

ROADS AND MARITIME SERVICES (RMS)

QA SPECIFICATION R117

LIGHT DUTY DENSE GRADED ASPHALT

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REVISION REGISTER

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<p style="text-align: center;">GUIDE NOTES (Not Part of Contract Document)</p>

Using Specification R117

R117 is a QA specification and the use of QA specifications requires the implementation of a quality system by the Contractor that meets the quality system requirements specified in RMS Q. To comply with the intention of government policy as well as R117, asphalt works constructed using R117 require adequate surveillance and audit by the Principal.

The RMS Project Manager must adapt the Model R117, including its Annexures, to suit the project.

Clause 2.1.1 Coarse Aggregates

This specification relies on Materials Specification RMS 3152, and RMS Project Managers must complete Annexure 3152/A which addresses such matters as Minimum PAFV.



LIGHT DUTY DENSE GRADED ASPHALT

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VERSION FOR: DATE:

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FOREWORD

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REVISIONS TO PREVIOUS VERSION

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 have been 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~~.

RMS QA SPECIFICATION R117

LIGHT DUTY DENSE GRADED ASPHALT

1 GENERAL

1.1 OVERVIEW

This Specification sets out the requirements for light duty dense graded asphalt where traffic loading is less than 10^7 Equivalent Standard Axles (ESAs).

The asphalt may contain reclaimed asphalt pavement material and/or glass granulate aggregate and can be manufactured using either conventional or warm mix asphalt technology.

During the first 24 months after the Date of Completion:

- (i) the asphalt must not ravel, rut, shove, strip or bleed; and
- (ii) the wearing course for the first 12 months must comply with the surface shape requirements specified in Table R117.10 plus 3 mm.

1.2 SCOPE

The work to be executed under this Specification consists of the following:

- (a) design of the asphalt mix(es);
- (b) supply of materials, production and transport of the asphalt;
- (c) preparation and application of tackcoat on the surface on which the asphalt is to be placed;
- (d) placement and compaction of asphalt;
- (e) all inspection and testing necessary to demonstrate that the quality requirements of this Specification have been achieved; and
- (f) implementation of an approved process to use increasing proportions of reclaimed asphalt pavement (RAP) material in asphalt, based on a system of performance verification, including materials testing and process controls.

1.3 STRUCTURE OF THE SPECIFICATION

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

1.3.1 Project Specific Requirements

Project specific requirements are shown in Annexure R117/A.

1.3.2 Measurement and Payment and Disposition of Nonconformities

The method of measurement and payment must comply with Annexure R117/B1.

Acceptance of materials and work must be in accordance with Annexure R117/B2.

1.3.3 Schedules of HOLD POINTS and Identified Records

The schedule detailed in Annexure R117/C lists the **HOLD POINTS** that must be observed. Refer to Specification RMS Q for the definition of **HOLD POINTS**.

The records listed in Annexure R117/C are **Identified Records** for the purposes of RMS Q Annexure Q/E.

1.3.4 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements shown in Annexure R117/D and must be implemented.

If the Contract does not require you to implement a PROJECT QUALITY PLAN, the documents shown in Annexure R117/D must be submitted to the Principal for consideration at least 5 working days prior to work commencing and must be implemented.

If your nominated mix designs contain Reclaimed Asphalt Pavement (RAP) as a constituent material, submit also a RAP Management Plan as part of your PROJECT QUALITY PLAN which addresses the requirements of this Specification.

Include in the PROJECT QUALITY PLAN all manufacturers' recommendations indicated in this Specification.

Adopt the following documents for procedure(s) not specifically addressed in this Specification:

- (a) AS 2150 "Hot mix asphalt - A guide to good practice"; and
- (b) AGPT04B/07 Austroads "Guide to Pavement Technology Part 4B: Asphalt".

1.3.5 Requirements for Technical Procedures

Details of calculation for insitu air voids and thickness are shown in Annexure R117/E.

1.3.6 Testing Procedures

Your Inspection and Test Plan must nominate the proposed testing frequency to verify conformity of the item, which must not be less than the frequency specified in Annexure R117/L except where the Principal has approved a reduced frequency of testing as per 5.3.1 of the Specification.

Where a minimum frequency is not specified, nominate an appropriate frequency.

1.3.7 Referenced Documents

Unless otherwise specified or is specifically supplied by the Principal, the applicable issue of a reference document 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 1234). For convenience, the full titles are given in Annexure R117/M.

1.4 DEFINITIONS AND ABBREVIATIONS

1.4.1 Definitions

In this Specification:

- (a) the terms “you” and “your” mean “the Contractor” and “the Contractor's” respectively;
- (b) “RAP Approval Level” refer to four levels or maximum amounts of reclaimed asphalt pavement material that may be substituted for aggregates supplied in accordance with Specification RMS 3152.

