

# TRANSPORT FOR NSW (TfNSW)

## QA SPECIFICATION R123

### THIN OPEN GRADED ASPHALT SURFACING

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#### REVISION REGISTER

Ed/Rev Number	Clause Number	Description of Revision	Authorised By	Date
Ed 1/Rev 0		Initial issue for trials	GM, RNIC	02.05.00
Ed 1/Rev 1	1.3, 2.1.3(b).	Minor changes	GM, RNIC	17.08.00
Ed 1/Rev 2	1.3, 2.1.3	RTA 3211 specified for Flyash	GM, RNIC	11.02.03
Ed 2/Rev 0	“Notice” Foreword Global Annex M	RTA PO Box and Fax numbers updated. Foreword, incorporating copyright clause, added Specification reformatted. Text revised to direct imperative style. “Contractor” replaced by “you”. “Superintendent” replaced by “Principal”. “shall” replaced by “must”. Some clauses moved to Annexures. Minor editing to clarify intent. Referenced documents updated.	GM, IC	24.11.09
Ed 2/Rev 1	Global	References to “Roads and Maritime Services” or “RMS” changed to “Transport for NSW” or “TfNSW” respectively.	DCS	22.06.20
Ed 2/Rev 2	Annex L	Clause L2 – Frequency of testing stated clarified to be for filler used in asphalt production.	MCQ	10.09.20

# GUIDE NOTES

(Not Part of Contract Document)

## USING SPECIFICATION R123

Specification TfNSW R123 is a QA specification and the use of QA specifications requires the implementation of a quality management system by the Contractor that meets the quality management system requirements specified in TfNSW Q. To comply with the intention of government policy as well as TfNSW R123, Thin Open Graded Asphalt Surfacing works constructed using TfNSW R123 require adequate surveillance and audit by the Principal.

TfNSW R123 requires the TfNSW Project Manager to select appropriate parameters identified in TfNSW R123 and nominate them in Annexure R123/A. The Project Manager is also required to select an appropriate version of Specification TfNSW Q commensurate with the size of the project and the risk to the Principal.

### Introduction

Thin Open Graded Asphalt Surfacing may be referred to by the acronym TOGAS. It is a porous, relatively low cost surface treatment intended to improve skid resistance through improved texture. The treatment incorporates a heavy tack coat which is intended to provide sufficient bond to prevent delamination of the thin layer and also to water proof the underlying pavement.

In the broadest sense, TOGAS is a paver laid chip seal and thus the intended application of TOGAS is as a substitute for a sprayed seal and not as a substitute for a normal layer of asphalt. Notwithstanding this, the characteristics of TOGAS make it more suitable for use in urban areas than a sprayed seal surfacing and it has also found application where an open graded surfacing has been specified for noise reduction.

TOGAS supplied under this specification is expected to have a service life of 5 to 7 years and hence quality requirements on raw materials and product are not as stringent as those for a structural dense graded asphalt which is expected to have 3 to 4 times the life. Nevertheless, TOGAS must still be adequately engineered if it is to achieve the desired life without the asphalt ravelling, rutting, stripping or bleeding or the tackcoat flushing through to the surface of the treatment.

Being a thin layer surfacing, TOGAS does not add strength to the pavement and will not bridge areas of defective pavement. TOGAS is not suitable for use in heavy turning and braking areas such as intersections.

The quality and surface condition of the existing pavement impacts on the suitability and performance of TOGAS as a surface treatment. Existing pavements with low deflection and relatively even surface texture offer the best chance of success.

TfNSW Project Managers may obtain a general guide and past performance information from TfNSW Engineering Services Pavements & Geotechnical Section.

### Edition 1

Edition 1 was the initial issue version of the specification and was expected to require upgrading on the basis of field experience.

## **TECHNICAL REFERENCE NOTES**

### **Clause 1.1 Scope**

The tackcoat application rate applied for TOGAS is dependent on the texture of the existing surface. Thus for example, sprayed seals which have highly varying texture (and possibly including flushed or bleeding areas) must be repaired prior to the application of TOGAS if the intent in respect of resistance to flushing, bleeding or maintaining texture depth is to be achieved.

Similarly and because TOGAS is not strictly an asphalt in the normal sense of the word, if the surface of the underlying pavement is deformed to the extent that TOGAS is paved in the wheel tracks in excess of the allowable thickness (see notes on Clause 4.4), there is increased risk of permanent deformation.

Asset Managers intending to use TOGAS may wish to consider doing so as part of a package of measures if the risk of applying TOGAS directly to the existing surface is unacceptable.

### **Clause 2.1.1(a) & Clause 2.1.2(a) Grading requirements**

Aggregate cleanliness has a significant influence on the effectiveness of binder coating. The additional requirement to determine the proportion of 75 micron material by washing gives an indication of the cleanliness of the aggregate. A comparison between the proportion of 75 micron determined by wet and dry sieving respectively gives an indication of adhering dust.

Under generally accepted industry standards, aggregates of 10 mm nominal size and greater are normally considered clean if the proportion less than 75 micron is less than 1% (for a 5 mm aggregate the proportion should be less than 2%). These measures do not directly address adhering dust.

In cases where production techniques, dust suppression procedures, weather and weathering cause these general limits to be exceeded, the matter should be dealt with as a condition adverse to quality requiring corrective action.

### **Clause 2.1.1(b) & 2.1.1(c) Shape and Crushed particles**

Whilst these parameters are important in helping to promote skeletal interlock and stability in the thin layer of “open graded” asphalt, consideration may also need to be given to the micro texture of the aggregate surface with a view to maximising inter-particle friction.

### **Clause 2.1.1(e) Resistance to Stripping**

It would be desirable that the Plate Stripping Test AS 1141.50 (T230) be conducted using the binder which has been specified for the works. However, pending the outcome of a proposed review of the test, resistance to stripping of the coarse aggregate may be assessed using C170 binder conforming to AS 2008 in lieu of the binder specified for the works. Adequate adhesion between the binder and aggregate in asphalt is considered to be a high priority issue.

As a matter of perspective, the Plate Stripping Test is a relative measure of relative binder adhesion to aggregate. Moisture sensitivity is a broader consideration and depends for example on other issues such as cleanliness of aggregates and effective coating of aggregate with binder. Longer mixing times are generally required for effective mixing of TOGAS under this specification particularly as the product includes polymer modified binder and hydrated lime.

### **Clause 2.1.1(f) Frictional Characteristics**

For pavements with high skidding risk, special aggregates with PAFV up to approximately 60 are available for use in asphalt but these often present other challenges in respect of asphalt mix design.

It should be noted that there are other factors as well as PAFV which may influence the skid friction characteristics of a pavement surface. Project Managers are advised to refer to the Vicroads/TfNSW “Guide to the Measurement and Interpretation of Skid Resistance using SCRIM”.

#### **Clause 2.1.1(g) & Clause 2.1.2(c) Water Absorption**

The limits specified for water absorption have been set to facilitate the use of steel furnace slag aggregate. Desirable limits on conventional aggregates would be at least 1% lower.

#### **Clause 2.1.2(e) & Clause 2.1.3 Methylene Blue Value**

Methylene Blue Value (MBV) in excess of 10 is an indicator of risk of moisture sensitivity due to the presence of reactive clays and/or other deleterious matter. If this occurs, the matter should be raised with the Contractor as a possible condition adverse to quality.

As with other asphalt design parameters, there may be opportunity to engineer the TOGAS product to offset the risk and the Contractor should be given opportunity to reconsider the adequacy of the design.

The symptoms of moisture damage may include rutting, ravelling, potholing and cracking.

#### **Clause 2.1.4 & Annexure R123/A Binder Selection**

The guide notes attached to Binder Specification TfNSW 3252 make recommendation on a variety of applications. In the case of TOGAS, TfNSW Project Managers are advised to consider the binder recommendations relating to open graded asphalt.

#### **Clauses 2.1.6 Bitumen Emulsion Tackcoat**

The bitumen emulsion tackcoat is required to be a high binder emulsion and not the normal tackcoat used in asphalt paving works. As this type of tackcoat will generally contain a polymer modifier, it will invariably require some degree of heating for the purpose of handling and spraying.

#### **Clause 2.2.1 Proportions of Constituents**

The specified proportion of hydrated lime is considered to be the minimum requirement for added filler for the average circumstances. For high performance applications, mix designers may include higher proportions of added filler(s) to generate higher dry compacted voids (DCV) or substitute for more natural material in the filler fraction. It should be noted that high DCV fillers generally require the incorporation of a higher proportion of binder than would other added fillers if the crack/ravelling resistance of asphalt is not to be compromised.

