R40 Pavement Base and Subbase
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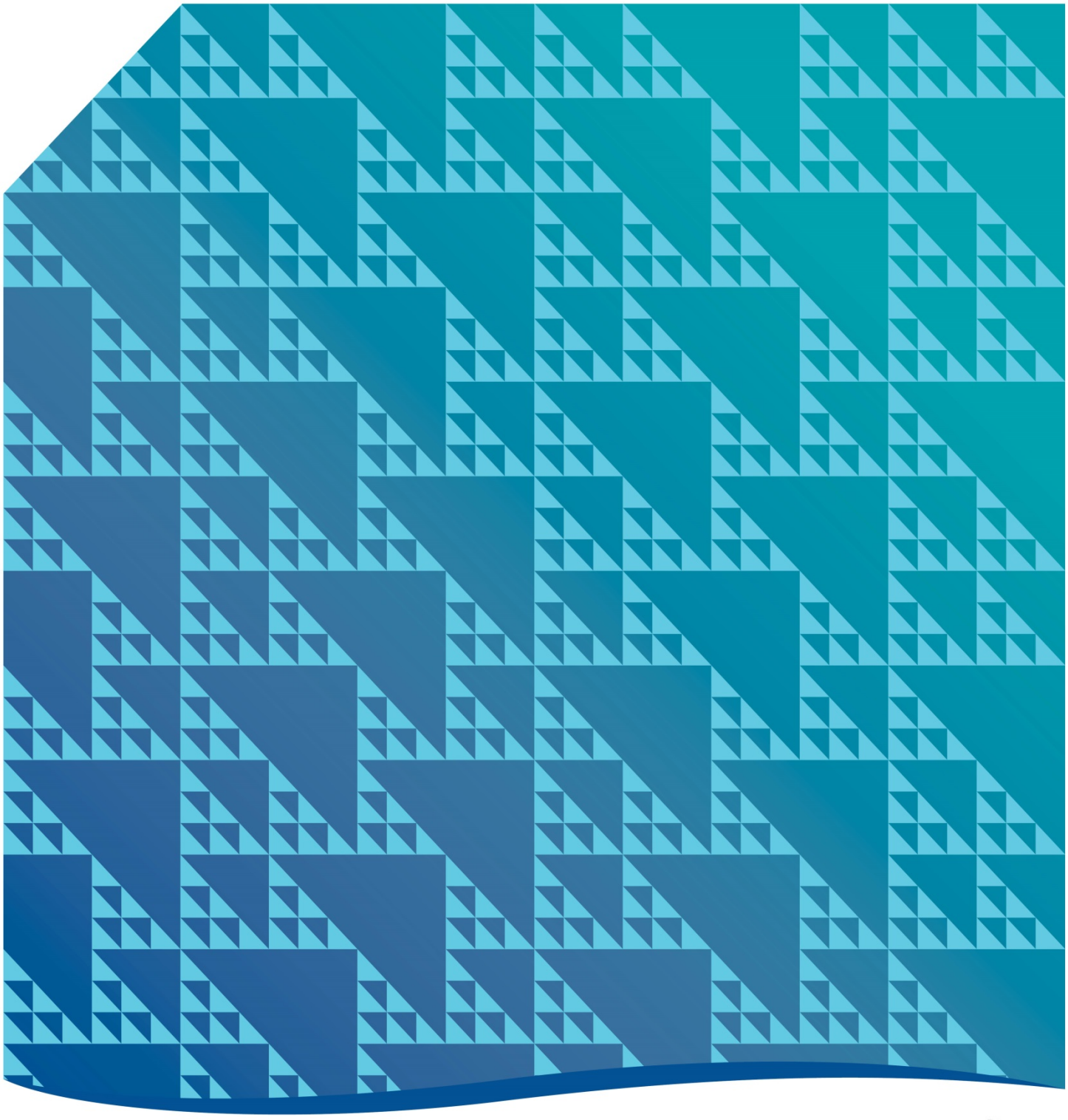
Roadworks Specification



Department of State Growth

Tasmanian Government

REVISION REGISTER

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 1 / Rev 1	All Document R40.4 R40.6.3 R40.6.3 R40.A.1 R40.A.1- R40.A.3	*'Department of State Growth'* replaces *'DIER'* Formatting updated to current Specification Template Reference to ENR40 added Inclusion of CBR testing for Base A material Clause (c) relating to Unsound and Marginal Rock Content added Clause 2. Requiring Base A material to have a minimum CBR of 100% Limits specified for the unsound and marginal rock component (applies to basic igneous rock only)	BW (MRA)	07.07.14
Ed 1 / Rev 0	R40.A.4(f) R40.A.5(c)3)	edited from '40m', to read '40mm' edited from '10m', to read '10mm'	BW (MAM)	14.06.13

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R40.1 SCOPE

This Specification sets out the minimum requirements for:

- properties of materials used as base and subbase
- properties of materials used as unsealed road and unsealed shoulders wearing surface
- sampling and testing
- quality control and documentation
- compaction
- tolerances on dimensions and levels and surface evenness

to be achieved in the construction of unbound granular pavements.

It includes a payment adjustment scheme which is based on the measured roughness of the completed pavement.

The material and construction standards for the five material categories (Base Class A and B, Subbase 1 and 2 and Unsealed Road and Unsealed Shoulders Wearing Surface) are included in the Appendices.

R40.2 DEFINITIONS

For the purposes of this Specification, the following definitions apply:

Course: Separately defined and specified layer(s) in a pavement.

Base: Uppermost granular course of the pavement. Two quality classes of base are defined (Class A and Class B).

Subbase 1: Course placed immediately below the Base.

Subbase 2: Course placed below Subbase 1.

Coarse Aggregate: That portion of the material retained on a 4.75mm A.S. Sieve.

Fine Aggregate: That portion of the material passing a 4.75mm A.S.Sieve.

Nominal Size: Whole number, expressed in mm, above the sieve size through which nearly all of the particles pass.

Lot: A single homogeneous production unit produced by the same work process and brought to completion at the same time. The lot shall appear to be of consistent quality without obvious changes in attribute values, whether or not these attribute values form part of the quality criteria.

Target Grading: A particle size distribution, expressed as percentage of material passing each relevant sieve size, which represents the expected median value of the material after placement and compaction within the pavement.

Deviation Limits of Grading: When added to and subtracted from the percentage passing each sieve size of the target grading, these define the extreme range of acceptable properties of the material.

OMC: Optimum Moisture Content, Modified Compaction

MDD: Maximum Dry Density, Modified Compaction

DDR: Dry Density Ratio, Modified Compaction

CBR: Californian Bearing Ratio

Lane IRIqc: It is average IRI (International Roughness Index) of two wheel paths in a single lane, with units of m/km.