Other definitions are in accordance with the Glossary of Austroads Terms.

1.4.2 Abbreviations

The following abbreviations apply to this Specification:

AADT	Average Annual Daily Traffic (expressed as axle pairs)
AAPA	Australian Asphalt Pavement Association
AC	Dense graded asphalt
ESA	Equivalent Standard Axle
FGG	Fine Gap Graded Asphalt
IRI	International Roughness Index
MTV	Material Transfer Vehicle
MBV	Methylene Blue Value
NATA	National Association of Testing Authorities
N/A	Not Applicable
PAFV	Polished Aggregate Friction Value
PQP	Project Quality Plan
RAP	Reclaimed Asphalt Pavement
SSD	Saturated Surface Dry
VMA	Voids in Mineral Aggregate

2 SUPPLY OF ASPHALT

2.1 MATERIALS FOR ASPHALT

All materials used in the manufacture of asphalt must comply with the requirements of this Specification and maintain a uniform appearance for the duration of the work.

2.1.1 Coarse Aggregate

Coarse aggregate must comply with Specification RMS 3152.

When aggregates from a specific source or type, or when aggregate with a high PAFV or other special characteristics are specified, 100% of the coarse aggregate in the asphalt must comply with this requirement.

2.1.2 Fine Aggregate

Fine aggregate must comply with Specification RMS 3152.

2.1.3 Recycled Materials

2.1.3.1 Reclaimed Asphalt Pavement (RAP) Material

RAP material must comply with Specification RMS 3153.

2.1.3.2 Granulated Glass Aggregate

Granulated glass aggregate must comply with Specification RMS 3154.

2.1.4 Filler

The total filler in asphalt is the combined fraction of fines produced from the crushing of aggregates and any added filler which passes the 0.075 mm AS sieve.

Filler must meet the following requirements:

- (a) Added filler must conform to Specification RMS 3211.
- (b) Dry compacted voids content of the total filler fraction in asphalt determined in accordance with AS 1141.17 must be 38% or greater.
- (c) Methylene blue value of the total filler in asphalt (excluding hydrated lime) determined in accordance with Test Method RMS T659 must not exceed 10 mg/g.

2.1.5 Binder

The class of binder used in the work must be as specified in Annexure R117/A, except that you may propose an alternative class of binder, subject to the approval of the Principal, under the following circumstances:

- (a) asphalt containing in excess of 25% RAP material; and/or
- (b) asphalt containing warm mix asphalt additive.

The binder must comply with the requirements of Specifications RMS 3252 or RMS 3253 for the class of binder specified. Provide documentary evidence of the binder conformity for each delivery used in the work.

2.1.6 Additives

(a) Bitumen Adhesion Agent

Bitumen adhesion agent may be added to improve the asphalt's propensity to stripping.

(b) Warm Mix Asphalt Additive

Warm mix asphalt additive may be added to asphalt to reduce the asphalt manufacturing temperature and/or to improve workability during the paving and compaction operations.

2.1.7 Bitumen Emulsion Tackcoat

Bitumen emulsion for use as a tackcoat must be CRS/170-60 complying with AS 1160 unless otherwise approved by the Principal.

2.2 REQUIREMENTS FOR ASPHALT

2.2.1 Proportions of Constituents

The following constituents and proportions are permitted:

(a) Combined Particle Size Distribution of Aggregate

The combined particle size distribution of asphalt aggregates, when determined in accordance with AS 2891.3.1, must conform to Table R117.1.

Table R117.1 – Combined Particle Size Distribution Limits for Different Nominal Size of Asphalt

AS Sieve Size	Combined Particle Size Distribution Passing Limits for Nominal Size of Asphalt (% by mass) (Asphalt Designation)						
	5 mm (AC05)	7 mm (AC07)	10 mm (AC10)	14 mm (AC14)	20 mm (AC20)	7 mm FGG07	10 mm FGG10
53.0 mm	–	–	–	–	–	–	–
37.5 mm	–	–	–	–	–	–	–
26.5 mm	–	–	–	–	100	–	–
19.0 mm	–	–	–	100	90 – 100	–	–
13.2 mm	–	–	100	90 – 100	71 – 86	–	100
9.50 mm	–	100	90 – 100	72 – 89	58 – 75	100	85 – 100
6.70 mm	100	85 – 100	68 – 87	54 – 79	46 – 64	85 – 100	60 – 86
4.75 mm	85 – 100	70 – 87	50 – 76	43 – 69	37 – 55	65 – 85	55 – 74
2.36 mm	55 – 75	44 – 65	32 – 57	28 – 53	24 – 42	55 – 72	50 – 70
1.18 mm	38 - 57	29 – 48	22 – 42	19 – 40	15 – 32	45 – 65	45 – 65
0.600 mm	26 – 43	19 – 35	15 – 31	13 – 30	10 – 24	30 – 60	30 – 60
0.300 mm	15 – 28	12 – 25	10 – 23	9 – 22	7 – 17	18 – 40	18 – 40
0.150 mm	8 – 18	8 – 16	6 – 14	6 – 15	4 – 12	8 – 18	8 – 18
0.075 mm	4 – 11	5 – 8	4 – 7	4 – 7	3 – 6	5 – 11	5 – 11

