to either protect the surface from traffic, or to “cut” a fines layer off the surface. See clause 5.2.
- Lot. A Lot is defined as a section where the same material is used, the same construction process undertaken and represents no more than a day's work. The Lot shall be visually homogeneous. If the Lot does not appear to be homogeneous it shall be divided into Sublots and tested as required below.

- (e) Target Dry Density: The Target Dry Density is the density to be achieved in the constructed pavement layers. It is determined using either (or both) of NZTA T24 and NZTA T28.
- (f) A patch or a dig out operation is defined by contract specified requirements.
- (g) Feather Edge: The surface of the pavement layers between the shoulder hinge point and the subgrade surface

4 Quality Management Requirements

4.1 General

The Contractor shall implement a quality management system that complies with the requirements of NZTA Z01 and Z08 specifications. The quality system shall be registered to AS/NZS ISO 9001 and be regularly audited by a JAS-ANZ accredited agency.

The supplier of aggregates for use as sub-base or basecourse materials shall operate a quality management system compliant with the principles of AS/NZS ISO 9001.

All material sampling and testing required by this specification shall be undertaken by a laboratory accredited to NZS ISO/IEC 17025 with the sampling and testing carrying the endorsement of the accreditation agency.

The Contractor shall prepare a Quality Plan that clearly explains how all of the requirements of this specification will be achieved in the field. The Quality Plan shall be submitted to, and is subject to, approval by the Principal. This shall constitute a Hold Point.

4.2 Submissions and Hold Points

The Contractor shall accommodate the following submissions and hold points (as defined in Z08) and provide advance notice to the Principal as in Table 1 below:

Table 1: Submissions and Hold Points

Clause	Criterion	Status	Advance Notice (working days)	Response time (working days)
4.1	Approval of Quality Plan	WP		14 maximum
5.1	Compliance of aggregate with the technical specification	CC	2 minimum	7 minimum
5.2	Running course aggregate complies with specified requirements	CC	2 minimum	7 minimum
6.3	Density compliance of layers containing granulated surfacings	CC	2 minimum	7 minimum
6.4.1	Transportation does not segregate aggregate	WP	2 minimum	7 minimum
6.4.2	Placement of aggregate	WP	2 minimum	7 minimum
6.4.3	Layer thicknesses comply	WP	2 minimum	7 minimum
6.4.4	Joints constructed with appropriate offset between layers	WP	2 minimum	7 minimum
7.1	Approval of compaction plant		2 minimum	14 maximum
7.2.1	MDD and OWC to T28 available	CC	2 minimum	7 minimum
7.2.2	Plateau density tests carried out (greenfield sites only)	CC	2 minimum	7 minimum
7.3	Layer density compliant	CC	2 minimum	1 minimum
8.1	Layer finish acceptable	WP	2 minimum	1 minimum
8.2	Dimensional tolerances compliant	CC	2 minimum	1 minimum
9.2.3	Roughness measured and complies with contractual requirements	CC	2 minimum	1 minimum
9.2.4	Final layer degree of saturation determined and compliant	CC	2 minimum	1 minimum

Note: “WP” denotes a witness point, “CC” denotes a compliance criterion.

The advance notice by the Contractor and response times by the Principal listed above are default values and may be amended by the specific contract requirements. These times may be varied by agreement between the Principal and the Contractor where external factors affect the works programming.

5 Materials

5.1 Aggregate Quality

Aggregates shall comply fully with the relevant technical specification. Sub-base aggregate shall be the aggregate Class specified by the contract and compliant with NZTA M03. Basecourse aggregate shall be the aggregate Class specified by the contract and compliant with NZTA M04.

Aggregates used as running course shall comply with clause 5.2 of this specification.

Acceptance of the aggregate as compliant with the relevant technical specification by the Principal shall constitute a Hold Point.

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.

5.2 Running Course

5.2.1 Material Properties

The running course aggregate shall be manufactured from a source rock that has a crushing resistance of not less than that of the M04 basecourse Class specified when tested in accordance with NZS 4407 test 3.10. It shall be free from contaminants. The quality of fines shall be not poorer than the M04 basecourse Class specified.

The Contractor will select the running course aggregate depending on its intended purpose. Running course aggregate may be used as a temporary surface layer to protect the finished basecourse from traffic or used as a medium to "cut" a layer of fines from the finished basecourse surface prior to the application of a chip seal.