Assigned Value: It is the value of a property, calculated from consecutive and the most recent measurements of that property. It is used to determine compliance of the product with the specified criteria for the particular property. It applies to a homogeneous product without obvious changes in attribute values, whether or not these attribute values are directly related to the particular property.

R40.3 OBJECTIVES AND QUALITY STANDARDS

The objective is to ensure a smooth and durable pavement structure which:

- contains only materials of the specified strength and durability
- has uniform properties, shape and dimensions
- will not lose shape under traffic loading

Quality requirements are defined in terms of:

- properties of the constituents of products such as durability and shape of aggregates
- strength (CBR) of the product at specified moisture and density
- particle size distribution and properties of the fines, after placing and compaction
- characteristic DDR of compacted layers
- dimensional tolerances of courses
- roughness of the finished pavement.

R40.4 REFERENCES AND STANDARDS

Pavement construction shall be compatible with the provisions of all Department of State Growth Standard Specifications for Design, Construction and Maintenance, Austroads Guides And Test Methods and Australian Standards in particular:

Department of State Growth Standard Specifications

- G1 – General Provisions
- G2 – Contract Management Plan
- G3 - Traffic Management
- G6 – Production of Aggregate and Rock Products
- G8 – Construction Survey
- G9 – Product Quality
- G10 – Construction Environmental Management Plan
- T4 - Planning and Design Survey.

Austroads Guide to Pavement Technology

- Part 4 – Pavement Materials
- Part 4A – Granular Base and Subbase Materials
- Part 4E – Recycled Materials
- Part 4G Geotextiles and Geogrids
- Part 4H Test Methods
- Part 6 – Unsealed pavements
- Part 8 Pavement Construction
- Part 9 – Pavement Work practices.

Austroads Guide to Asset Management

- Part 5B – Roughness.

There are a number of Austroads reports referenced in these guides that are also to be used particularly:

- AP-C87/08 Glossary of Austroads Terms.

Australian Standards

- AS 1141 Methods of Sampling and Testing Aggregates
- AS 1289 Methods of Testing Soils for Engineering Purposes
- AS 2758 Aggregates and Rock for Engineering Purposes.

ENR40 Pavement Base and Subbase - Explanatory Notes provide background information, and should be read in conjunction with this Specification.

R40.5 NOMINATION OF MATERIALS

The Contractor is required to provide evidence that the materials nominated for use in the pavement are capable of meeting the specified criteria.

For each nominated material, the Contractor shall, at least five (5) working days prior to intended use of the material, supply to the Superintendent the following:

- a completed *Nomination of Materials Form R40.1* which includes:
  - the source and geological origin of all component materials and the percentage by dry mass of each component, this is particularly relevant to blended products
  - the target grading, where this applies
  - test data, which demonstrate that the material satisfies the relevant requirements of this specification
  - estimates of the effect of compaction on particle size distribution (*R40.6.3(b)*) where the Contractor intends to use, as evidence of product control, particle size distributions measured prior to placement and compaction
- for Base and Subbase 1 materials, evidence that the material source is managed in accordance with *Department of State Growth Standard Specification G6*.
- a representative sample (100kg) in clearly labelled bags, individually no heavier than 25kg, if required by the Superintendent. For blended products, the Contractor shall provide 10kg samples of each component material in clearly labelled bags in addition to the representative sample, if required by the Superintendent.

The above requirements shall also apply to any changes of materials and their components during the course of the contract.

Note:
The Contractor should be aware that payment adjustments apply to the achieved evenness of surface. The Contractor's choice of materials, spreading and compaction plant and control over the variability of materials and processes will largely determine the achieved evenness of surface. The likely stability of materials under traffic is an important consideration.

Test reports and other information shall comply with the following:

- The date on the test reports, required to accompany the completed Nomination of Materials form, shall be within six (6) months of the date of submission of the form
- The assigned values are derived from tests undertaken within the previous 24 months
- The CBR test report is accompanied by particle size distribution, properties of fines, maximum dry density and optimum moisture content for the sample tested for CBR.

R40.6 PRODUCT QUALITY

R40.6.1 General

The quality of all material after placement and compaction shall meet all the requirements of this specification, including particle durability and shape, CBR, particle size distribution and properties of fines.

Non compliance of a lot with respect to particle size distribution and/or properties of fines will be treated as defective work (*Clause G2.4.6*).

Retests of lots will not include any earlier test result.

The Contractor shall test materials and document results as defined *R40.6.3*

R40.6.2 Material Quality

(a) General

Materials shall be uniform in composition and moisture content, well mixed and not segregated.

Material shall be free from the seeds of noxious weeds, plant pathogens and other organic matter, lumps or balls of clay. In the event that the source contains sulphides, mica, secondary minerals or other constituents with potentially adverse effects on the performance of the product, the Contractor shall submit a plan to the Superintendent in accordance with Clause G6.6.

All components, coarse and fine, shall be comprised of hard durable particles with no tendency to fret or breakdown when alternately wetted and dried.

The properties of materials crushed to produce the fines of blended products shall satisfy the durability requirements for coarse aggregate.

(b) Material Quality Requirements

The requirements for particle size are defined in terms of the acceptable deviation of the measured percentage passing each nominated sieve size from the specified or target grading.

Different deviation limits apply to:

- the mean of the three samples within each lot
- for each sample within the lot

In each case the measured value must fall within the range defined by the specified or target value, plus and minus the particular deviation limits. In addition to the above, limits are placed on the relative proportion of particles within consecutive sieve sizes. These are termed grading ratios.

The requirements for properties of fines are defined in terms of maximum acceptable values of:

- Liquid Limit (LL)
- Plastic Index (PI)

Plastic Index multiplied by percentage passing 0.425 mm sieve for each sample within a lot and the lot mean.

R40.6.3 Quality Control

(a) Sampling Procedures

Where material is supplied from a compliant source using production control testing for both particle size distribution and properties of fines, test results supplied from this source will be acceptable as evidence of product compliance provided that:

- the Contractor's control procedures, including dealing with a non-complying product, are detailed in the Contract Management Plan
- the production quality testing undertaken at a frequency of not less than 1 test per 600 tonnes
- there is traceability between the location of the material in the pavement and the production quality testing, sufficient to ensure that the location of non-complying materials can be established
- account is made of any changes to material properties that may arise from placement and compaction, as defined in R40.6.3 (b)

- after accounting for the effects of compaction the moving average of the latest three consecutive tests shall comply with the specified mean value and all tests shall comply with the "each sample" limits
- the supplier provides all production test results for the particular material during the period of supply of the particular lot in question.