The specified binder content range is applicable to commonly used natural sources of asphalt aggregates and sands. If the Contractor proposes to use constituents of substantially different density (for example, steel furnace slag), then the Contractor may propose and use, subject to the Principal's agreement, a non-conforming binder content provided that the Contractor demonstrates volumetric proportions within the proposed TOGAS which are consistent with the intent of the specification.

#### **Clause 2.2.3 & Clause 2.2.4 Binder in Asphalt & Voids in Asphalt**

Performance of asphalt is dependent on mix volumetrics and TfNSW is seeking consistency in the results reported for filler to binder ratio and laboratory compacted air voids. Assessment of consistency is best done on the basis of rolling average and rolling range and close control is recommended for TOGAS.

Suitable guides to process control are available from TfNSW and the Australian Asphalt Pavement Association. Clause 2.4.1 of this specification should be noted.

Note also that this is a process control issue and is designed to give the parties warning of undesirable trends which may impact on flushing or bleeding of the surface. In all circumstances, the Contractor's staff are expected to seek appropriate technical advice before adjusting specified product designs.

### **Clause 2.3.1(c) Validity of Test Certificates**

The provision that all testing should have been completed within the past twelve months is intended to allow the Contractor to submit a suitable nominated mix which may have been established for another contract. It is assumed that minimum frequency of testing of product and constituents will have been conducted as specified.

Proper and effective mix design and process control necessitates the use of current and compatible data. It is well recognised within the industry that constituent sources may be variable and it is always advisable to obtain and use up-to-date information (preferably at an interval not exceeding 1 month) throughout all phases of the Contract.

### **Clause 2.5.1 Sampling**

If appropriate, the point of sampling may be specified by the TfNSW Project Manager rather than leave the option to the Contractor. Essentially the samples are required to represent the asphalt as accepted and for most applications, sampling at the point of loading is considered suitable.

However, there may be cases where sampling at the point of delivery is considered more appropriate. These will tend to be cases where:

- (i) Haul distances are long,
- (ii) Special purpose aggregates (which may be absorptive) are used,
- (iii) Surveillance indicates evidence of segregation including binder drainage during haulage.

Most asphalt plants have fixed sampling platforms designed to provide safe access to the product in the loaded truck. Sampling at the point of delivery may require the Contractor to provide a portable sampling platform at the site.

### **Clause 3 Preparation of Pavement**

The following items are not normally expected to be provided under this Clause 3,

- (i) "correction of surface defects" as detailed in Section 6.2 of Asphalt Guide,
- (ii) "pretreatment" in the form of a sprayed seal as detailed in Section 6.2 of Asphalt Guide,
- (iii) "herbicide treatment" and "treatment of existing oil contamination",
- (iv) "raising of utility and manhole covers" as detailed in Sections 6.2.7 & 6.8.10 of the Asphalt Guide.

However, all contamination introduced by the Contractor must be removed by the Contractor irrespective of its nature.

Clause 4.5 of TfNSW R123 takes precedent over Section 6.3.2 of Asphalt Guide.

### **Clauses 4.4, 5.1 and Annexure R123/A Course Thickness**

TOGAS is a thin surfacing and hence the existing pavement surface must have relatively good shape if tearing of the mat under the paver screed, crushing of aggregate under rollers or deformation under traffic is to be minimised.

As a guide, TOGAS supplied and laid under this Specification is not intended for use in circumstances where the road has deformed in excess of 20 mm depth for applications where traffic volumes are less

than 2,500 vehicles per lane per day or 10 mm where traffic volumes exceed 2,500 vehicles per lane per day.

The course thickness of TOGAS at any point on the pavement should be within the range of 15 mm to 40 mm and hence specified average course thickness should be within this range making due allowance for the shape of the existing surface.

Best performance may be expected when TOGAS is applied at the minimum practical thickness with a suitable tackcoat application rate.

#### **Clause 4.7 Tackcoat**

The Contractor may heat the tackcoat to facilitate application and the residual binder on the pavement from the tackcoat should be applied at the nominated application rate which will generally be somewhere between 0.5 to 1.0 L/m<sup>2</sup> at 15°C.

As with a sprayed seal, the application rate proposed by the Contractor should take into account the condition of the existing surface. Note that surface factors used for design of sprayed seal work do not necessarily apply to TOGAS.

It is expected that the tackcoat will penetrate the overlying asphalt layer to some extent and hence the application rate of the tackcoat will also be influenced by the design of the asphalt.

Insufficient tackcoat may result in delamination of TOGAS from the existing surface.

#### **Clause 4.8 Rolling**

Being an “open graded” asphalt, rolling procedures may be expected to include only steel drum rollers. Initial rolling will generally include at least two passes in static mode and the same will apply to final rolling.

It is expected that the Contractor’s procedure will require completion of rolling before a minimum surface temperature (nominated in the PROJECT QUALITY PLAN) has been reached. It is also expected that the nominated minimum temperature by which rolling should be completed will not be less than 80°C and may be higher for some polymer binders.

#### **Clause 4.11 Placement Trial**

The nature of the TOGAS process is such that significant rates of output may be achieved in a day and at this stage, many jobs are relatively small in size.

Thus Project Managers are advised to consider the cost/benefit of a possible placement trial prior to completing Annexure R123/A.

#### **Clause 5 Finished Pavement Properties**

Under this specification, TOGAS is not intended to be paved to shape or survey levels.

#### **Clause 5.2 Ride Quality**

The cost/benefit of measuring ride quality warrants consideration similar to that for placement trials. As TOGAS is a thin layer surfacing, the opportunity for significant improvement in ride quality may be limited in some circumstances.

Assessment in respect of TOGAS overlays requires measurement of ride quality before and after the work and TfNSW Project Managers have an option to require the Contractor to conduct both measurements. The alternative is for TfNSW to provide ride quality measurement of the existing

pavement to tenderers. In all cases, ride quality information should be reported and assessed for each 100 m interval or part thereof and not as an average figure for the job.

#### **Clause 6.1 Rectification or replacement**

Rectification or replacement of minor nonconformities due to isolated high spots in the underlying pavement may present unacceptable practical difficulties and acceptance of an alternative suitable disposition by the Contractor may prove to be a better option overall. One such possibility may include a form of extended Period of Post-completion Undertaking

Notwithstanding the above, any proposal by the Contractor to extend the Period of Post-completion Undertaking in a disposition:

- (a) should give assurance that:
  - (i) there are adequate procedures and resources to monitor the works and rectify defects;
  - (ii) any failure arising from the nonconformity will become apparent during the Period of Post-completion Undertaking; and,
  - (iii) after the extended Period of Post-completion Undertaking, the life of the work will not be reduced by the nonconformity.
- (b) should not increase the net costs of administering the Contract during the extended Period of Post-completion Undertaking, including costs of:
  - (i) quarantining the works from other works that are the responsibility of the TfNSW,
  - (ii) directing repairs;
- (c) should not increase the costs of maintaining the works after Completion;
- (d) should provide an appropriate retention of Post-completion Undertaking.

The proposal should be referred to Commercial Services Branch.

#### **Annexure R123/A Details of Work**

Project Managers must ensure that this annexure is fully completed prior to issue of this document for procurement purposes.





Transport  
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QA SPECIFICATION R123

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# THIN OPEN GRADED ASPHALT SURFACING

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VERSION FOR: DATE:
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## FOREWORD

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### REVISIONS TO PREVIOUS VERSION

This document has been revised from Specification TfNSW R123 Edition 2 Revision 1.

All revisions to the previous version (other than minor editorial and project specific changes) are indicated by a vertical line in the margin as shown here, except when it is a new edition and the text has been extensively rewritten.

### PROJECT SPECIFIC CHANGES

Any project specific changes are indicated in the following manner:

- (a) Text which is additional to the base document and which is included in the Specification is shown in bold italics e.g. ***Additional Text***.
- (b) Text which has been deleted from the base document and which is not included in the Specification is shown struck out e.g. ~~Deleted Text~~.

# TfNSW QA SPECIFICATION R123

## THIN OPEN GRADED ASPHALT SURFACING

### 1 GENERAL

#### 1.1 SCOPE

This Specification sets out the requirements for Thin Open Graded Asphalt Surfacing (TOGAS). It includes:

- (a) design of asphalt and tack coat, including constituent materials, its production and transport;
- (b) preparation of the pavement; and
- (c) placing of asphalt including application of tack coat, laying and rolling of asphalt.

Stone Mastic Asphalt is an asphalt manufactured with a high proportion of coarse aggregate and relatively low air voids.