5.2.2 Material Performance

The running course aggregate will be such that:

- (a) the surface finish specified is obtained.
- (b) if necessary, fine aggregate is available to fill small voids between the large aggregate on the surface of the basecourse.
- (c) a uniform spread of running course is maintained to protect the pavement below; and
- (d) the running course material does not compact on top of the basecourse to form an additional 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.

6 Construction

6.1 Maintenance of Existing Surface

Where the project consists of reconstruction, or overlay of an 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.

6.2 Dimensions

Except as specified in clauses 6.4.7 or 6.4.8 as appropriate, 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 design.

Construction shall be controlled such that the finished dimensions are achieved within the tolerances specified in clause 8.2.4.

6.3 Existing Surfacing

The pavement surfacing shall either be removed or granulated as specified in the contract documents.

Granulation shall be such that surfacing fragments shall be nominally 50mm or finer. The depth of the granulated layer after compaction shall be at least twice the thickness of the existing surfacing.

The layer containing the granulated surfacing shall be visually homogeneous to the satisfaction of the Principal.

Granulated layers greater than 100mm thickness shall be tested and shall comply with layer density requirements. This shall constitute a Hold Point.

6.4 Construction of the Pavement

6.4.1 Transport and Stockpiling

Transport operations and construction of site stockpiles shall be such that the aggregate does not become segregated.

6.4.2 Placement of Aggregate

A pavement layer shall only be constructed once the underlying layer meets all the specified requirements.

Aggregate shall be placed in layers of uniform thickness. Placement of aggregate shall be such that the aggregate does not become segregated. The Quality Plan shall detail procedures used to prevent segregation occurring.

The Principal may sample the aggregate after placement but before compaction. The method of NZS 4407 clause 2.4.7 shall be used to obtain samples from the placed aggregate.

Placement operations of the aggregate shall be undertaken such that no damage to, or rutting of, the underlying layer occurs. At all times 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. Particular care shall be taken that traffic or construction plant movements are not concentrated in one location.

Unless permitted by the Principal in writing, overweight construction vehicles are not permitted to use the compacted pavement layer as a haulage route.

6.4.3 Layer Thickness

The compacted 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 6.4.7 or 6.4.8 as appropriate, and
- (b) more than 260mm for an AP 65 aggregate, or
- (c) more than 200mm for an AP 40 aggregate, or
- (d) less than 75mm and more than 120mm for an AP 20 aggregate.

6.4.4 Joints

The construction joints in each successive layer of the pavement shall be offset such that joints are not directly above the construction joints in the lower layer. Transverse joints shall be offset by at least 500mm. Longitudinal joints shall be offset by at least 250mm and clear of wheel paths.

Pavement surfacings and bound pavement layers shall be saw cut to at least 100mm depth to provide a clean and accurate joint face.

6.4.5 Pavement Widening

Longitudinal joints between existing pavement layers and widened pavement layers shall be saw-cut through the existing surfacing and any stabilised pavement layers to the full depth of the pavement. The surfacing of unstabilised layers shall be saw-cut, but the pavement layer does not need to be saw-cut.

The location of the initial saw-cut shall be above the point that the bottom existing pavement layer is to be widened from, as specified in the Contract. All the layer material to the outside of the saw-cut (on the side to be widened), shall be trimmed away along the saw-cut to form a vertical face down to the full depth of pavement layers that are to be widened.

The bottom pavement layer material for the widening shall then be placed and compacted as specified, extending from up against the trimmed vertical face to the outer edge.

Once the bottom layer has been completed, a saw-cut at least 250mm away from the first saw-cut, towards the road centreline and parallel to the first saw-cut, shall be made to the depth of the newly constructed bottom pavement layer. The pavement layer material to the outside of the second saw-cut (on the side to be widened), shall then be trimmed away along the saw-cut to form a vertical face down to the top of the newly constructed pavement layer.

The next layer over the widened bottom layer shall then be placed and compacted as specified, up against the trimmed vertical face to the outer edge of this pavement layer.

The process of stepping back by 250mm towards the road centreline for each additional widened layer followed by a saw-cut, trimming to create a vertical face and then processing and compacting the next layer to the outer edge for each layer, is repeated for each successive widened layer until the underside of the pavement surfacing. The number of 250mm wide longitudinal staggered steps cut into the existing road pavement layers will be the same as the number of new pavement layers constructed unless otherwise specified.