Note:
Where for instance the supplier may have produced, say 3000 tonnes of a particular material while supplying only say 2000 tonnes to the contract in question, the Superintendent will require access to all the results for the 3000 tonnes.

In the event that the supplier is not undertaking production control testing for compliance with particle size distribution and properties of fines, testing shall be carried out on a lot basis. The maximum size of lots, for insitu testing, shall not exceed 5000m2. The frequency of sampling and testing shall be 3 tests per lot.

(b) CBR Tests on Compacted Base Class A and B, Subbase, I Subbase 2 and Unsealed Wearing Surface
Soaked CBR tests at the specified dry density ratio and moisture content (Appendices A1 – A5 as required) shall be undertaken at a rate of not less one (1) test per 3000 tonnes of supply.

Each test result shall comply with the minimum soaked CBR in Appendices A1 – A5 as required.

In the event that the supplier is undertaking routine CBR tests in accordance with the above and maintaining quality control charts, compliance shall be based on the assigned value. The assigned values calculated from five (5) consecutive measurements and using the following formula (`x-s).

The Superintendent may accept an assigned value determined using some data older than 24 months provided that there is at least two (2) measurements not older than 24 months. The Superintendent may also judge compliance based on less than five (5) measurements provided that three (3) of these measurements are not more than 24 months old and that the measurements are the only measurements that have been made for the particular product. In this latter case, the assigned value shall be the minimum value in the data set.

In both the above situations the Superintendent may require an increased frequency of testing until there are five (5) test results within the 24 month time frame.

In the event that the assigned value is not less than:

- 120% of the specified minimum CBR, the testing frequency may be reduced to not less than one (1) test per 6,000 tonnes of supply.
- 150% of the specified minimum CBR, the testing frequency may be reduced to one (1) test per 10,000 tonnes of supply.

In the event that the assigned value falls outside the limits for a lower frequency of testing, the higher test frequency shall apply until the limit for the lower frequency of test is satisfied.

(c) Unsound and Marginal Rock Content
This clause relates to basic igneous rock only. The rock shall be classed as either sound, marginal or unsound, in accordance with *Standard Specification G6 Production of Aggregates and Rock Products Clause G6.8.2(b)*. The fraction of marginal and unsound rock retained on a 4.75mm AS sieve shall not exceed the limits in Appendix A1 – A5.

(d) Accounting for Effects of Compaction
The specification applies to the properties of the material in place and after compaction. If the Contractor intends to submit results of tests made prior to placing and compaction as evidence of product compliance; the Contractor must demonstrate either that:

- the particle size distribution has not been significantly affected by compaction
- or that after correcting for changes that arise from compaction, the particle size distribution complies with the specified limits.

Demonstration will involve a field trial undertaken in accordance with Appendix B1. The trial will be undertaken either during or prior to the placement of the first lot of each course and repeated:

- at intervals not exceeding 5000m^3 of in place material
- whenever there is a significant change in the compaction processes or plant

The Contractor shall give the Superintendent at least 24 hours notice of the trial. The Contractor may be required to provide duplicate samples to the Superintendent.

Field trials may not be required where the Contractor can demonstrate to the satisfaction of the Superintendent, by previous tests and reports, that there is no significant change in particle size distribution resulting from placement and compaction or that the change is well established.

The above procedure does not remove the Contractor's obligations concerning the properties of the in-place material.

Where the particle size distribution is changed by compaction, the Contractor is required to deal with this matter in the Contract Management Plan.

The plan should define:

- the correction to be applied to each sieve size
- the methods by which the Contractor will account for the corrections in the setting of target values and compliance limits and in the control charts.
- the procedures to be adopted by the Contractor in the oversight of material quality and test results.

(e) Change of Target Grading

A Contractor in seeking a change to the target grading of Base Class B, Subbase 1, Subbase 2 or Unsealed Wearing Surface must demonstrate that the material and proposed limits fully comply with all the requirements of this specification. The Superintendent may require the Contractor to comply with *R40.5 Nomination of Materials*.

(f) Quality Control Documentation

The Contract Management Plan shall define the methods by which quality control and compliance with this specification is demonstrated and displayed.

The Contractor shall maintain quality control charts for CBR, particle size distribution, properties of fines and the product of PI and percent passing the 0.425mm sieve in addition to control charts required in Department of State Growth *Standard Specification G6*. The charts shall be readily available during construction for inspection by the Superintendent at all times.

The minimum requirements for the charts are:

- identify the property to be controlled
- all individual test results are included and identified by a sample or test number
- the test plots are made in chronological order (eg. date of supply, time of sampling or date of test)
- include at least one set of control limits (average or single sample) for each particular property
- at least four sieve sizes are included in the particle grading control charts. The charts shall include the 0.075 and 0.425 mm sieve sizes
- a chart for PI and PI x % passing 0.425mm sieve.

Test results shall be entered on the charts within five working days of receipt of the test results.

For the purpose of the control charts, test results, included in the charts, remain current for two years.

R40.7 CONSTRUCTION

R40.7.1 General

Each layer shall be finished to a uniform surface, free of segregated areas that does not deform or weaken under traffic or exposure to the weather.

Note:
The Contractor must select materials, plan construction and manage plant and traffic consistent with this requirement.

The top surface of base course shall be tight and shall not ravel under traffic. The top surface of other courses and layers shall not be loose or ravelled and shall be suitable to provide a good frictional bond with the succeeding layer.

No course shall be covered with a succeeding layer until it has met all the requirements of this Specification.

When placing a frost resistant base course a maximum length of 800m of base being left unsealed at any one time shall apply.

Note:
Previous experience with a Frost Resistant Base has indicated that compaction is best achieved with the use of a combination of vibrating and multi tyre rollers and that it needs to be sealed as soon as possible after compaction and preparation of the surface to limit traffic damage. The pavement will noticeably deteriorate if left unsealed over a weekend.

R40.7.2 Handling and Spreading

The material shall be handled in a manner that avoids segregation and produces a uniform finished product.

R40.7.3 Pavement Layer Thickness

The maximum permitted thickness of compacted layers within each course is included in Appendices A1 – A5 as required.

R40.7.4 Compaction

Compaction shall be assessed according to *Department of State Growth Standard Specification G4*.

Pavement materials shall be compacted to the relevant minimum characteristic DDR given in Appendices A1 – A5 as required.

R40.7.5 Moisture Content Prior to Sealing

Prior to sealing, the Contractor shall inspect the base and ensure that it is of uniform moisture content and free of local damp and wet spots and demonstrate that the Moisture Content of the base course is not more than 70% of the corrected OMC.