#### 1.2 STRUCTURE OF THE SPECIFICATION

This Specification includes a series of annexures that detail additional requirements.

##### 1.2.1 Details of Work

Details of work are shown in Annexure R123/A.

##### 1.2.2 Measurement and Payment and Resolution of Nonconformities

The method of measurement and payment must comply with Annexure R123/B.

Acceptance of materials and work must be in accordance with Clause 6.

##### 1.2.3 Schedules of HOLD POINTS, WITNESS POINTS and Identified Records

The schedules in Annexure R123/C list the **HOLD POINTS** and **WITNESS POINTS** that must be observed. Refer to Specification TfNSW Q for the definitions of **HOLD POINTS** and **WITNESS POINTS**.

The records listed in Annexure R123/C are **Identified Records** for the purposes of TfNSW Q Annexure Q/E.

##### 1.2.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure R123/D and must be implemented.

Adopt the AS 2150 (Hot mix asphalt – A guide to good practice) or the Austroads AP-G66/02 (Asphalt Guide) for necessary procedure(s) not specifically addressed in this Specification.

In all cases where this Specification refers to the manufacturer's recommendations, these must be included in the PROJECT QUALITY PLAN.

### **1.2.5 Referenced Documents and Definitions**

Unless specified otherwise, the applicable issue of a referenced document, other than a TfNSW Specification, must be the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 2350). For convenience, the full titles are given in Annexure R123/M:

The terms "you" and "your" mean "the Contractor" and "the Contractor's" respectively.

In this specification, the open graded asphalt component of TOGAS may be referred to as "asphalt".

## **2 SUPPLY OF TOGAS**

Design and supply the product within the limits of the specification to exhibit the following performance properties:

- (i) durability in resistance to delamination, ravelling, rutting, stripping and flushing or bleeding;
- (ii) high permeability in the asphalt to reduce build up of surface water;
- (iii) low permeability through the tack coat to prevent ingress of water into the underlying pavement; and
- (iv) substantial texture depth to assist in providing skid resistance.

Adopt AS 2150 or Austroads AP-G66/02 for procedures(s) not specified in this Specification.

### **2.1 MATERIALS FOR TOGAS**

#### **2.1.1 Coarse Aggregates**

Coarse aggregates must conform to the requirements of AS 2758.5, subject to the following options and exceptions shown in Table R123.1:

**Table R123.1 – Coarse Aggregate Requirements**

<b>Item No.</b>	<b>Material Requirements</b>	<b>Acceptance Criteria</b>	<b>Test Method</b>	<b>Minimum Frequency</b>
2.1.1a	Particle size distribution The nominated particle size distribution of each constituent aggregate, determined in accordance with AS 1141.11.1, must conform to the asphalt manufacturer's specification which is attached to the PROJECT QUALITY PLAN. Allowable tolerances must not exceed Table 1 of AS 2758.5.  In addition to the above requirement, material finer than 75 µm must be determined and reported in accordance with AS 1141.12.	Asphalt manufacturer's specification	AS 1141.11.1 and AS 1141.12	Refer to Annexure R123/L
2.1.1b	Particle shape (for fraction retained on the 9.5 mm AS sieve)  (i) using 2:1 calliper ratio	≤ 25%	AS 1141.14	
2.1.1c	Fractured face(s) for aggregates derived from gravels and meta-sediments  (i) at least two fractured faces  (ii) at least one fractured face for Normal Application	≥ 75%  ≥ 98%	TfNSW T239  TfNSW T239	
2.1.1d	Strength and durability  (i) Wet strength  (ii) Wet/dry strength variation	≥ 150 kN  ≤ 35%	AS 1141.22  AS 1141.22	
2.1.1e	Resistance to Stripping (Aggregate in "as received" condition without precoat but dried to constant mass using Class C170 bitumen)	Report	AS 1141.50	
2.1.1f	Frictional characteristic (Polished aggregate friction value - PAFV)	≥ 48 (unless specified otherwise in Annexure R123/A)	AS 1141.41	
2.1.1g	Water absorption  (i) for steel furnace slag aggregate	≤ 2.5%*	AS 1141.6.1	
2.1.1h	Apparent Density  (i) Dry Density  (ii) SSD Density	Report	AS 1141.6.1	

**2.1.2 Fine Aggregates**

Fine aggregates must be:

- (a) (i) aggregate; and/or

- (ii) secondary and/or tertiary crusher dusts (such crusher dusts may be washed and/or classified prior to use in TOGAS),

resulting from the manufacture of coarse aggregates conforming to Clause 2.1.1;

or

- (b) natural sands.

Fine aggregates must also conform to the requirements shown in Table R123.2:

**Table R123.2 – Fine Aggregate Requirements**

<b>Item No.</b>	<b>Material Requirements</b>	<b>Acceptance Criteria</b>	<b>Test Method</b>	<b>Minimum Frequency</b>
2.1.2a	Particle size distribution The nominated particle size distribution of each constituent aggregate, determined in accordance with AS 1141.11.1, must conform to the asphalt manufacturer's specification which is attached to the PROJECT QUALITY PLAN. Allowable tolerances must not exceed Table 1 of AS 2758.5.  In addition to the above requirement, material finer than 75µm must be determined and reported in accordance with AS 1141.12 for each fine aggregate.	Asphalt manufacturer's specification	AS 1141.11.1 and AS1141.12	Refer to Annexure R123/L
2.1.2b	Soundness	≤ 12% weighted loss	AS 1141.24	
2.1.2c	Water absorption	≤ 3.5%	AS 1141.5	
2.1.2d	Apparent Density (i) Dry Density (ii) SSD Density	Report	AS 1141.5	
2.1.2e	Methylene Blue of the portion passing 0.075 mm AS sieve	Report	ISSA Technical Bulletin #145	

### **2.1.3 Added Fillers**

Added fillers must conform to Specification TfNSW 3211.

For rock flour and baghouse dusts, determine and report the Methylene Blue Value (MBV) of the portion of material passing 0.075 mm AS sieve to AS 1141.11.1 in accordance with International Slurry Surfacing Association Technical Bulletin No. 145.

### **2.1.4 Binder**

The binder must conform to Specification TfNSW 3252 and must be the class specified in Annexure R123/A.

Provide documentary evidence of the binder conformity for each delivery used in the work.

**2.1.5 Bitumen Adhesion Agent**

Any added bitumen adhesion agent must conform to Specification TfNSW 3269 except that:

- (i) Substitute test method AS 1141.50 for Test Method TfNSW T230; and
- (ii) in all cases, the binder used to conduct the test must be Class C170 conforming to AS 2008.

**2.1.6 Bitumen Emulsion Tackcoat**

Bitumen Emulsion Tackcoat must be CRS grade high binder content emulsion conforming to the requirements of AS 1160 and in addition must contain a minimum of 3% SBR polymer modifier. The bitumen in the emulsion must be Class C170 or C320 in accordance with AS 2008.

Nominate in your PROJECT QUALITY PLAN the class of binder in the emulsion and any proposed modification to the binder.

**2.2 QUALITY REQUIREMENTS FOR TOGAS****2.2.1 Proportions of Constituents**

- (a) Hydrated Lime. The asphalt must contain, by mass of the combined particle size distribution, a minimum of 1.0% of powdered hydrated lime complying with Clause 2.1.3.
- (b) Adhesion Agent. A bitumen adhesion agent may be added to the binder.
- (c) Binder. The binder content of the nominated mix (% by mass of total asphalt mix) must not be less than 4.8% in accordance with AS/NZS 2891.3.1.

**2.2.2 Combined Particle Size Distribution**

The combined particle size distribution of the nominated mix, when determined in accordance with AS/NZS 2891.3.1, must conform to the requirements of Table R123.3.

**Table R123.3 - Combined Particle Size Distribution**

<b>AS Sieve Size (mm)</b>	<b>Combined Particle Size Distribution Design Limits Percent Passing (by mass)</b>
13.2	100
9.50	80 – 100
6.70	30 – 55
4.75	20 – 40
2.36	18 – 36
1.18	14 – 30
0.600	10 – 25
0.300	7 – 20
0.150	6.0 – 12.0
0.075	4.0 – 8.0

### **2.2.3 Binder in Asphalt**

Determine binder film thickness and report in accordance with AG:PT/T237.

Determine and report the ratio of mineral material passing 0.075 mm AS sieve (% by mass of total aggregate) to binder content (% by mass of total mix). Refer to this parameter as filler to binder ratio.