Note: Where the particle size distribution is shown as “#”, you must state the values of the Particle Size Distribution limits in your nominated mix design submission and in the trial and production mixes reporting.

(b) Binder

In the nominated mix design, the proportion of binder expressed as a percentage by mass of the total mix must comply with the requirements of Table R117.2.

Table R117.2 – Binder Content

Nominal Size of Asphalt (Asphalt Designation)	5 mm (AC05)	7 mm (AC07)	10 mm (AC10)	14 mm (AC14)	20 mm (AC20)	7 mm FGG07	10 mm FGG10
Binder Content (% by mass of total mix)	5.4 – 7.0	5.4 – 7.0	5.1 – 6.5	4.8 – 6.3	4.4 – 5.8	6.0 – 7.0	6.0 – 7.0

Note: The specified binder content range is applicable to commonly used natural sources of aggregates and sands for a known range of densities. If you propose to use constituents of substantially different density, then for the nominated design mix and use of the mix in the works, you may propose a nonconforming binder content subject to the approval of the Principal. You must demonstrate that the volumetric proportions are consistent with the intent of the Specification.

Determine the binder content in accordance with AS 2891.3.1.

(c) Reclaimed Asphalt Pavement Material

You are permitted to use RAP material in the wearing and other courses up to a maximum of 20% by mass (Approval Level 1L or 1WL), as shown in Table R117.3, provided that the testing requirements of Table R117/F Section A are complied with.

Table R117.3 – Prerequisites for Allowable Percentage of Reclaimed Asphalt Pavement Materials for Use in Asphalt

RAP Approval Level	Maximum Percentage ⁽¹⁾ for other than Wearing Courses			RAP Approval Level	Maximum Percentage ⁽¹⁾ for Wearing Course		
	Amount (maxi- mum)	Testing Required (Table R117/F)	Perform- ance Period		Amount (maxi- mum)	Testing Required (Table R117/F)	Perform- ance Period
1L ⁽³⁾	20%	Section A	N/A	1WL ^(2, 3)	20%	Section A	N/A
2L ⁽³⁾	40%	Section B	2 years	2WL ^(2, 3)	25%	Section B	2 years

Notes:

- (1) Determined as a percentage by mass of RAP material to mass of total mix.
(2) “W” denotes wearing course.
(3) “L” denotes light duty dense graded asphalt.

To progress from the existing RAP Approval Level to a higher Approval Level, you must demonstrate:

- (i) compliance with this Specification, including the requirements for RAP Level progression as specified in Annexure R117/F; and
(ii) a history of proven performance (the “Performance Period”) acceptable to the Principal for the RAP Approval Level requested as shown in Table R117.3.

Warm mix asphalt may contain RAP material, but its RAP Approval Level may not progress beyond Level 1L or Level 1WL.

The percentage of RAP material must not exceed the percentages shown in Table R117.3 for the RAP Approval Level at which you have been approved.

HOLD POINT

Process Held:	Progression to a higher RAP Approval Level.
Submission Details:	Documentation demonstrating a proven history of performance of the asphalt at your requested RAP Approval Level.
Release of Hold Point:	The Principal will consider the submitted documentation prior to authorising the release of the Hold Point.

(d) Granulated Glass Aggregate

The maximum proportion of granulated glass aggregate is 2.5% of the total mix.

(e) Hydrated Lime

Asphalt may contain hydrated lime complying with Specification RMS 3211.

(f) Adhesion Agent

Asphalt may contain bitumen adhesion agent not exceeding 1.0% by mass of the binder.

(g) Warm Mix Asphalt Additive

The proportion of additive is limited to:

- (i) for wax, the maximum percentage by mass of binder must not exceed 2.0%;
- (ii) for surfactants, your nominated maximum percentage by mass of binder;
- (iii) for water (either directly added or added in the form of water containing crystals), the maximum percentage by mass of the total mix must not exceed 0.06%.