The Contract Management Plan shall define:

- inspection plan for the completed base
- method of selecting lots and test sites
- number of samples in each lot(minimum shall be 3)
- the manner by which the Contractor will deal with an uneven distribution of moisture.

Where the number of test sites for moisture content is 4 or less the assessment shall be based on the maximum moisture content measured in those samples. Where the number of test sites is greater than 4, the assessment shall be based on the average plus one standard deviation of the test results for that lot.

The sampling depth shall be 75mm or greater. The moisture contents determined by the use of an appropriately calibrated nuclear density meter will be acceptable.

In addition to the above moisture content requirements, the surface of the base may have to meet ball penetration test criteria (embedment) as defined in *Department of State Growth Standard Specification R51*.

R40.8 COMPLETED SURFACE

R40.8.1 General

The surface of each pavement course shall conform to the levels, grades and shapes shown on the Drawings or in the computer printout.

No point on the finished surface of a course shall deviate from the designated levels by more than the tolerances defined in Appendices A1 – A5.

The join to existing work after placement of the surfacing shall be smooth without any abrupt change in levels. The location of the join shall not be detectable when driven over in a passenger vehicle.

R40.8.2 Evenness Of Finished Surface - Roughness Survey

Where the works include construction of a base course across a full lane width, a roughness survey shall be undertaken after the completion of all bituminous surfacing works but prior to Practical Completion.
Payment adjustments may be made based on these measurements.

All areas of roadway, carriageways and ramps shall be tested, except in those areas of the contract which are less than 200m continuous length. These need not be tested.

Individual carriageways, ramps, side roads and different surfacing types shall be treated as individual lots.

The required procedures for the assessment and analysis of the roughness data and calculation of the assigned roughness are included in *Appendix B2*.

R40.8.3 Payment Adjustment

Unless specified otherwise in the Works Specification, the adjustments to the payment given in *Table R40.1 - Payment Adjustment for Level of Service* will apply to new work.

New work for the purpose of this clause involves the construction of a full lane width base course layer including any modification or stabilisation of an existing pavement structure.

The adjustment is based on the assigned roughness determined for each carriageway.

The adjustment, which applies to the tendered price for the supply, placement and compaction of the base and sprayed surfacing course placed on the base. The adjustment may be positive or negative. The payment adjustment applies only to that portion of the base that is surfaced.

In the event that the starting and finishing points of the survey do not include the joints between the new work and adjacent sections, or that the Contractor deletes the readings covering these joints from the calculation of the characteristic roughness, the Contractor shall: inform the Superintendent of the reasons for excluding the joints

eliminate unevenness of the joints to the satisfaction of the Superintendant.

Table R40.1 – Payment Adjustment for Level of Service

Assigned Roughness Lane IRIqc m/km	Percentage Adjustment to Payment (%)
0 – 2.0	Additional 1.0% for each 0.10 or part thereof that R c < 2.0
2.01 – 2.3	No adjustment
2.31 – 3.0	Reduction of 1.0% for each 0.10 or part thereof that R c > 2.3
Greater than 3.01	Unacceptable Level of Service

R40.8.4 Unacceptable Level of Service

Where the completed surface is of an unacceptable level of service the Contractor shall provide to the Superintendent a proposal to return the works to an acceptable level.

The Contractor shall not proceed with the proposed remedial works without the prior approval of the Superintendent.

The Principal shall not be liable for any costs incurred by the Contractor in returning the works to an acceptable level of service.

R40.9 MEASUREMENT AND PAYMENT

The Contractor shall demonstrate compliance with this specification as a condition of payment.

When field measurement of pavement is undertaken (Ref. *Clause G1.18*), payment shall be for the quantities of material for each course computed on the basis of the measured plan area of the top finished surface of each course within the design perimeters constructed to the specified thickness within the tolerances. The unit of measurement shall be square metres. The top surface shall not include embankment and table drain batter slopes.

In areas of kerb or kerb and gutter, the plan area of the top finished surface of base shall be measured from the face of the kerb, or lip of kerb and gutter. The Contractor shall make allowance, within the rate for base quoted in the Schedule of Rates, for base placed under and 150mm minimum beyond the back of kerb or kerb and gutter.

Base course supplied, spread and compacted on site shall be paid for at the tendered rate per square metre adjusted in accordance with *Table R40.8.3*. Where the base course is measured in the Schedule as cubic metres, the value of the base subject to the payment adjustment shall be the surfaced area multiplied by the rate per cubic metre multiplied by the average depth of the base course.

R40.10 COMPLETED WORKS REPORT

In addition to any requirements stated elsewhere, the completed works report shall contain:

- location plans that identify
  - materials used
  - the precise position of a change in material type within any course
  - lot boundaries for material properties and compaction control
- nomination of material forms for each material used
- control charts for particle size distribution, properties of fines and Corrected MDD and OMC for each material used.
- CBR test results, or alternatively CBR control charts for Base Class B, Subbase 1 & 2
- moisture contents prior to sealing as a percentage of corrected OMC for each sealing lot
- record of the mean Lane IRIqc for each measurement interval for each lane.

R40.11 HOLD POINTS

The hold points (Refer *Clause G2.5.4*) identified in this Specification are in *Table R40.2 Hold Points*.

Table R40.2 – Hold Points

Reference	Description	Nominated Work not to Proceed	Evidence of Compliance
R40.5	nomination of pavement material	Supply of pavement material	Nomination of materials form with supporting test data
R40.7.1	top of each pavement course	Placement of the next layer	Test data
R40.6.1	non compliance with respect to material quality	Further placement of material	Corrective action with supporting test data
R40.6.3 (d)	change of target grading	Placement of material	Test data
R40.8.3	exclusion of joint from roughness survey	Payment	Corrective action
R40.8.4	unacceptable level of service	Payment	Corrective action

R40.12 CONTRACT MANAGEMENT PLAN

The following clauses are relevant to the Contract Management Plan:

- *R40.6.3(a)*, dealing with non-complying product
- *R40.6.3(b)*, dealing with changes to particle size distribution as a result of placement and compaction
- *R40.6.3(d)*, defining methods by which quality control an compliance with the specification is demonstrated and displayed
- *R40.7.5*, defining inspection and test procedures of the base prior to sealing
- *Appendix A5 (c)(2)*, equipment and procedures that will be used to undertake the compaction of shoulder material.