### **2.2.4 Voids in Asphalt**

The voids in laboratory compacted asphalt (% voids of the volume of the asphalt mix) must not be less than 13% when compacted by 80 cycles of a gyratory compactor in accordance with AS/NZS 2891.2.2 and tested in accordance with AS/NZS 2891.7.3, AS/NZS 2891.8 and AS/NZS 2891.9.3.

## **2.3 NOMINATED MIXES**

### **2.3.1 Submission of Nominated Mixes**

Submit to the Principal at least one nominated mix. Include the following details in your submission:

- (a) Constituent materials
  - (i) Aggregates - source, geological type.
  - (ii) Filler - type and source.
  - (iii) Binder - source, class or grade.
  - (iv) Bitumen adhesion agent - name, type, source of supply.
  - (v) Bitumen emulsion tackcoat - class of bitumen, any bitumen modification, source.
  - (vi) Relevant test results verifying material properties specified in Clause 2.1 for the above mentioned materials.
- (b) TOGAS Design
  - (i) Proportion of each constituent by percentage of mass of total asphalt mix.
  - (ii) Test Record (verification) Forms showing a nominated value and allowable tolerances for each asphalt quality requirement in Clause 2.2. Include each sieve of the combined particle size distribution.
  - (iii) Type and identification number of asphalt mixing plant.
  - (iv) Application rate of the tackcoat.
- (c) Submit test results of the following properties of a trial batch of each nominated mix produced by the mixing plant from which the asphalt is to be supplied.
  - (i) Combined Particle Size Distribution, AS/NZS 2891.3.1, for all sieves listed in Table R123.1.
  - (ii) Binder Content, by mass of total mix, AS/NZS 2891.3.1.
  - (iii) Binder film thickness, RC 201.01 (Design and production trial only)
  - (iv) Filler to binder ratio, Clause 2.2.3.
  - (v) Voids in the laboratory compacted mix, expressed as per cent by volume: AS/NZS 2891.2.2, AS/NZS 2891.7.3, AS/NZS 2891.8 and AS/NZS 2891.9.3 at 80 cycles of gyratory compaction.

The required testing must have been carried out within the twelve month period prior to the date of submission to the Principal. All tests for each nominated mix must be from one trial batch and tests of the constituent materials must represent the materials used in this trial batch. Perform all phases of any particular test at one laboratory.

Report the nominated combined particle size distribution and VMA in accordance with Annexure R123/E.

- (d) A statement, signed by you stating that each asphalt mix and its constituents meet the requirements of Clauses 2.1 and 2.2. Include NATA-endorsed test results for all specified tests in your statement. Attach a copy of your completed verification checklist.

### **HOLD POINT**

Process Held: Use of each nominated mix.

Submission Details: Documents as detailed in Clause 2.3.1 at least 7 working days before each asphalt mix is proposed to be used.

Release of Hold Point: The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

### **2.3.2 Tolerances for Nominated Mixes**

Tolerances for the trial and production mixes are permitted, for the actual binder content from the nominated binder content and the actual combined aggregate particle size distribution from the nominated aggregate particle size distribution, within the limits shown in Table R123.4.

**Table R123.4 - Tolerances for Asphalt**

<b>Description</b>	<b>Tolerance</b>
Tolerances for the actual combined particle size distribution from the nominated combined particle size distribution during trial and production (% by mass of total aggregate, AS/NZS 2891.3.1) for each mix size:	
Pass 4.75 mm AS sieve and larger	± 7
Pass 2.36 mm and 1.18 mm	± 5
Pass 0.600 mm and 0.300 mm	± 4
Pass 0.150 mm	± 2.5
Pass 0.075 mm	± 1.5
Production tolerance for the actual binder content from the nominated binder content during trial and production (% by mass of total asphalt mix, AS/NZS 2891.3.1)	± 0.3

### **2.3.3 Variations to Nominated Mix**

If you propose to vary:

- (a) the proportions of the constituents in a nominated mix, with the exception of added filler, by 10% or more of the value nominated in accordance with Clause 2.3.1(b)(i); or

- (b) the proportion of added filler by 15% or more of the value nominated in accordance with Clause 2.3.1(b)(i); or
  - (c) values nominated in accordance with Clause 2.3.1(b)(ii); or
  - (d) any constituent source including binder,
- then submit a new nominated mix in compliance with Clause 2.3.1.

## **2.4 PRODUCTION OF TOGAS**

### **2.4.1 Methods of Production**

Your methods of production must be such as to:

- (a) control the process and to target the nominated mix; and
- (b) supply a homogeneous product.

### **2.4.2 Plant**

The production plant must have, and you must allocate, sufficient capacity to supply asphalt for continuous operation of the paver.

### **2.4.3 Storage and Handling of Binder**

Implement procedures for storage and handling of binder which prevent segregation and contamination of the binder by flushing liquids or other materials.

At the asphalt manufacturing plant, recirculate binder covered by TfNSW 3252 in delivery and/or storage tanks to a uniform consistency prior to use in the asphalt. In addition to this requirement, clearly demonstrate adherence to the binder manufacturer's written recommendations in regard to storage times and storage temperatures (refer to Clause 1.3).

### **2.4.4 Temperatures of Materials**

#### **2.4.4.1 Asphalt**

Control temperatures of constituent materials by suitable thermometer elements placed in the flow of materials from the drier and in the binder storage system or binder supply line. The difference in temperature between binder and aggregate must not exceed 30°C at the point of mixing.

Thermometer registrations must be readable and accurate to within  $\pm 2^\circ\text{C}$ .

In accordance with a documented procedure, nominate in your PROJECT QUALITY PLAN the range of temperatures within which the binder and asphalt will be maintained for the manufacturing process.

Measure the asphalt temperatures as the asphalt leaves the pugmill or drum and the hot storage bin(s) or on the trucks prior to leaving the plant.

#### **2.4.4.2 Tackcoat**

In accordance with a documented procedure, nominate in your PROJECT QUALITY PLAN the range of temperatures within which the tackcoat will be maintained for the manufacturing process.

**2.5 SAMPLING AND TESTING ASPHALT****2.5.1 Sampling**

Sample asphalt at either the point of loading or the point of delivery to the work.

Undertake sampling of each nominal size of asphalt supplied in accordance with AS/NZS 2891.1.1 and at the frequencies nominated in the PROJECT QUALITY PLAN.

Further to the requirements of TfNSW Q Clause 7.5.3 and Annexure Q/L and unless specified otherwise or agreed with the Principal, boundaries of Lots represented by a single tested sample must be defined by the midpoints in production between the sample points.

When obtaining samples requested by the Principal, provide samples from the same Lot by riffing or quartering your own samples.

**2.5.2 Testing**

Test asphalt supplied for the work for the purpose of verifying conformity with this Specification.

Complete tests for binder content, combined particle size distribution, voids in laboratory compacted mix and filler to binder ratio and report to the Principal within 1 working day of mixing. Complete tests for compacted course thickness and report to the Principal within 3 working days of placing the asphalt.

**2.5.3 Minimum Frequency of Testing**

Nominate in your PROJECT QUALITY PLAN the proposed testing frequency which must not be less than that specified in Annexure R123/L. Where a minimum frequency is not specified, nominate an appropriate frequency. Table R123.5 will apply when referred to in Annexure R123/L.

**Table R123.5 - Minimum Frequency of Testing of Asphalt**

<b>Quantity of Asphalt Supplied each Shift</b>	<b>Minimum Frequency of Testing</b>
Less than 100 tonnes	One per 50 tonnes or part thereof
101 to 300 tonnes	One per 100 tonnes or part thereof
301 to 600 tonnes	One per 150 tonnes or part thereof
Over 600 tonnes	One per 200 tonnes or part thereof

**Note:** For the purpose of this Minimum Frequency of Testing clause, a "shift" must be continuous work not exceeding a period of 12 hours

The Principal may conditionally agree to your proposal to reduce the specified minimum frequency of testing. Support your proposal by a statistical analysis verifying consistent process capability and product characteristics. The Principal may vary or restore the specified minimum frequency of testing, either selectively or permanently, at any time.

**2.6 TRANSPORT**

Transport of asphalt must comply with Section 6.5 of AP-G66/02 except that release agents must be water based soap solutions.

### 3 PREPARATION OF PAVEMENT

Preparation of the pavement prior to placing asphalt must comply with Section 6.2 of AP-G66/02 and must include removal of raised extruded thermoplastic road markings and raised pavement markers.

### 4 PLACING TOGAS

#### 4.1 GENERAL

Place and finish asphalt so as to:

- (a) produce a homogeneous product with a sound surface;
- (b) ensure that the tackcoat is evenly spread and undamaged prior to placing asphalt;
- (c) achieve the specified rolling effort before the asphalt has cooled; and
- (d) achieve the finished pavement properties, specified in Clause 5, to the specified tolerances.