2.2.2 Volumetric Characteristics

For all asphalt mixes:

- (a) air voids in laboratory compacted briquettes must be $\geq 3.0\%$ and $\leq 6.0\%$ when determined in accordance with Test Method RMS T662 (80 cycles of compaction), AS 2891.7.1 or AS 2891.7.3, AS 2891.8 and AS 2891.9.2;
- (b) voids in mineral aggregate (VMA) must comply with the requirements of Table R117.4 when determined in accordance with Test Method RMS T662 at 80 cycles of compaction, AS 2891.7.1 or AS 2891.7.3, AS 2891.8 and AS 2891.9.2.

Table R117.4 – Voids in Mineral Aggregate (VMA)

Nominal Size of Asphalt (Asphalt Designation)	5 mm (AC05)	7 mm (AC07)	10 mm (AC10)	14 mm (AC14)	20 mm (AC20)	7 mm FGG07	10 mm FGG10
VMA %	≥ 17	≥ 17	≥ 16	≥ 15	≥ 14	≥ 17	≥ 16

2.2.3 Moisture Content

For all mixes produced in a drum plant and/or containing RAP and/or containing a warm mix asphalt additive, the moisture content must be < 0.5% by mass of total mix when determined in accordance with Test Method RMS T660.

2.3 NOMINATED MIXES

The nominated mix design submission must:

- (a) satisfy the requirements of this Specification; and
- (b) be targeted during production of the asphalt.

The nominated mix design submission is:

- (i) materials specific, and substitution of constituents is not permitted;
- (ii) design specific, and variation to the design nominated mix submission is not permitted;
- (iii) asphalt plant specific, and except for component maintenance, changes in the components, configuration and/or location of the plant is not permitted;
- (iv) contract specific, and release of the Nominated Mix Hold Point under another contract is not applicable to this Contract.

For each new establishment of a mobile asphalt plant, a full nominated mix submission is required.

Special requirements for the use of rhyolite aggregate from Gosforth are contained in RMS Technical Direction TD 2013/02.

2.3.1 Submission of Nominated Mixes

Unless specified otherwise, all asphalt and binder tests relating to the submission must be carried out within a one month period prior to the date of submission to the Principal. All other tests relating to the submission must be carried out within a 6 month period prior to the date of submission to the Principal. All phases of any particular test must be performed at the same laboratory.

Submit to the Principal one nominated mix design for each asphalt mix specified in Annexure R117/A. The nominated mix design submission must include the following details:

(a) Constituent Materials

- (i) Coarse and fine aggregates: source, geological type.
Aggregate of different type or quality from the same quarry face or within a quarry will be regarded as a different source.
- (ii) Added filler: type, grade and source.
- (iii) Binder: source, class or grade.
- (iv) Recycled materials:
 - For RAP materials, the effective binder content (that portion considered to contribute to the binder content of the asphalt mix design) and recovered viscosity of the binder.
 - For recycled glass granulate, the type, source and manufacturer's recommendations.

- (v) Additives: type, source, trade name and manufacturer's recommendations.
- (vi) Bitumen emulsion tackcoat: source, class of bitumen, any bitumen modification.

(b) Mix Design

- (i) Proportion of each constituent by percentage of mass of total mix.
- (ii) Where you propose to use RAP material, the RAP Approval Level for which you are approved to use.
- (iii) For each nominated mix design, the nominating values and allowable tolerances, where required, for each requirement for the asphalt specified in Clause 2.2.
- (iv) Graphical representation of the nominated combined particle size distribution with control points as required by the limits of Table R117.1 and the production tolerances in accordance with Table R117.5.
- (v) Type and identification number of the asphalt mixing plant.
- (vi) Temperature at which the asphalt is manufactured.

(c) Production Trial

All production trial tests on each nominated mix must be from one trial batch. The tests on the constituent materials must represent the materials used in this trial batch.

(d) Signed Statement

A signed statement confirming that each nominated and production trial mix including all constituents meet the requirements of Clauses 2.1 and 2.2. The statement must include NATA endorsed test results for all specified tests. Attach a copy of your completed verification checklist.

(e) Warm Mix Asphalt Additives

When using warm mix asphalt additives, provide details of the additive(s) in your nominated mix design submission. Include evidence acceptable to the Principal that the additive is designed, supplied and has proven performance for the purpose described in this Specification.

The nominated mix design will be rejected if the nature, intended purpose and dosage of the warm mix asphalt additive are not clear in your nominated mix design submission. Clearly state in your submission:

- (i) any proposed amendments to the mix design procedure, operational processes and/or test methods as a result of the inclusion of a warm mix asphalt additive; and
- (ii) the classification of the warm mix asphalt additive.