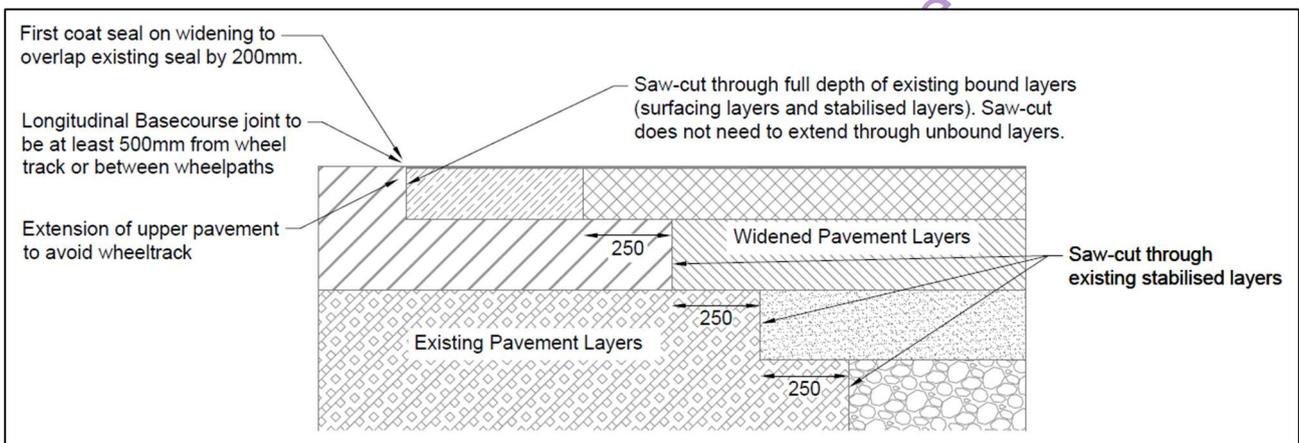


Figure 1: Detail of Staggered Widening Layers

6.4.6 The Use of Running Course

On completion of the layer 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.

6.4.7 Tapers of Sub-base or Levelling Layers

Where tapering of sub-base or levelling layer aggregates is specified, 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 6.4.3 (a). Taper areas of less than minimum uncompacted thickness shall be compacted in conjunction with subsequent pavement course or layer construction.

6.4.8 Tapers of Basecourse and Finishing Layers

Where tapering of basecourse including finishing layer aggregate is specified 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 6.4.3 (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 compacted thickness of greater than 2.5 times the maximum particle size of the basecourse used.

6.4.9 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 7.3 do not apply to these areas.

Edges designed to have gradient 5:1 or flatter the surface shall be able to withstand a moving wheel load of up to 4 tonnes without displacement.

Feather edges designed steeper than 5:1 shall be over-constructed and cut to shape. Any aggregate that is surplus as a result of shaping shall be removed from the works.

6.4.10 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.

7 Compaction

7.1 Compaction Plant

The Contractor shall provide compaction plant and equipment of suitable capacity such that the granular pavement layers are compacted uniformly in both vertical and horizontal dimensions to, or more than, the Target Dry Density.

The suitability of the compaction plant is subject to approval by the Principal. This shall constitute a Hold Point.

Final consolidation, compaction of the surface layer and the required surface finish may be obtained using a combination of compaction plant and, if permitted by the Principal, use by normal road traffic actively managed across the full width of the pavement works.

7.2 Determination of Target Dry Density

7.2.1 General

The Contractor shall be responsible for obtaining laboratory tests using the method of NZTA T28 to determine the laboratory maximum dry density (MDD) at the optimum water content (OWC) of the aggregate used. Test results carried out on behalf of the aggregate supplier may be used provided they are representative of the aggregate supplied and no more than three months old.

The combined Solid Density of the aggregate tested shall be determined as specified by T28 using the method of NZS 4407, Test 3.7. The tests shall be undertaken on material that is representative of that used in construction and a particle size distribution for the material tested shall be supplied with the results.

Successive pavement layers shall only be constructed once underlying layers have been demonstrated to meet all specified requirements and have been approved by the Principal.