Place TOGAS by a self-propelled paving machine with integrated tackcoat spray system and automatic joint matching facility. Use hand placement of asphalt only for minor correction of the existing surface and in areas where placement with a paver is impracticable.

#### WITNESS POINT

Process Witnessed: Each placement trial and initial placing of each nominated mix.

Submission Details: Notification of the time, place and location at least 7 days prior to commencement.

#### 4.2 PROTECTION OF WORK

Provide for traffic in accordance with the requirements of Specification TfNSW G10 while undertaking the work and protect the work until the required thickness of asphalt has been laid, compacted and cooled sufficiently to carry traffic without damage to the work.

#### 4.3 PROTECTION OF SERVICES AND ROAD FIXTURES

Take all necessary precautions to prevent asphalt or other material used on the work from entering or adhering to gratings, hydrants or valve boxes, manhole covers, bridge or culvert decks and other road fixtures. Immediately after the asphalt has been placed, clean off or remove any such material.

#### **4.4 COURSE AND LAYER THICKNESS**

A course of TOGAS comprises one layer only of the asphalt and the tackcoat.

#### **4.5 TEMPERATURE AND WEATHER CONDITIONS**

Measure and record pavement surface temperature and wind velocity at the point of asphalt laying.

Do not place TOGAS unless the pavement surface temperature is at least 10°C and rising.

Do not place TOGAS when the surface of the pavement is wet or while rain appears imminent.

#### **4.6 ASPHALT TEMPERATURE FOR LAYING**

Measure the temperature of asphalt immediately prior to placing. Use a suitable stem type thermometer readable and accurate to within plus or minus 2°C with a range from at least 0°C to 200°C. Insert the stem into the asphalt to a depth of approximately 200 mm at a location at least 300 mm from the side of the truck body. Adopt the average of two readings as the temperature of the asphalt.

Do not use in the work that part of any truck load which contains lumps of cooled asphalt which are liable to affect the quality of the finished surface. Do not induce rapid cooling in the asphalt by the application of water at any stage in the process, including preparations for trafficking.

In accordance with a documented procedure, nominate in your PROJECT QUALITY PLAN the range of temperatures within which the paving of the asphalt will be completed.

#### **4.7 TACK COAT**

Evenly spread the tackcoat over the surface to be tack coated and apply at the nominated application rate  $\pm 0.2 \text{ L/m}^2$ . Do not damage the tackcoat layer prior to placing of the asphalt layer.

Endorse and provide to the Principal, a record of the average tack coat application rate in each Lot.

#### **4.8 ROLLING**

Uniformly roll the asphalt in accordance with your PROJECT QUALITY PLAN which must incorporate a rolling pattern comprising at least a minimum of three passes of a double drum smooth steel wheeled roller of minimum dead weight of 6 tonnes. No vibration is allowed except at the transverse joints if necessary.

In accordance with a documented procedure, nominate in your PROJECT QUALITY PLAN the range of temperatures within which the rolling of the asphalt will be completed.

#### **4.9 JOINTS**

Construct all joints following a procedure which maximises joint density and is documented in the PROJECT QUALITY PLAN. Fully roll and finish each joint with a smooth, planar surface coinciding with the surface of the rest of the mat.

Locate longitudinal joints coincident with final traffic markings, unless approved otherwise by the Principal.

Form a transverse joint at the commencement of each paving run and when the asphalt being paved has cooled below the minimum temperature nominated in the PROJECT QUALITY PLAN for rolling.

#### **4.10 HOMOGENEITY**

A Lot contains only areas of work which are essentially homogeneous. Any surface areas which show bony or fatty material or have been damaged during construction will be deemed to be nonconforming and must be managed in accordance with Clause 6.

#### **4.11 PLACEMENT TRIAL**

Where specified in Annexure R123/A, subject your plant and personnel proposed for use under the Contract to placement trial(s) prior to commencing work. Adhere to all procedures in the submitted PROJECT QUALITY PLAN.

The trial section must be at least 300 m in length and one lane in width and a maximum of one day's production. Each nominated mix is subject to a separate placement trial and the location of each trial is subject to the agreement of the Principal.

#### **HOLD POINT**

Process Held:	Commencement of placing TOGAS for each combination of materials, mix proportions, equipment, rate of paving and methods for placement, rolling and finishing.
Submission Details:	Verification checklist and all relevant test results of the trial section at least 3 working days prior to use of the nominated mix.
Release of Hold Point:	The Principal will consider the submitted documents and agree the trial location, prior to authorising the release of the Hold Point.

In the event of a nonconformity in the placement trial in respect of insitu characteristics, including thickness, joint quality or riding quality or when the Principal deems that a previous trial does not represent the changes in the equipment, materials, asphalt mix proportions, temperature, plant or rate of output, the Principal may direct a new trial.

## **5 FINISHED PAVEMENT PROPERTIES**

### **5.1 COURSE THICKNESS**

The average course thickness (mm) of the Lot must neither be less than the specified average course thickness nor greater than the specified average course plus 6 mm.

Determine the average course thickness of a Lot by calculation on the basis of:

- (a) average bulk density of laboratory compacted air voids samples for the Lot, AS/NZS 2891.2.2; AS/NZS 2891.7.3, AS/NZS 2891.8, AS/NZS 2891.9.3 at 80 cycles of compaction;
- (b) mass of asphalt paved in the Lot; and
- (c) area of the Lot.

**5.2 RIDE QUALITY**

The finished surface must have a smooth longitudinal profile. Measure ride quality by laser profilometer (Test Method TfNSW T187).

The laser profilometer must have a current TfNSW approved calibration label issued within the previous six months.

Ride quality for each lane is determined based on the application of the quarter-car model to determine the International Roughness Index (IRI) for each wheel path as follows:

- (i) Calculate the single track  $IRI_{qc}$  using the quarter-car model for each wheel path for each 100 m section being tested. Each 100 m section represents a test result.
- (ii) Calculate the lane IRI for each lane for each 100 m section being tested as follows:

$$Lane\ IRI_{qc} = \frac{IRI_{qcL} + IRI_{qcR}}{2}$$

where

$Lane\ IRI_{qc}$  = Lane Roughness (IRI m/km)

$IRI_{qcL}$  = Roughness of left wheel path profile (IRI m/km)

$IRI_{qcR}$  = Roughness of right wheel path profile (IRI m/km)

Determine ride quality from the average of three replica runs as follows:

- (a) Divide each lane into sections 100 m long. Include any length less than 100 m with the section immediately preceding it and an average roughness determined for the section;
- (b) Do not include the start and finish joints of the entire work in any section;
- (c) Do not measure roundabouts under this Clause.

The asphalt surface must have a smooth longitudinal profile and the ride quality of each section of asphalt surface must not exceed 1.56 m/km/lane, where construction of the underlying pavement forms part of the Contract or where, including any corrective course, asphalt is placed in more than one layer, over a pavement constructed by others.

Where you provide only one course, excluding any corrective course, in a single layer operation over a pavement constructed by others, calculate the  $IRI_a$  as specified below:

$$IRI_a = 0.3 + (0.667 \times IRI_b) - (0.0109 \times T) \quad \text{or} \quad 1.56 \text{ m/km/lane, whichever is the greater}$$

where:

$IRI_a$  = IRI after overlay (m/km)

$IRI_b$  = IRI before overlay (m/km)

T = Thickness of asphalt layer (mm)

Where a wearing course does not form part of the works under the Contract, take the measurements on the surface of the intermediate course.

Where specified in Annexure R123/A, determine and report the ride quality of the existing surface.

## **6 NONCONFORMITY**

### **6.1 GENERAL**

If a section of TOGAS pavement fails to achieve conformity to specification, such failure constitutes a “Nonconformity” under the Contract.

If the nonconformity is not acceptable in accordance with Clause 6.2, rectify or replace the section of nonconforming TOGAS pavement.

Use a method of rectification which avoids damage and does not affect the performance of structures such as underlying bound pavement layers, reinforced concrete, utilities, utility covers and similar structures.

The cost of rectification, including any restoration work to the underlying or adjacent surface or structure, which becomes necessary as a result of such replacement or correction, is to be borne by you. Replace TOGAS removed from the works with TOGAS conforming to the requirements of this Specification.

### **6.2 ACCEPTANCE OF NONCONFORMITIES**

Nonconformities may be accepted by the Principal subject to deductions (as specified hereunder) to the schedule rate applied to the quantity of asphalt represented by the test sample for combined particle size distribution and binder content; and by 100 m lane interval for ride quality.