APPENDIX R40.A – MATERIALS & CONSTRUCTION STANDARDS

APPENDIX R40.A.1 – BASE CLASS A

(a) Nature of Materials

The material shall be either a crushed rock or crushed natural gravel or a combination of both. At least 75% by mass of the coarse aggregate shall have two (2) or more broken faces. The moisture content prior to placement shall be within 1.0% of OMC.

The project specification may nominate either a nominal 19mm or 27mm material.

(b) Nomination of Materials (Ref *R40.5*)

1) Whole Sample – Particle Size Distribution

The target particle size distribution is defined below:

AS Sieve Size mm	% Passing	
	Nominal 19mm	Nominal 27mm
26.5		100
19.0	100	86
9.5	73	63
4.75	54	46
2.36	39	34
0.425	18	16
0.075	8	7

2) Soaked CBR

Soaked CBR (*AS 1289.6.1.1*), compacted to 98% DDR and within 1% of OMC, then soaked for 4 days prior to test. Material passing the 53mm sieve but retained on the 19mm sieve may be replaced by an equal portion by mass of the material passing the 19mm sieve but retained on the 4.75mm sieve. The amount of replaced material, on a dry mass basis, shall not exceed 25% of the portion passing the 19mm sieve. The report shall indicate the percentage replaced.

CBR (minimum) = 100

3) Coarse Aggregate

i) Wet/Dry Strength Variation (AS 1141-22)

Assigned Wet Strength (minimum) = 100kN

Assigned Wet/Dry Strength Variation (maximum) = 35%

ii) AS 1141.15 Flakiness Index

Assigned Flakiness Index (maximum) = 35

The Superintendent may accept the results of a single test report for Flakiness Index, provided that the report is not more than 6 moths old and the test result does not exceed 30.

4) Fine Aggregate

Liquid Limit (LL) (*AS 1289.3.1.1*)

Plastic Index (PI) (*AS 1289.3.3.1*)

Liquid Limit (maximum) = 25

Plastic Index (maximum) = 4

5) Unsound and Marginal Rock Content

This clause relates to basic igneous rock only. The rock shall be classed as either sound, marginal or unsound, in accordance with *Standard Specification G6 Production of Aggregates and Rock Products Clause G6.8.2(b)*. The fraction of marginal and unsound rock retained on a 4.75mm AS sieve shall not exceed:

- Unsound rock: maximum 5%

- Unsound and marginal rock: combined maximum 10%

(c) Acceptance Limits for in Place Product

1) Particle Size Distribution

The particle size distribution, for the mean and each sample, of the in-place compacted material shall fall within the following limits.

AS Sieve Size mm	% Passing			
	Nominal 19mm		Nominal 27mm	
	Lot Mean Limits	Each Sample Limits	Lot Mean Limits	Each Sample Limits
26.5			95-100	93-100
19.0	95-100	93-100	79-93	76-96
9.5	66-80	63-83	56-70	53-73
4.75	47-61	44-64	39-53	36-56
2.36	33-45	31-47	28-40	28-42
0.425	14-21	12-23	12-19	10-21
0.075	5-10	4-11	4-9	3-10

The particle size distribution curve for the inplace material shall not deviate from a lower limit to a higher limit but shall roughly parallel the target grading. The percent passing the 0.075mm sieve, divided by the percent passing the 0.425mm sieve shall fall within the range 0.35 to 0.60.

2) Properties of Fines

The properties of the lot mean and each sample shall not exceed:

Property	Lot Mean	Each Sample
Liquid Limit	25	27
Plastic Index	4	6

(d) Pavement Layer Thickness

Thickness of Compacted Layer (maximum) = 175mm

(e) Compaction (Ref *R40.7.4*)

Characteristic DDR (minimum) = 98.0%

(f) Completed Surface (Ref *R40.8.1*)

1) Maximum deviation from designated surface level of the base course

5mm (below) and 10mm (above)

2) Maximum gap under a 1.2m straight edge located anywhere on the completed surface

Maximum gap = 6mm

3) Roughness (IRI)

refer R40.8.3

APPENDIX R40.A.2 – BASE CLASS B

(a) Nature of Materials

The material may be a crushed rock, natural gravel or a mixture of both.

(b) Nomination of Materials (Ref R40.5)

The Contractor is required to nominate a target grading and to provide evidence that the nominated material satisfies the requirements specified in (1) to (4) below

1) Whole Sample – Particle Size Distribution AS 1289-3.6.1

The nominated particle size distribution must satisfy two requirements:

- % passing limits for target grading
- grading ratio limits

The limits for each are defined below.

The particle size distribution curve of the nominated grading shall not deviate from a lower limit to a higher limit of the target range but shall roughly parallel the limits of the target grading range defined in the table below. The grading ratio limit is the quotient of the percentage passing the two identified sieves. The divisor is the percentage passing the larger sieve.

Targets and Limits (% of Total Mass)						
Sieve Size mm	Specified Values			Nominated Grading	Acceptance Limits	
	Target	Limits of Deviation				
		Lot Mean	Each Sample		Lot Mean	Each Sample
100						
75	100					
37.5	90-100	8	12			
19	68-100	8	12			
9.5	50-100	8	12			
4.75	38-90	8	12			
2.36	28-60	7	10			
0.425	14-30	5	8			
0.075	7-20	3	5			

2) Grading Ratio Limits

Sieve Sizes mm	Limits % Passing
0.075 / 0.425	0.3 – 0.8
0.425 / 2.36	0.3 – 0.8
2.36 / 4.75	0.5 – 0.9
4.75 / 9.5	0.5 – 0.9

3 Soaked CBR

Soaked CBR (*AS 1289.6.1.1*), compacted to 98% DDR and within 1% of OMC, then soaked for 4 days prior to test. Material passing the 53mm sieve but retained on the 19mm sieve may be replaced by an equal portion by mass of the material passing the 19mm sieve but retained on the 4.75mm sieve. The amount of replaced material, on a dry mass basis, shall not exceed 25% of the portion passing the 19mm sieve. The report shall indicate the percentage replaced.

CBR (minimum) = 80

4) Coarse Aggregate

Wet/Dry Strength Variation *AS 1141-22*

Assigned Wet Strength (minimum) = 80kN

Assigned Wet/Dry Strength Variation (maximum) = 40%

5) Fine Aggregate
Liquid Limit (LL) (*AS 1289-3.1.1*)
Plastic Index (PI) (*AS 1289-3.3.1*)
Liquid Limit (maximum) = 25
Plastic Index (maximum) = 6
PI x % passing 0.425 mm sieve (maximum) = 180

6) Unsound and Marginal Rock Content
This clause relates to basic igneous rock only. The rock shall be classed as either sound, marginal or unsound, in accordance with *Standard Specification G6 Production of Aggregates and Rock Products Clause G6.8.2(b)*. The fraction of marginal and unsound rock retained on a 4.75mm AS sieve shall not exceed:

- Unsound rock: maximum 7%
- Unsound and marginal rock: combined maximum 10%

(c) Acceptance Limits for in Place Product

1) Particle Size Distribution
The particle size distribution limits for the mean and each sample of the inplace compacted material shall fall within limits defined by:

- the target grading,
- plus or minus deviation limits separately specified for the mean value and each sample within a lot

The specified deviation limits are included in section R40-A2 b(i) of this Appendix.