7.2.2 Greenfield Sites

The Contractor shall construct test sections and undertake plateau density tests using the method of NZTA T24 for the purpose of determining the field maximum dry density. Compaction plant shall be typical of that to be used on site. Field density testing shall be at optimum water content $\pm 1.0\%$.

The Contractor shall determine the minimum number of roller passes required to produce pavement layer compaction as required in clause 7.3 at OWC $\pm 1.0\%$ and make the information available to the Principal. It shall be the responsibility of the Contractor to achieve the specified requirements.

The Target Dry Density (TDD) shall be established as the higher of the field maximum dry density and the laboratory maximum dry density.

The process used to establish the Target Dry Density shall be repeated every 5000m² of material laid.

7.2.3 Pavement Rehabilitation Works – Imported Materials

For pavement rehabilitation works using an imported aggregate that complies with NZTA M03 or NZTA M04 specifications as appropriate the Target Dry Density shall be the laboratory maximum dry density at optimum water content (OWC) determined using the method of NZTA T28.

If the specified density cannot be achieved in the field using approved compaction equipment, then the Principal may allow the use of NZTA T24 to determine the Target Dry Density.

The maximum dry density testing (either T24 or T28 as appropriate) shall be repeated at a frequency of one test per 5000m² of material laid.

7.2.4 Pavement Rehabilitation Works – Blended and In-Situ Materials

For pavement rehabilitation works where in-situ materials are being recycled into the pavement then the method of NZTA T24 shall be used to establish the Target Dry Density. The T24 testing shall be repeated at a minimum frequency of one plateau density test for every 5000m² of blended material laid.

The blend shall also be tested using the method of NZTA T28. The Target Dry Density shall be the higher of the values established by T24 and T28. The laboratory maximum dry density testing shall be repeated at a frequency of one test per 5000m² of blended material laid.

Where the in-situ material is observed to change then the NZTA T24 and T28 testing shall be repeated to confirm the Target Dry Density.

Refer to NZTA B02 Notes and T24 for guidance on appropriate compaction plant.

7.3 Density Requirements

Each pavement layer shall be compacted to a homogenous, dense, stable condition.

Compaction testing of the pavement layers shall be carried out in Lots. The degree of compaction for each Lot shall be determined by testing at least one randomly selected position per 200m² with a minimum of ten test positions per Lot. The method of NZTA T29 shall be used to select the test positions.

The method of NZS 4407 test 4.2 (i.e. nuclear density by direct transmission) shall be used to determine the dry density of the compacted aggregate. The nuclear density gauge probe shall be extended to its fullest extent, or the base of the layer, whichever is the lesser. The application of a moisture correction to the dry density test results as specified by NZS 4407 clause 4.2.6 is mandatory. Moisture corrections previously established using T24 may be used but must be with the same nuclear densometer.

The compacted aggregate layer shall be considered compliant with this specification if the minimum and mean dry density test results comply with the values in Table 2.

Table 2: Acceptance Criteria for Pavement Layer Dry Density as Percentage of Target Dry Density

Criterion	Sub-base Pavement Layer	Basecourse Pavement Layer
Mean Dry Density	95% of TDD minimum	98% of TDD minimum
Minimum Dry Density	92% of TDD minimum	95% of TDD minimum

The Contractor shall provide evidence of compliance for each pavement layer prior to construction of successive layers or surfacings. Such evidence can be in the form of preliminary or final test reports, checklists, inspection reports or similar. This shall constitute a Hold Point.

8 Layer Finish

8.1 Layer Surface

Aggregate layers shall be finished such that the surface exhibits a tightly interlocked stone mosaic surface with no appreciable layer of fines. Underlying layers shall exhibit sufficient texture such that successive layers key in to and bind with the substrate.

The basecourse surface finish, as distinct from the surface shape, shall present a tightly consolidated surface when swept in accordance with CCNZ *Industry Guidance for Basecourse Preparation for Road Construction*. This includes:

- (a) Large aggregate particles are exposed to the surface and held in place with a matrix of smaller aggregates.
- (b) Smaller aggregate particles held firmly in place by fine material.
- (c) The matrix is not displaced under normal trafficking or sweeping.