HOLD POINT

Process Held:	Placing of the nominated mix(es).
Submission Details:	Documents as detailed in Clause 2.3.1 at least 7 working days before the nominated mix(es) is (are) proposed to be placed.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point. This Hold Point release is valid for a maximum period of 12 months.

2.4 PRODUCTION OF ASPHALT

2.4.1 Method of Production

Adopt a method of production that:

- (a) controls the process and targets the nominated mix; and
- (b) supplies a homogeneous and consistent product at the nominated manufacturing temperature.

2.4.2 Production Tolerances

2.4.2.1 Proportions of Constituents

The proportion of each constituent may be varied for the purpose of process control provided that:

- (a) the asphalt produced remains uniform and consistent and in compliance with the nominated mix submission; and
- (b) the proportion of RAP does not exceed the Rap Approval Level in Table R117.3 at which you have been approved.

2.4.2.2 Combined Particle Size Distribution and Binder Content

The actual combined particle size distribution and actual binder content may vary from the nominated value within the limits shown in Table R117.5, provided that the actual values also remain within the limits of Tables R117.1 and R117.2 respectively.

Table R117.5 – Production Tolerances

Description	Tolerance
Permissible variation to nominated combined particle size distribution during production (% by mass of total aggregate, AS 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
Permissible variation to the nominated binder content during production (% by mass of total mix, AS 2891.3.1)	± 0.3

2.4.3 Asphalt Manufacturing Plant

Operate the asphalt manufacturing plant with adequate production process controls to produce asphalt of a consistent quality and conforming to the requirements of this Specification. The production control system must produce auditable records of key process parameters including individual aggregate and filler feed rates/batch masses, binder application rate/batch mass and various process temperatures.

Implement a documented procedure for the management and control of the moisture content of each constituent aggregate material, including RAP material. Moisture content must be determined at least daily, and the asphalt manufacturing process controls adjusted accordingly.

RAP materials where added must be dispersed uniformly throughout the mix such that there is no apparent variability or temperature segregation in the mix.

The asphalt manufacturing plant must have sufficient capacity to supply asphalt for a continuous operation of the paver.

2.4.4 Storage and Handling

(a) Binder

Heating and storage of binder must comply with the temperature and time limits set out in Advisory Note 7 published by the Australian Asphalt Pavement Association.

Provide details in your PROJECT QUALITY PLAN of the procedures for acquisition, storage and handling of binder which identify and prevent segregation and/or contamination of the binder and implement them.

At the asphalt manufacturing plant, binder supplied in accordance with Specification RMS 3252 must be recirculated in delivery and/or storage tanks to a uniform consistency immediately prior to its use in the manufacturing process.

(b) Asphalt

Asphalt which does not contain RAP material may be retained in hot storage silos for a period not exceeding 24 hours. You may propose and implement a longer period based on effective

temperature management and oxidation suppression systems, subject to the approval of the Principal.

Asphalt mixes containing RAP materials may be retained in a purpose designed storage system which has been demonstrated to cause no deterioration in the stored asphalt for a period not exceeding 24 hours, subject to the approval of the Principal.

2.4.5 Manufacturing Temperatures

Control the temperatures of constituent materials in response to suitable thermometer elements placed in the flow of materials from the drier, and in the binder storage system or binder supply line. Thermometer registrations must be readable and accurate to within $\pm 2^{\circ}\text{C}$.

Measure and record the temperature of the asphalt when:

- (a) the asphalt leaves the pugmill or mixing drum; or
- (b) the asphalt discharges from the hot storage bin(s); or
- (c) in the trucks prior to leaving the plant.

The despatch temperature of the asphalt must facilitate the specified density in the finished product. Provide details of the project specific process temperatures and the frequency of recording in your PROJECT QUALITY PLAN.

The temperature of asphalt must not at any time in the process exceed 175°C .

2.4.6 Sampling

Asphalt samples must be taken in accordance with AS 2891.1.1 at the frequency specified in Annexure R117/L.

2.5 TRANSPORT OF ASPHALT

The transport of asphalt must be in accordance with the requirements in AS 2150.

State in your PROJECT QUALITY PLAN the method of application and control of release agent to ensure a uniform, light coating of the vehicle's tray without ponding of surplus release agent.

Facilitate continuous operation of the paving train by:

- (a) providing and allocating sufficient transport capacity; and
- (b) ensuring efficient on-site management of asphalt deliveries.

3 PLACING ASPHALT

3.1 GENERAL

Your method of placing and finishing the asphalt must:

- (a) produce a homogeneous product with a tightly bound surface;
- (b) achieve a uniform bond to the surface below; and
- (c) achieve the finished pavement properties, specified in Clause 4, within the specified tolerances.