2) The Properties of Fines
The properties of the lot mean and each sample shall not exceed:

Property	Lot Mean	Each Sample
Liquid Limit	25	30
Plastic Index	6	8
PI x % Passing		
0.425 mm sieve	180	210

(d) Pavement Layer Thickness (Ref *R40.7.3*)

Compacted Layer Thickness (maximum) = 175mm

(e) Compaction (Ref *R40.7.4*)

Characteristic DDR (minimum) = 98%

(f) Completed Surface (Ref *R40.8.1*)

1) Maximum Deviation from designated surface level of course
5mm (below) and 10mm (above)

2) Maximum gap under a 1.2 m straight edge located anywhere on the completed surface
Maximum gap = 6 mm

3) Roughness IRI
Refer *R40.8.3*

APPENDIX R40.A.3 – SUBBASE 1

(a) Nature of Materials

The material may be a crushed rock, natural gravel or a mixture of both.

(b) Nomination of Materials (Ref *R40.5*)

The Contractor is required to nominate a target grading and to provide evidence that the nominated material satisfies the requirements specified in (i) to (iv) below.

1) Whole Sample – Particle Size Distribution AS 1289-3.6.1

The nominated particle size distribution must satisfy two requirements:

- % passing limits for target grading
- grading ratio limits

The limits for each are defined below.

The grading ratio limit is the quotient of the percentage passing the two identified sieves. The divisor is the percentage passing the larger sieve.

Targets and Limits (% of Total Mass)						
Sieve Size mm	Specified Values			Nominated Grading	Acceptance Limits	
	Target	Limits of Deviation				
		Lot Mean	Each Sample		Lot Mean	Each Sample
100	100	0	0			
75	95-100	9	15			
37.5	70-100	9	15			
19	52-100	9	15			
9.5	40-100	9	15			
4.75	30-100	9	15			
2.36	22-75	7	12			
0.425	12-40	6	10			
0.075	6-26	4	6			

2) Grading Ratio Limits

Sieve Sizes mm	Limits % Passing
0.075 / 0.425	0.3 – 0.8
0.425 / 2.36	0.3 – 0.8
2.36 / 4.75	0.5 – 0.9
4.75 / 9.5	0.5 – 0.9

3) Minus 19mm Fraction

Soaked CBR (*AS 1289.6.1.1*), compacted to 95% DDR and within 1% of OMC, then soaked for 4 days prior to test. Material passing the 53mm sieve but retained on the 19mm sieve may be replaced by an equal portion by mass of the material passing the 19mm sieve but retained on the 4.75mm sieve. The amount of replaced material, on a dry mass basis, shall not exceed 25% of the portion passing the 19mm sieve. The report shall indicate the percentage replaced.

CBR (minimum) = 30

4) Coarse Aggregate

Wet/Dry Strength Variation *AS 1141-22*

Assigned Wet Strength (minimum) = 50kN

Assigned Wet/Dry Strength Variation (maximum) = 45%

5) Fine Aggregate
Liquid Limit (LL) (*AS 1289-3.1.1*)
Plastic Index (PI) (*AS 1289-3.3.1*)
Liquid Limit (maximum) = 35
Plastic Index (maximum) = 12
PI x % passing 0.425
mm sieve (maximum) = 300

6) Unsound and Marginal Rock Content
This clause relates to basic igneous rock only. The rock shall be classed as either sound, marginal or unsound, in accordance with *Standard Specification G6 Production of Aggregates and Rock Products Clause G6.8.2(b)*. The fraction of marginal and unsound rock retained on a 4.75mm AS sieve shall not exceed:

- Unsound rock: maximum 10%
- Unsound and marginal rock: combined maximum 20%

(c) Acceptance Limits For In Place Products

1) Particle Size Distribution
The particle size distribution limits for the mean and each sample of the in place compacted material shall fall within limits defined by:

- the target grading,
- plus or minus deviation limits separately specified for the mean value and each sample within a lot

The specified deviation limits are included in section *R40-A3 b(i*) of this Appendix.

2) The Properties of Fines
The properties of the lot mean and each sample shall not exceed:

Property	Lot Mean	Each Sample
Liquid Limit	35	40
Plastic Index	12	16
PI x % Passing		
0.425 mm sieve	300	350

(d) Pavement Layer Thickness (Ref *R40.7.3*)
Compacted Layer Thickness (maximum) = 200mm

(e) Compaction (Ref *R40.7.4*)
Characteristic DDR (minimum) = 96%

(f) Completed Surface (Ref *R40.8.1*)
1) Maximum Deviation from designated surface level of course
30mm (below) and 15mm (above)

APPENDIX R40.A.4 – SUBBASE 2

(a) Nature of Materials

The material may be a crushed rock, natural gravel or a mixture of both.

(b) Nomination of Materials (Ref *R40.5*)

The Contractor is required to nominate a target grading and to provide evidence that the nominated material satisfies the requirements in (1) to (3) below.

1) Whole Sample – Particle Size Distribution AS 1289-3.6.1

The nominated particle size distribution must satisfy the limits defined in the table below.

Targets and Limits (% of Total Mass)						
Sieve Size mm	Specified Values			Nominated Grading	Acceptance Limits	
	Target	Limits of Deviation				
		Lot Mean	Each Sample		Lot Mean	Each Sample
100	100	0	5			
75	85-100	10	15			
37.5	70-100	10	18			
19						
9.5	35-100	10	18			
4.75						
2.36	18-80	10	18			
0.425	4-45	7	12			
0.075	0-25	7	12			

2) Minus 19mm Fraction

Soaked CBR (*AS 1289.6.1.1*), compacted to 95% DDR and within 1% of OMC, then soaked for 4 days prior to test. Material passing the 53mm sieve but retained on the 19mm sieve may be replaced by an equal portion by mass of the material passing the 19mm sieve but retained on the 4.75mm sieve. The amount of replaced material, on a dry mass basis, shall not exceed 25% of the portion passing the 19mm sieve. The report shall indicate the percentage replaced.
CBR (minimum) = 15

3) Fine Aggregate

Liquid Limit (LL) (AS1289-3.1.1)
Plastic Index (PI) (AS1289-3.3.1)
Liquid Limit (maximum) = 40
Plastic Index (maximum) = 20
PI x % passing 0.425mm sieve (maximum = 450

(c) Acceptance Limits For In Place Product

1) Particle Size Distribution

The particle size distribution limits for the mean and each sample of the in-place compacted material shall fall within limits defined by:

- the target grading,
- plus or minus deviation limits separately specified for the mean value and each sample within a lot

The specified deviation limits are included in section *R40-A4 b(i)* of this Appendix.