The standard of sweeping shall be sufficient to remove all loose aggregate, dirt, dust, silt and other deleterious matter. The presence of any layer of fine material, including crusher dust, on the surface shall render the surface unacceptable for sealing.

Layer finish and acceptance by the Principal shall constitute a Hold Point.

8.2 Dimensional Tolerances

8.2.1 Testing Frequency

Testing frequency shall be every 20 longitudinal metres or as directed by the Principal.

8.2.2 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 tolerances in Table 3 and Table 4. The standard of smoothness shall be such that there is no point in the surface that varies more than 10mm from a 3m 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%.

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.

8.2.3 Maximum Variation of Horizontal Dimensions

Width variations from specified dimensions shall comply with the requirements of Table 3 below:

Table 3: Requirements for Widths

Condition	Maximum Variation
Unconstrained	-20 mm +100 mm
Constrained	Zero

8.2.4 Maximum Variation of Vertical Dimensions

Vertical dimensions of finished sub-base and basecourse layers shall be determined and comply with the following requirements depending on road configuration.

The finished height shall be measured at multiple transverse locations across the full width of the pavement as follows:

- (a) All lane lines
- (b) All edge lines
- (c) All centre lines
- (d) All hinge points

The finished height shall not vary by more than the limits of Table 4 from the specified dimensions.

Vertical variations from specified dimensions shall comply with the requirements Table 4 below:

Table 4: Maximum vertical variations

Pavement layer	Between pavement centreline and pavement edge (mm)	
	Without concrete channel	With concrete channel
Sub-basecourse	-25 +5	-25 +5
Basecourse with asphalt surfacing	-15 +5	Varies, see Notes (a) & (b)
Basecourse with chip seal surfacing	-5 +15	Varies, see Notes (a) & (c)

Notes:

- (a) at or close to the lip of channel –5 +5 mm
- (b) at other locations on pavement –15 +5 mm
- (c) at other locations on pavement –5 +15 mm

In some alignments achieving the specified vertical tolerances can be at the expense of ride quality. Where this is identified by the Contractor the Principal may direct whether the construction tolerances or the ride quality takes precedence. In these specific instances the Contractor will not be required to meet the specified requirements for the non-precedent criterion.

8.2.5 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 8.2.2 for surface shape and clause 8.1 for surface finish shall be checked by the Contractor, as detailed in the Quality Plan, and records made available for inspection by the Principal.

9 Pre-Sealing Requirements

9.1 Pre-Seal Maintenance

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

9.2 Specific Requirement

9.2.1 Hold Points

The following clauses constitute a hold point.

9.2.2 Sweeping

Prior to sealing, the Contractor shall advise the Principal that the pavement surface has been prepared in accordance with clause 8.1 although final sweeping may not have been performed. The Principal shall be given the opportunity to inspect the site. Additional dimensional testing may be required by the Principal at this time.

9.2.3 Roughness

The longitudinal smoothness of the final surfacing layer shall comply with the maximum International Roughness Index (IRI) roughness value detailed in the specific contract requirements.

9.2.4 Degree of Saturation

The method of NZS 4407 test 4.3 may be used for final water content testing provided that the density testing of clause 7.3 has been completed and complies with the requirements of this specification. The water correction factor determined during the testing of clause 7.3 or T24 shall be used to correct the water content test results. If this is unavailable then the water correction procedure of NZS 4407 clause 4.3.6 shall be followed.

The degree of saturation shall be determined by testing every 200m² with a minimum of five tests per lot. The test positions shall be selected using the method of NZTA T29.

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 complies with the limits in Table 5. Pavement layer compaction test results may be used for this purpose where the Principal is satisfied that the water content has not had a chance to rise between testing and sealing. (i.e. it has not rained, had heavy dewfall nor additional watering been applied to the pavement). The degree of saturation (% saturation or DOS) is defined in NZS 4402 and is calculated using the formula below.

$$\text{Degree of saturation} = \frac{\text{dry density} \times \% \text{ water}}{1 - \frac{\text{dry density}}{\text{combined solid density of the aggregate}}} \quad (\%)$$

The maximum Degree of Saturation shall comply with the limits of Table 5 below:

Table 5: Degree of Saturation Requirements

Design Traffic Loading (DESA)	Degree of Saturation (%)
Greater than 5 x 10 ⁶	65% maximum
Less than 5 x 10 ⁶	80% maximum

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