Do not induce rapid cooling in the asphalt by the application of water at any stage in the process, including preparation for trafficking.

3.2 PREPARATION OF PAVEMENT

Prior to placing asphalt, prepare the surface to be paved in accordance with the requirements in AS 2150, including removal of raised extruded thermoplastic road markings and raised pavement markers.

3.3 PLANT AND EQUIPMENT

The asphalt must be placed by a self-propelled paving machine equipped and operated with automatic thickness control and automatic joint matching facility.

Hand placement of asphalt is only permitted for minor corrections of the existing surface and in areas where placement with a paving machine is impractical.

State in your PROJECT QUALITY PLAN the method of achieving conforming compaction including roller type, number of passes and rolling pattern.

If specified in Annexure R117/A, a Material Transfer Vehicle (MTV) must be used in the paving process. The MTV must be a self propelled machine with independent controls which will receive asphalt from delivery vehicles, store, remix and transfer the asphalt to the paving machine without contact and be equipped with:

- (a) a receiving hopper compatible with delivery vehicles;
- (b) conveying mechanisms and anti-segregation devices for remixing asphalt;
- (c) conveying mechanisms capable of delivering asphalt to the paver at a minimum rate to suit the paving output;
- (d) a minimum nominal on-board storage capacity of 15 tonnes;
- (e) an additional holding bin in the paving machine hopper; and
- (f) sufficient power output from the motor to operate with full load on grades up to 6% and travel in tandem with the paver, either directly in front or in an offset position.

If specified in Annexure R117/A, place the asphalt by echelon paving using a minimum of two paving machines operating continuously in tandem. The paving run layout must be such that the hot joint is located to minimise cold joints within the trafficked carriageway, unless otherwise approved by the Principal.

3.4 PROTECTION OF WORK

Provide for traffic in accordance with the requirements of Specification RMS G10 while undertaking the work.

Protect the work until the required thickness of asphalt has been placed, compacted and cooled sufficiently to carry traffic without damage to the work.

3.5 PROTECTION OF SERVICES AND ROAD FIXTURES

Do not allow asphalt or other material used on the work from entering or adhering to grates, hydrants or valve boxes, service covers, bridge joints and other road fixtures. Immediately after the asphalt has been placed, clean and remove all waste asphalt from the affected services and road fixtures.

3.6 COURSE AND LAYER THICKNESSES

A course of asphalt may comprise of one or more layers. Where a course comprises of more than one layer, and the layer thicknesses have not been specified by the Principal, nominate the thickness of each layer in your PROJECT QUALITY PLAN.

3.6.1 Nominated Layer Thickness

The nominated thickness of a layer of asphalt must be within 3.0 to 5.0 times the nominal mix size.

3.6.2 Corrective Courses and Tie-ins to Existing Pavement

For corrective courses and tie-ins to an existing pavement, you may propose and implement a layer thickness that does not conform to the thickness requirements of Clause 3.6.1.

HOLD POINT

Process Held: Placing of asphalt in nonconforming layer thicknesses.

Submission Details: Details must include:

- (a) work methods proposed to ensure that a dense homogeneous layer will be provided; and
- (b) proposed nominated layer thicknesses; and
- (c) evidence that affected areas are the absolute minimum necessary to conform to the Drawings and that as far as possible, the nominated layer thickness of the corrective courses complies with the limits specified in Clause 3.6.1.

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

3.7 PAVEMENT TEMPERATURE AND WEATHER CONDITIONS

You must measure and record the pavement surface temperature and wind velocity at the point of asphalt placing. The method of measurement and recording must be documented in your PROJECT QUALITY PLAN. Do not commence or continue placing asphalt, unless the pavement surface temperature complies with the following requirements:

- (a) Where the nominal size of asphalt is less than 20 mm, the minimum pavement surface temperature must be 10°C for a zero wind speed at pavement level for binder complying with Specification RMS 3253.
- (b) Where the nominal size of asphalt is 20 mm or greater, the minimum pavement surface temperature must be 5°C for a zero wind speed at pavement level for binder complying with Specification RMS 3253.

- (c) Add 5°C to each of the limits in (a) or (b) above for binder complying with Specification RMS 3252.
- (d) Add 5°C to each of the limits in (a), (b) and (c) above for each 5 kph of wind speed above zero (measured at pavement level) provided that the cumulative temperature for (a), (b) or (c) above does not exceed 30°C.

Do not place tackcoat and/or asphalt when the pavement surface is wet and/or rain is imminent.