2) The Properties of Fines

The properties of the lot mean and each sample shall not exceed:

Property	Lot Mean	Each Sample
Liquid Limit	40	45
Plastic Index	20	25
PI x % Passing		
0.425 mm sieve	450	600

(d) Pavement Layer Thickness (Ref *R40.7.3*)

Compacted Layer Thickness (maximum) = 250mm

(e) Compaction (Ref *R40.7.4*)

Characteristic DDR (minimum) = 95%

(f) Completed Surface (Ref *R40.8.1*)

1) Maximum Deviation from designated surface level of course

40mm (below) and 20mm (above)

APPENDIX R40.A.5 – UNSEALED ROAD AND UNSEALED SHOULDERS WEARING SURFACE

(a) Nature of Materials

The material shall be produced from natural gravel, crushed rock or a mixture of both. The material shall be free from organic matter (clay lumps, excess mica and other deleterious materials). The desired material will have a marked resistance to ravelling in dry weather and to deformation in wet weather and will be of uniform quality.

(b) Nomination of Materials (Ref *R40.5*)

The Contractor is required to nominate a target grading (for the material in place and after compaction) and to provide evidence that the nominated material satisfies the requirements in this appendix.

1) Whole Sample Particle Size Distribution

The nominated particle size must satisfy two requirements

- % age passing limits
- Grading ratio limits

(i) Particle Size Distribution and Nominated Grading

The particle size distribution of the nominated material must be such, that after adding and subtracting the Limits of Deviation, the percentage passing falls within the target grading limits in the *Table R40.A.5.1* below.

Table R40.A.5.1 - Percent Passing Limits

Sieve Size (mm)	Target Grading Limits % Passing	Limits of Deviation %
26.5	100	0
19		12
9.5		12
4.75		12
2.36	40 to 70	10
0.425		8
0.075	6 to 25	5

The Contractor shall define and provide to the Superintendent, the percent passing of the nominated material for all the sieve sizes included in *Table R40.A.5.1*.

(ii) Grading Ratio Limits

The nominated grading shall also satisfy *Table R40.A.5.2* below:

Table R40.A.5.2 - Grading Ratio Limits

Sieve Size (mm)	Grading Ratio Limits / % passing
0.075/0.425	0.3 to 0.8
0.075/2.36	0.2 to 0.6
2.36/4.75	0.5 to 0.9
4.75/9.5	0.5 to 0.9

2) Coarse Aggregate

Crushed Aggregates when tested in accordance with *AS 1141-22* shall have:

Assigned Wet Strength. Minimum of 50kN

Assigned Wet Dry Strength Variation, Maximum of 45%

Natural Gravels and Sedimentary rocks when tested in accordance with *AS 1141.28* shall have a Ball Mill Value not greater than 50%.

Where the product is a mixture of crushed stone and natural gravels, both of the above provisions shall be met.

3) Fine Fraction

The Plastic Index (PI) (*AS 1289C3*) shall not be less than 4 or greater than 15.
The PI x Nominated % Passing the 0.425mm sieve size shall not exceed 300.

4) Soaked CBR (AS 1289.F1.1(2))

The Soaked CBR of the material at the nominated grading, compacted to 95% DDR and within 1% of OMC and soaked for four days, shall not be less than 50%.

(c) Acceptance Limits For In Place Product

1) Particle Size Distribution and Property of Fines

The particle size distribution of material in place and after compaction shall be within the limits defined by the nominated particle grading plus and minus the Limits of Deviation defined in *Table R40.A.5.1* and as well comply with the Target Grading limits of that same table and the Grading Ratio Limits of *Table R40.A.5.2*.

All material after compaction shall meet the requirement of Fine Fraction.

2) Compaction

The thickness of compacted layers shall not exceed 150mm or be less than 2.5 times the nominal size of the material.

For wearing surface placement on unsealed pavements and shoulder filling in existing pavements, the course shall be finished to a uniform tight surface that does not deform, ravel or weaken under traffic.

The Contractor shall define in the Contract Management Plan, the equipment and procedures that will be used to undertake the compaction of shoulder material.

3) Tolerance

10mm below or 15mm above the design surface level. Material abutting a sealed pavement shall match the level of the seal and shall not impede surface drainage.

APPENDIX R40.A.6 – FROST RESISTANT BASE

NOMINATION OF MATERIAL

For each separate material, the Contractor shall, at least 5 working days prior to intended use of the material, supply to the Superintendent the following:

- Details of the source and geological description of the material
- A representative sample (150kg) in clearly labelled bags, individually no heavier than 25kg
- Test results including historical data demonstrating that the material satisfies the relevant requirements of this specification and Specification G6
- The target grading
- For blended products, the Contractor shall identify the source and geological origin of all component materials and the percentage by dry mass of each component in the blend and provide 10kg samples of each component material in clearly labelled bags

The above shall also apply to any changes of materials and their components during the course of the contract.

MATERIAL QUALITY

The following requirements apply to all materials, unless specifically exempted by other Clauses of this specification.

Material shall be free from organic matter, lumps or balls of clay, excessive amounts of mica or secondary minerals or other adverse constituents. It shall be uniform, well-mixed and not segregated.

All components, coarse and fine, shall comprise of hard durable particles with no tendency to fret or breakdown when alternately wetted and dried.

While the strength and durability requirements have been expressed in terms of wet strength and wet/dry strength variation respectively, the contractor may nominate another criteria, provided that the combination of strength and durability criteria are consistent with *AS 2758.2*.

Specification Clause of *AS 2758.2* is as follows:

Base Class A

The Material shall be produced by crushing either quarried rock or naturally occurring gravel or a mixture of both.

The Coarse aggregate shall comprise clean, hard, durable, pieces of stone. At least 75% by mass of the coarse aggregate shall have 2 or more broken faces.

Grading Limits

The grading Limits for Frost Resistant Base material shall be given in *Table R40.A.6.1 – Target Grading Limits*.