Record deductions against Pay Item R123P3.

Other nonconformities may be accepted subject to the agreement of the Principal.

#### **6.2.1 Combined Particle Size Distribution and Binder Content**

For asphalt having particle size distribution or binder content outside the limits specified in Clause 2.3.2, the deductions shown in Table R123.6 will apply and will be cumulative.

If the particle size distribution on any sieve size or the binder content varies from the nominated mix by more than twice the permissible variations specified in Table R123.2 or the combined deductions exceed 20 per cent, replace the asphalt in accordance with Clause 6.1.

**Table R123.6 - Deductions for Combined Particle Size Distribution and Binder Content**

Description	Variations*	Deductions (per cent of schedule rates)
<b>Combined Particle Size Distribution Element</b>	<b>(% by mass of total aggregate)</b>	
Pass 13.2 mm AS sieve	Each 2 or part thereof	1
Pass 9.50 mm AS sieve	Each 2 or part thereof	1
Pass 6.70 mm AS sieve	Each 2 or part thereof	1
Pass 4.75 mm AS sieve	Each 2 or part thereof	1
Pass 2.36 mm AS sieve	Each 1 or part thereof	1
Pass 1.18 mm AS sieve	Each 1 or part thereof	1
Pass 0.600 mm AS sieve	Each 1 or part thereof	1
Pass 0.300 mm AS sieve	Each 1 or part thereof	2
Pass 0.150 mm AS sieve	Each 0.5 or part thereof	2
Pass 0.075 mm AS sieve	Each 0.5 or part thereof	2
<b>Binder Content for</b>	<b>(% by mass of total asphalt mix)</b>	
10 mm asphalt	Each 0.1 or part thereof	3

**Note:**

Outside the production tolerance for the combined aggregate particle size distribution and binder content set out in Clause 2.3.2.

**6.2.2 Ride Quality**

For sections having ride quality outside that specified in Clause 5.2, deductions in accordance with Table R123.7 will apply.

**Table R123.7 - Deductions for Ride Quality**

IRI result above limit (metres per measured kilometre)	Deduction per cent for the value of the section
< 0.25	2
0.25 – 0.43	4
0.44 – 0.61	8
0.62 – 0.80	16
> 0.80	Top 30 mm to be removed and replaced provided remaining thickness of layer is at least twice the nominal mix size. Otherwise remove and replace whole depth of layer.

**ANNEXURE R123/A – DETAILS OF WORK**

*NOTES TO TENDER DOCUMENTER: (Delete this boxed text after customising Annexure R123/A)*

*Insert in the table below details of asphalt to be used.*

*Repeat the table for requirements of each pavement design.*

*Where “Yes / No” options are shown below, delete whichever option that is not applicable.*

Location:

<b>Course</b>	<b>Nominated Size of Asphaltic Material</b>	<b>Asphalt Binder</b>	<b>Specified Compacted Course Thickness</b>
TOGAS	10 mm		

<b>Clause</b>	<b>Description</b>	<b>Requirement</b>
2.1.1(f)	Minimum PAFV of Coarse Aggregate for wearing course	.....
4.11	Placement trial required	Yes / No
5.2	Ride quality of existing surface to be measured	Yes / No
5.2	Ride quality of finished surface to be measured	Yes / No
5.2	Ride quality on existing surface	Refer test result printout attached

## **ANNEXURE R123/B – MEASUREMENT AND PAYMENT**

### **B1 MEASUREMENT AND PAYMENT**

Payment will be made for all costs associated with completing the work detailed in this Specification in accordance with the following Pay Items.

Where no specific pay items are provided for a particular item of work, the costs associated with that item of work are deemed to be included in the rates and prices generally for the Work Under the Contract.

Unless specified otherwise, a lump sum price for any of these items will not be accepted.

Measurement and Payment of asphalt is made on the basis of either mass or area as follows:

#### **(a) Measurement by Mass:**

Unless it is specified otherwise in Annexure R123/A, the quantity of asphalt must be measured by mass and the unit of measurement must be per tonne.

The quantity of asphalt in place in the final work must be determined by the Principal from truck weighbridge dockets supplied by you and issued at a weighbridge certified by the NSW Government Department of Fair Trading and collected at the point of delivery unless measurement by batch weight using certified scales is approved by the Principal.

Include a separate pay item for asphalt in the Schedule of Rates for each specified course thickness and binder type.

#### **(b) Measurement by Area:**

If specified so in Annexure R123/A, measure the quantity of tack coat used and/or the quantity of asphalt by area and the unit of measurement per square metre.

Determine the area from the dimensions of the plan surface shown on the Drawings or as specified for the work being measured.

Include a separate pay item for asphalt in the Schedule of Rates for each specified course thickness and binder type.

### **Pay Item R123P1 - Preparation of Surface**

#### **R123P1.1 Preparation of surface**

The unit of measurement is the square metre.

### **Pay Item R123P2 - Supply, Deliver and Lay TOGAS Asphalt (including Tackcoat)**

#### **R123P2.1 10 mm Nominal Size**

### **Pay Item R123P3 - Deductions in Accordance with Clause 6.2**

#### **R123P3.1 Combined Particle Size Distribution and Binder Content**

#### **R123P3.2 Ride Quality**

Deductions made under this pay item will not be subject to rise and fall adjustments.

## **ANNEXURE R123/C – SCHEDULES OF HOLD POINTS, WITNESS POINTS AND IDENTIFIED RECORDS**

Refer to Clause 1.2.3.

### **C1 SCHEDULE OF HOLD POINTS AND WITNESS POINTS**

<b>Clause</b>	<b>Type</b>	<b>Description</b>
2.3.1	Hold	Use of each nominated mix.
4.1	Witness	Each placement trial and initial placing of each nominated mix.
4.11	Hold	Commencement of placing trial TOGAS.

### **C2 SCHEDULE OF IDENTIFIED RECORDS**

The records listed below are Identified Records for the purposes of TfNSW Q Annexure Q/E.

<b>Clause</b>	<b>Description of Identified Record</b>
2.1.4	Documentary evidence of the binder conformity for each delivery
2.3.1	Documents as detailed for each nominated asphalt mix
2.5.2	Test Reports for binder content, combined particle size distribution, voids in laboratory compacted mix and filler/binder ratio
2.5.2	Test Reports for compacted course thickness
4.7	Average tack coat application rate in each Lot.
4.11	Verification checklist and all relevant test results of the trial section for each combination of materials, mix proportions, equipment, rate of paving and methods for placement, compaction and finishing
5.2	Ride quality of the existing surface (where specified)

**ANNEXURE R123/D – PLANNING DOCUMENTS**

Refer to Clause 1.2.4.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. Review the requirements of this Specification and others included in the Contract to determine additional documentation requirements.

Key Project Quality Planning Action Points to be shown in the Inspection and Test Plan (and Checklists) and implemented, also additional requirements to be included in project quality planning documents:

H = Hold Point Release

I = Inspection Point

J = Joint Inspection Point

M = Measurement Point for payment

N = Notice to Principal

T = Test Point

R = Additional requirements to be shown in the PROJECT QUALITY PLAN

W = Witness Point

<b>Clause</b>	<b>Description</b>	<b>Action Point</b>
	<b>General</b>	
TfNSW Q	Definition of Lot for each step of the process	R
TfNSW Q	Include procedures for management of each Lot to completion of the Contract in the PROJECT QUALITY PLAN	R
TfNSW Q	Include details of verification and endorsement procedures in the PROJECT QUALITY PLAN	R
TfNSW Q	Storage and availability of conformity records	R
TfNSW Q	Subcontractor's PROJECT QUALITY PLAN assessed and audit procedure established	R
1.1	Account taken of specification intent	R
1.3	Relevant technical references held on Site	I
1.4	Details of all procedures, construction methods, manufacturing plant and machinery, technical equipment, Project staff, manufacturer's written recommendations and statistical techniques	R
TfNSW Q	Procedure for the identification and implementation of corrective action	R
1.3	List of all documents to be held on Site	R
	<b>Supply of Asphalt</b>	
2.1.1	Coarse aggregate properties conform	I, T
2.1.2	Fine aggregate properties conform	I, T
2.1.3	Filler properties conform	T
2.1.4, 2.1.5	Binder and bitumen adhesion agent properties conform	T
2.1.6	Bitumen emulsion tack coat conforms and binder type and modification notified.	T, R
2.2	TOGAS asphalt mix conforms	I, T
2.3.1	Submission of Nominated Mix constituent materials, mix design and test results and verification (7 days notice) NOTE: Hold Point applies	N