3.8 PAVING AND COMPACTION TEMPERATURES

Your PROJECT QUALITY PLAN must document the temperatures at which the asphalt is placed and compacted to achieve the insitu air void requirements specified in clause 4.1.1.

HOLD POINT

Process Held: Placing of the nominated mix (including placement trial).

Submission Details: Nominate in writing:

- (a) the minimum temperature at which asphalt is to be delivered to the paver; and
- (b) the minimum temperature at which initial compaction of the asphalt is to commence; and
- (c) the method of temperature measurement.

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

Do not incorporate asphalt that exhibits a temperature variation into the Works unless it has been remixed to a consistent and adequate temperature for compaction.

Measure and monitor paving and compaction temperatures as described in your PROJECT QUALITY PLAN with a hand held or machine mounted infrared thermometer readable and accurate to within $\pm 2^\circ\text{C}$ at the discharge point from a tipper truck or at the distribution auger on the paver.

Verification of the accuracy of the infrared thermometer and the determination of a correlation factor must be undertaken daily at the commencement of work and at any other time at the request of the Principal.

3.9 TACKCOAT

Prior to applying the tackcoat, the existing surface must be clean, dry and free from loose material.

Apply the tackcoat evenly at a rate of between 0.15 and 0.30 litres of residual bitumen per square metre so that it is effectively bonded to the surface. For joints and chases, double the application rate. Nominate in writing to the Principal your proposed tackcoat application rate prior to applying the tackcoat.

You may propose in writing to the Principal a reduced application rate for the tackcoat due to the existing underlying pavement material, particularly where the underlying layer is a primerseal or seal that is less than 3 months old and has not been trafficked. Your proposal must be supported by examples of previous cases where this has been done, including location and insitu material types and the current pavement performance.

Provide to the Principal a daily record with your endorsement, of the average tackcoat application rate applied to each Lot. Report the tackcoat application rate in terms of residual bitumen and state the percentage dilution of the tackcoat used during spraying.

3.10 JOINTS

Describe in your PROJECT QUALITY PLAN the procedure for the construction of joints. Your procedure must maximise joint density and include mechanised edge compaction or mechanised edge trimming. Hand tamping of edges is permitted where the use of a machine is impractical. Excess material resulting from hand preparation of edges is not to be spread on the surface of the work.

All loose, cracked and/or boney material at the edge of a paved mat must be removed prior to placing the adjacent mat. Asphalt resulting from clean-up of process trimmings is not to be used in the work.

Each joint must be finished with a smooth, planar surface coinciding with the surface of the rest of the mat and satisfying the surface shape requirements specified in Clause 4.4.

Longitudinal joints must be:

- (a) offset by 150 mm from the joint in the underlying layers;
- (b) coincident within 150 mm of the line of change in crossfall;
- (c) coincident with final traffic markings, unless otherwise approved by the Principal.

Transverse joints must be:

- (a) located a minimum of 25 m apart;
- (b) offset by a minimum of 1 m from the joint in the underlying layer;
- (c) formed at the commencement of each paving run;
- (d) formed when a delay in paving causes asphalt temperature to fall below the initial compaction temperature nominated in Clause 3.8.

3.11 PLACEMENT TRIAL

If specified in Annexure R117/A and prior to commencing work, the plant and personnel proposed for use on the work must be subjected to a placement trial.

Each nominated mix must be subjected to a separate placement trial. Each placement trial must be located remote from the work, unless otherwise approved by the Principal. The size of the placement trial must be limited to one production shift. Design the trial to implement all the procedures described in your PROJECT QUALITY PLAN and demonstrate conformity to the Specification in respect of:

- (a) homogeneity;
- (b) insitu air voids;
- (c) course thickness;
- (d) course position;

- (e) surface shape;
- (f) joint quality; and
- (g) ride quality, where specified.

HOLD POINT

Process Held:	Placing of the nominated mix.
Submission Details:	Verification checklist and all relevant test results from the placement trial demonstrating conformity to the Specification at least 3 working days prior to further placing of your nominated mix on the work.
Release of Hold Point:	The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

In the event of a nonconformity in the placement trial, or when the Principal determines that a previous trial is not representative of the materials, asphalt mix proportions, temperature, plant, rate of output and/or method of placement, a new trial must be implemented.

Where a placement trial forms part of the work, manage all nonconformity in respect of materials, process and finished pavement properties in accordance with Clause 5.

3.12 TEMPORARY RAMPS AND TIE-INS TO EXISTING PAVEMENT AND STRUCTURES

Temporary ramps that are constructed for the safe trafficking of the work, must be constructed by placement of asphalt complying with this Specification as appropriate for the application, or by cold milling of existing or new asphalt.