Table R40.A.6.1 – Target Grading Limits

A.S. Sieve Size (mm)	Percent Resistant Base	
	Frost Resistant Base (27 mm)	
	Target Grading Limits % Passing	Target Grading Limits % Passing
100		
75		
37.5		
26.5	95-100	93-100
19	78-92	75-95
9.5	54-68	51-71
4.75	37-51	34-54
2.36	25-37	23-39
0.425	8-15	6-17
0.075	2-9	1-10

The Frost Resistant Base shall also comply with the relevant material quality requirements.

The road is to be sealed in a number of sections with a maximum length of 800m of frost resistant Base being unsealed at any one time.

Note:
Previous experience with a Frost Resistant Base has indicated that compaction is best achieved with the use of a combination of vibrating and multi tyre rollers and that it needs to be sealed as soon as possible after compaction and preparation of the surface to limit traffic damage. The pavement will noticeably deteriorate if left unsealed over a weekend.

APPENDIX R40.B.1 - FIELD TRIAL TO DETERMINE CORRECTION TO PARTICLE SIZE DISTRIBUTION

(a) Scope

The following describes procedures to be used by the Contractor in the event that the Contractor intends to submit results of tests made prior to placing and compaction as evidence of product compliance.

(b) Procedure

Demonstration will involve:

- A field trial which would normally be part of the works, using identical equipment, processes, layer thicknesses and moisture control as that intended to be used in the placement of the particular material.
- Particle size distributions of three samples taken prior to compaction. The samples shall be taken at the same point in the process, normally used by the supplier in sampling.
- Particle size distributions of three samples taken after the material has been placed and compacted to the specified values.
- Insitu density and moisture content tests in at least five locations within the trial
- Laboratory compaction test on a representative sample

(c) Report

The Contractor will provide a report which defines:

- The particular material tested
- Plant, layer thicknesses and number of passes used
- Measured moisture contents, insitu densities, dry density ratios (DDR) and characteristic
- DDR achieved in the trial
- Particle size distribution of samples, prior to and after compaction
- Intended corrections to the particle size distribution obtained prior to placement and compaction

APPENDIX R40.B.2 - MEASUREMENT AND CALCULATION OF ASSIGNED ROUGHNESS

(a) Measuring Device

The measuring device used for the measurement of roughness shall be:

- Capable of measuring the longitudinal profile along one or both wheel paths of a lane at least every 250mm with a precision of elevation of 0.5mm over a wave band of 1 to 20metres
- Calibrated according to the relevant test method

(b) Method of Measurement

- Measurements are made over 100m intervals. End lengths of less than 100m will not be included in the calculations but joints between lots shall be included.
- Measurement will be made in each traffic lane
- Three runs will be made in each lane
- Each run in a lane will commence at the same starting point

The starting point of the survey shall be within 10m of the start of the works. The start and finish chainages shall be recorded.

The Lane IRI qc is calculated for each measurement entered for each of the three lanes

A mean value of Lane IRIqc (Rm) is determined for each measurement interval of the three runs on each lane.

(c) Calculation of Assigned Roughness

A characteristic roughness Rc, expressed in Lane IRIqc, will be calculated for each lane from the following formula:

Rc = Rm + 1.0sn-1

Where the standard deviation:

sn-1= (Sum 1 to n (R n-R)2)½/ n-1

n = number of measurement intervals within the lane

The assigned roughness shall be the highest characteristic lane roughness within the particular carriageway. The Contractor may subdivide the readings of the lane with the highest characteristic roughness within a carriageway into subsections, provided that all subsections but one are longer than 0.5km and that no subsection is less than 0.3km.

FORM R40.1 - NOMINATION OF MATERIAL FORM

Electronic forms are available from
http://www.transport.tas.gov.au/road/contractor/specifications

Contractor:			
Contract No:			
Course:		Date:	

Material Source					
Name of Source:					
Supplier's Business Name:					
Address:					
Suburb:		State:		P/Code:	

Geological Descriptions		
a) Primary Material:		%
b) Additives:		%

Test Properties (Most recent test data)			
1) CBR			
Tested By:			
Report Date:		Report No:	
Specified CBR:		Measured CBR:	
			Attach Report

2) Durability			
Tested By:			
Report Date:		Report No:	
Specified Wet Strength:	kN	Assigned Wet Strength:	kN
Specified WDSV:	%	Assigned WDSV:	%
			Attach Report

3) Modified Compaction			
Tested By:			
Report Date:		Report No:	
Test Max Grain Size:	mm	Oversize:	%
Measured MDD:	t/m^3	Measured OMC:	%
Corrected MDD:	t/m^3	Corrected OMC:	%
Particle Density:	t/m^3		Attach Report

4) Properties of Fines			
Tested By:			
Report Date:		Report No:	
LL	PL	PI	Attach Report

5) Particle Size			
Tested By:			
Report Date:		Report No:	
			Prior to / after completion

Sieve Size (mm)	100	75	37.5	26.5	19	9.5	4.75	2.36	0.425	0.075
% Passing										
Target Grading % Passing										
Before/After Compaction										
Lot Mean Upper Limit % Passing										
Lot Mean Lower Limit % Passing										
Single Sample Upper Limit % Passing										
Single Sample Lower Limit % Passing										

Expected % Change in PSD Resulting from Compaction										
Sieve Size (mm)	100	75	37.5	26.5	19	9.5	4.75	2.36	0.425	0.075
Expected % Change to % Passing										

Tested By:			
Report Date:		Report No:	
			Attach Report

CONTROL CHARTS TO BE PROVIDED FOR SAME MATERIAL AS REQUIRED UNDER DEPARTMENT OF STATE GROWTH SPECIFICATIONS

1) Corrected Maximum Dry Density – Department of State Growth Standard Specification G4, Clause G4.8 (ii)

Supplied / Not Supplied

2) Wet Strength + Wet Dry Strength Variation – Department of State Growth Standard Specification G6, Clause G6.9(a)

Supplied / Not Supplied

3) Particle Size Distribution – Department of State Growth Standard Specification R40, Clause R40.8.2(e)

Supplied / Not Supplied

4) Plastic Index – Department of State Growth Standard Specification R40, clause 6.3(d)

Supplied / Not Supplied

SAMPLES

1) Primary Material

Identification: Number of Bags:

2) Additives

(a) Identification Number of Bags:
(b) Identification Number of Bags:
(c) Identification Number of Bags:

Signed:

Recorded:

Department of State Growth

GPO Box 536
Hobart TAS 7001 Australia

Transport Infrastructure Services

Phone: 1300 135 513

Email: info@stategrowth.tas.gov.au
Web: www.stategrowth.tas.gov.au