Clause	Description	Action Point
2.3.1	Hold Point on submitted Nominated Mix has been released	I, H
2.3.3	Procedure to identify need for submission of new nominated mix	R
TfNSW Q	Procedures for handling and storing materials for asphalt	R
2.4.1	Procedures for the manufacture of asphalt including targeting of the nominated mix and control of the process	R
2.4	Procedure for storage of asphalt	R
2.4	Details of manufacturing plant including calibration	R, T
2.4.3	Procedures for storage and handling of binder established. Storage temperatures and storage times documented	R
2.4.3	Storage tank contents recirculated	I
2.4.4	Details of thermometers including calibration	R, T
2.4.4	Process temperatures ranges included to PROJECT QUALITY PLAN	R
2.5.2	Procedure including timeframe for submission of test results	R
2.5.3	Schedule of sampling and testing established	R
	<b>Placing</b>	
2.6	Procedure for the transport of asphalt	R
3	Procedure for preparation of pavement including removal of existing markings	R
4.1, 1.3	Procedures for placing asphalt, tack coating, hand placed areas and rolling	R
4.1	Notify intention to commence placing asphalt or placement trial (7 days notice)	N, W
4.2	Traffic management procedures comply with TfNSW G10	R, I
4.3	Procedures for protection of services and road fixtures	R, I,
4.5	Include details of equipment and personnel for pavement surface temperature measuring and recording in the PROJECT QUALITY PLAN	R, I
4.5	Pavement temperature measured and conforming	T
4.5	Pavement surface is not wet and rain is not imminent	I
4.6	Details of asphalt temperature before discharge	R, I, T
4.7	Tack coating procedures established	I, N
4.7	Tack coat application rate is in accordance with that nominated	T
4.8	Procedure for construction of joints	R, I
	<b>Rolling</b>	
4.9	Details of rolling methods established	R
4.11	Product is homogeneous	I
4.11	Placement trial location advised by Principal	H
4.11	Placement trial Hold Point released	H

<b>Clause</b>	<b>Description</b>	<b>Action Point</b>
	<b>Finished Pavement Properties</b>	
5.1	Compacted course thickness: Areas measured, average bulk density of laboratory compacted samples determined, thickness conformance	I, T
5.3	Surface has smooth longitudinal profile, riding quality conforms	I, T
6	Nonconformity held, investigated and reported, dispositions accepted by Principal	I
6.1, TfNSW Q	Rectifications completed, Hold Point (where specified) is released	I, T, H
6.2	Acceptance of nonconforming combined particle size distribution, binder content and riding quality reported with proposed payment deduction calculations	M, N
TfNSW Q	Final inspection and all test results for each Lot verified	I
7	Lot measurement agreed with Principal	J
Annex R123/A	Details of work incorporated in the PROJECT QUALITY PLAN	R

# ANNEXURE R123/E – COMBINED PARTICLE SIZE DISTRIBUTION CHART

## Instructions for Preparation of Annexure R123/E

- Plot the following on the attached chart:
  - Nominated Combined Particle Size Distribution;
  - Control Points as required by the limits of Table R123.1;
  - Production tolerances of the nominated mix in accordance with Table R123.2;
  - The 0.45 power Fuller Curve by connecting the origin by a straight line to the sieve size immediately above the nominal mix size.
- Record the Contract ID, Nominal Mix Size, Mix Type, VMA, and Date in the space provided.

An example of the completed chart is shown in Figure R123.1 below:

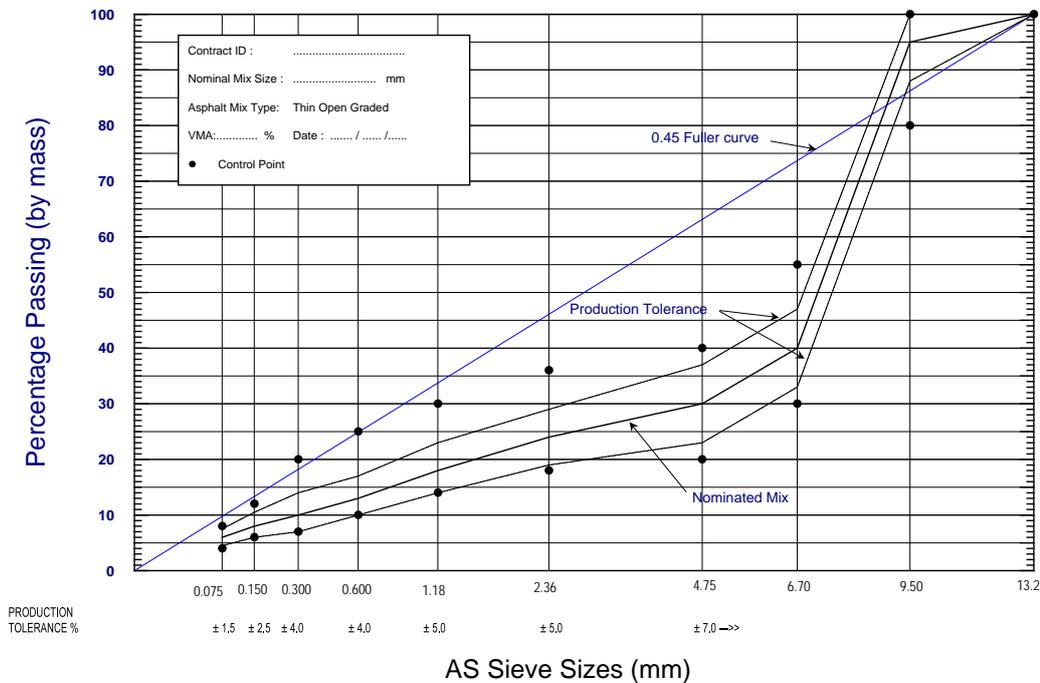


Figure R123.1 - Combined Particle Size Distribution - 10mm TOGAS

R123\_F1.PRS

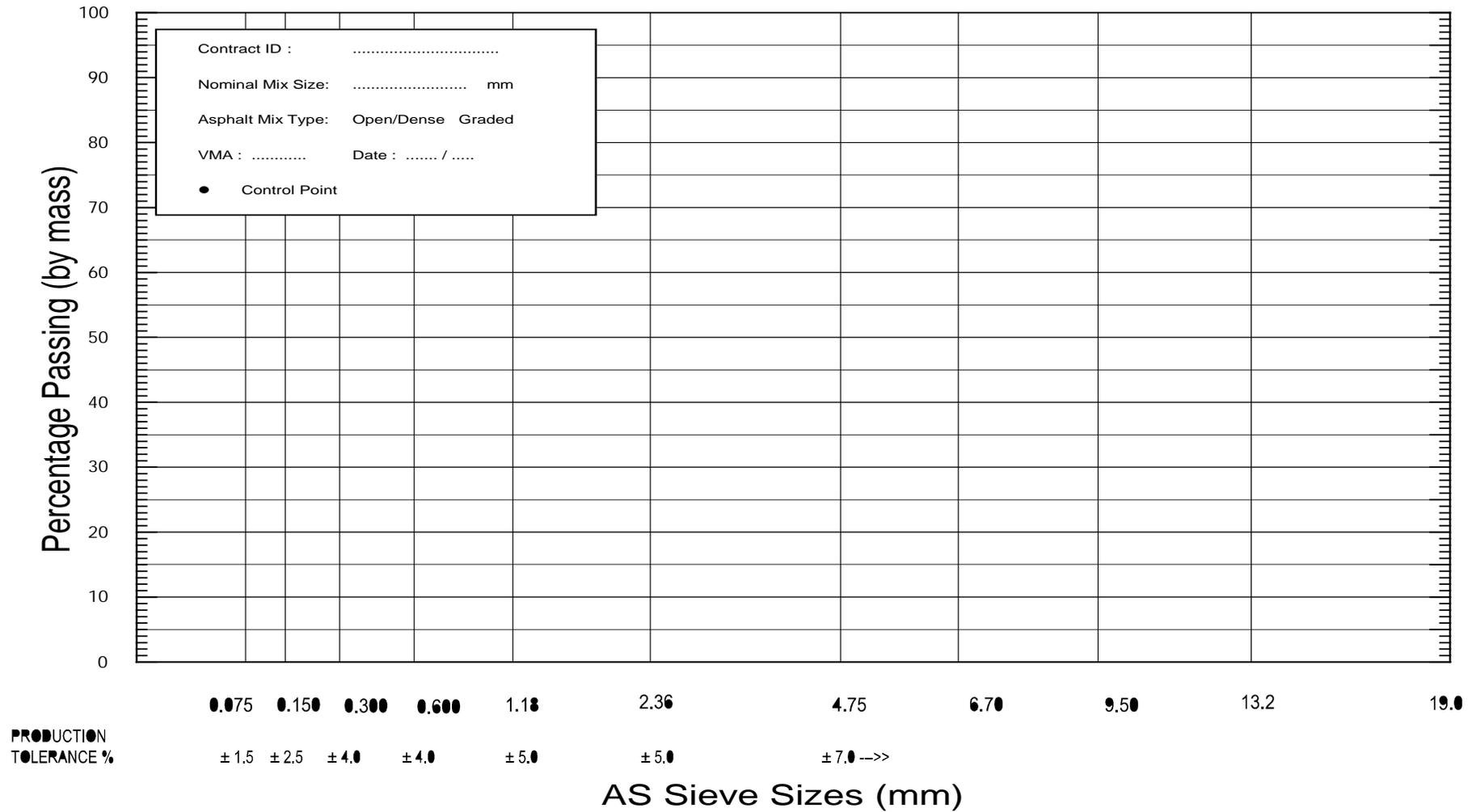


Figure R123.2 -Combined Particle Size Distribution - Nominal Mix size up to 14

R116\_F2.PRS

**ANNEXURES R123/F TO R123/K – (NOT USED)****ANNEXURE R123/L – MINIMUM FREQUENCY OF TESTING**

Attention is drawn to the requirements of Clause 7.5.3 of TfNSW Q in respect of limits on Lot size.

**L1 AGGREGATES**

Clause 2.1.1 - Coarse Aggregates						
Total Mass of Material represented, (tonnes)		1 – 500	501 – 1,000	1,001 – 2,000	2,001 – 4,000	Refer to Note
Test Method	Characteristic Analysed	Minimum Frequency of Testing				
AS 1141.11.1	Grading	1	1	2	3	
AS 1141.12	Material finer than 75 µm by washing	1	1	2	3	
AS 1141.14	Particle Shape	1	1	2	3	(i)
TfNSW T239	Fractured Faces	1	2	3	4	
AS 1141.22	Wet Strength	1	1	2	3	(ii)
AS 1141.22	Wet/Dry Variation	1	1	2	3	(ii)
AS 1141.32	Weak particles	1	1	2	3	
AS 1141.50	Stripping Resistance	1 per 6 months and at change in quarry face				
AS 1141.41, AS 1141.42	PAFV	1 per 6 months and at change in quarry face				
AS 1141.6.1	Water Absorption	1 per 6 months and at change in quarry face				

**Notes:**

- (i) A change in production parameters will initiate the commencement of a new Lot.
- (ii) Provided that for the six previous Lots actually tested, all tests have met specification requirements for both wet strength and wet/dry strength variation, then apply the following reduced frequency;
- where all wet/dry variation results are < 25%: 1 per 10,000 tonnes
- where all wet/dry variation results are < 30%: 1 per 4,000 tonnes
- where all wet/dry variation results are < 35%: 1 per 2,000 tonnes

<b>Clause 2.1.2 - Fine Aggregates</b>							
<b>Total Mass of Material represented, (tonnes)</b>		<b>1 - 500</b>	<b>501 – 1,000</b>	<b>1,001 – 2,000</b>	<b>2,001 – 4,000</b>	<b>Refer to Note</b>	
<b>Test Method</b>	<b>Characteristic Analysed</b>	<b>Minimum Frequency of Testing</b>					
AS 1141.11.1	Grading	1	1	2	3		
AS 1141.12	Material finer than 75 µm by washing	1	1	2	3		
AS 1141.5	Water Absorption, Particle Density	1 per 6 months and at change in quarry face					
AS 1141.24	Soundness	1 per 6 months and at change in quarry face					
ISSA Bulletin 145	Methylene Blue Value	1 per 6 months and at change in quarry face					

**L2 FILLER**

<b>Clause</b>	<b>Characteristic Analysed</b>	<b>Test Method</b>	<b>Minimum Frequency of Testing</b>
2.1.3	Methylene Blue Value – for rock flour and baghouse dusts	ISSA Technical Bulletin No. 145	One per 10,000 tonnes or part thereof used in asphalt production, and at change in source of mineral matter

For other added fillers, refer to TfNSW 3211.

**L3 PRODUCTION ASPHALT**

<b>Clause</b>	<b>Characteristic Analysed</b>	<b>Test Method</b>	<b>Minimum Frequency of Testing</b>
2.2.2	Particle Size Distribution of combined aggregate	AS/NZS 2891.3.1	As set out in Clause 2.3.2, Table R123.2
2.2.3	Binder Content	AS/NZS 2891.3.1	As set out in Clause 2.3.2, Table R123.2
2.2.3	Binder Film Thickness	RC 201.01	Design and production trial only
2.2.3	Filler to Binder Ratio	Clause 2.2.3	As set out in Clause 2.3.2, Table R123.2
2.2.4	Voids in laboratory compacted asphalt at 80 cycles of compaction	AS/NZS 2891.2.2, AS/NZS 2891.7.3, AS/NZS 2891.8 & AS/NZS 2891.9.3	As set out in Clause 2.3.2, Table R123.2

**L4 PLACING TOGAS**

<b>Clause</b>	<b>Characteristic Analysed</b>	<b>Test Method</b>	<b>Minimum Frequency of Testing</b>
4.5	Pavement temperature	Contractor's Written Procedure	One every two hours.
4.6	Asphalt temperature	Refer to Clause 4.6	One per delivered load.
4.7	Tack coat application rate	Contractor's Written Procedure	One per Lot.

**L5 INSITU TOGAS**

<b>Clause</b>	<b>Characteristic Analysed</b>	<b>Test Method</b>	<b>Minimum Frequency of Testing</b>
5.1	Average compacted Course Thickness	Refer to Clause 5.1	One per Lot
5.2	Ride quality	TfNSW T187	One per ride quality Lot *

**Note:**

\* Ride quality Lot must be in accordance with Clause 5.2.

**ANNEXURE R123/M – REFERENCED DOCUMENTS**

Refer to Clause 1.2.5.

**TfNSW Specifications**

TfNSW G10	Traffic Management
TfNSW Q	Quality Management System
TfNSW 3211	Cements, Binders and Fillers
TfNSW 3252	Polymer Modified Binder for Pavements
TfNSW 3269	Bitumen Adhesion Agent (for Polymer Modified Binder)

**TfNSW Test Methods**

TfNSW T187	Measurement of Ride Quality of Road Pavements by Laser Profiler
TfNSW T230	Resistance to Stripping of Aggregates and Binders
TfNSW T239	Fractured Faces of Coarse Aggregate

**Australian Standards**

AS 1141	Methods for sampling and testing aggregates
AS 1141.5	Particle density and water absorption of fine aggregate – Weighing-in-water method
AS 1141.6.1	Particle density and water absorption of coarse aggregate
AS 1141.11.1	Particle size distribution – Sieving method
AS 1141.12	Material finer than 75 µm in aggregates (by washing)
AS 1141.14	Particle shape by proportional calliper
AS 1141.22	Wet/dry strength variation
AS 1141.24	Aggregate soundness – Evaluation by exposure to sodium sulphate solution
AS 1141.32	Weak particles (including clay lumps, soft and friable particles) in coarse aggregates
AS 1141.41	Polished aggregate friction value – Horizontal bed machine
AS 1141.42	Pendulum friction test
AS 1141.50	Resistance to stripping of cover aggregates from binders
AS 1160	Bituminous emulsions for the construction and maintenance of pavements
AS 2008	Bitumen for pavements
AS 2150	Hot mix asphalt – A guide to good practice
AS 2758.5	Aggregates and rock for engineering purposes – Coarse asphalt aggregates
AS/NZS 2891	Methods of sampling and testing asphalt
AS/NZS 2891.1.1	Loose asphalt
AS/NZS 2891.2.2	Sample preparation – Compaction of asphalt test specimens using a gyratory compactor

AS/NZS 2891.3.1	Binder content and aggregate grading – Reflux method
AS/NZS 2891.7.3	Determination of maximum density of asphalt – Methylated spirits displacement
AS/NZS 2891.8	Voids and volumetric properties of compacted asphalt mixes
AS/NZS 2891.9.3	Determination of bulk density of compacted asphalt – Mensuration method

**Austrroads Documents**

AG:PT/T237	Binder Film Index
AP-G66/02	Asphalt Guide

**VicRoads Test Methods**

RC 201.01	Binder Film Thickness
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**International Slurry Surfacing Association Documents**

Bulletin 145	Determination of Methylene Blue Adsorption Value
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