The length and grade of temporary ramps must be equivalent to those specified for treatment at edges and structures described in Specification RMS R101.

Construct permanent tie-ins to existing pavement by placement of asphalt complying with this Specification.

4 FINISHED PAVEMENT PROPERTIES

4.1 INSITU AIR VOIDS

4.1.1 Requirements for Insitu Air Voids

Each layer of asphalt must be uniformly compacted to achieve the specified characteristic values of insitu air voids before the next layer is placed.

The asphalt must have a dense appearance with the cut or cored faces of samples exhibiting few, if any, surface voids.

Asphalt layers less than or equal to 30mm nominated thickness should not be tested for insitu air voids.

The characteristic values of insitu air voids for the Lot must comply with Table R117.7.

Table R117.7 – Insitu Air Voids Standard

Limits for Characteristic Values of Insitu Air Voids	
Specified layer thickness > 30 mm and < 50 mm	Specified layer thickness ≥ 50 mm
$V_L = 3.0\%$ and $V_U = 8.0\%$	$V_L = 3.0\%$ and $V_U = 7.0\%$
Notes: V_L is the lower limit of characteristic value of insitu air voids and V_U is the upper limit of characteristic value of insitu air voids.	

4.1.2 Determination of Insitu Air Voids

Carry out compaction control on Lots using statistical techniques as specified in RMS Q.

The calculation for determining the insitu air voids is set out in Annexure R117/E. Determine the bulk density either from cores in accordance with AS 2891.9.2 or from nuclear density measurements taken in accordance with AS 2891.14.2 and using the calibrated procedure described in AS 2891.14.3. Only one of these methods is to be used to calculate the bulk density.

Cores must be taken in accordance with AS 2891.1.2. Determine the layer thickness prior to trimming of cores. Trimming must not reduce the core layer thickness by more than 5mm.

The nuclear density method is not to be used when steel reinforcement exists within 300 mm of the surface of the layer.

The reference density for the purpose of insitu air voids calculations is the mean maximum density of the Lot where the individual values are determined in accordance with AS 2891.7.1 or AS 2891.7.3.

Air voids must be determined for:

- (a) every change in underlying pavement material and layering within 300 mm of the surface of the layer being measured, and
- (b) every change in nominated mix and specified layer thickness.

4.2 COURSE THICKNESS

4.2.1 Requirement for Course Thickness

The specified course thickness is detailed in Annexure R117/A.

(a) Where finished surface levels are not specified

You must comply with EITHER of the following:

- (i) Where a single layer of asphalt is placed over an existing pavement constructed by others, the average compacted course thickness for each Lot must not be less than the specified course thickness or greater than the specified course thickness plus the tolerance specified in Table R117.8 for the nominal size of asphalt.

OR

- (ii) Where asphalt is placed over one or more layers placed by you, the Lot is deemed to be conforming if the lower characteristic value of thickness (TL) for the Lot is not less than the specified course thickness as shown on the Drawings or specified in Annexure R117/A and the upper characteristic value of thickness (TU) for the Lot is not more than the specified course thickness plus the tolerance specified in Table R117.8 for the nominal size of the asphalt.

Table R117.8 – Allowable Tolerances for Course Thickness

Nominal Size of Asphalt (mm)	Tolerance (mm)
5	+ 5
7	+ 5
10	+ 6
14	+ 8
20	+ 10

(b) Where finished surface levels are specified

Control the course thickness by maintaining the design levels and the surface shape requirements specified in Clause 4.4 provided that:

- (i) The average compacted course thickness of each Lot calculated from surveys must be consistent with the average compacted course thickness of the respective Lot determined from cores. Include in your PROJECT QUALITY PLAN, the statistical technique for verifying the consistency of the results.
- (ii) The average compacted course thickness of each Lot of the wearing course is within 10% of the specified course thickness.

4.2.2 Determination of Course Thickness

Determine the characteristic values and average value of thickness of the Lot on the basis of statistical techniques as specified in RMS Q on cores taken in accordance with AS 2891.1.2 where:

- (a) core layer thickness is determined prior to trimming of the core;
- (b) the core diameter can be less than 95 mm;
- (c) the test specimen may comprise more than one layer.

The calculation of the upper and lower characteristic values of thickness for the Lot is shown in Annexure R117/E2.

4.3 COURSE POSITION

4.3.1 Determination of Course Position

Where finished surface levels are specified, measure the course position of each Lot by survey in accordance with Specification RMS Q.

Where finished surface levels are not specified, determine the course position by reference to existing pavement surface and road fixtures.

Determine the course position within 72 hours of the installation of the Lot.

4.3.2 Requirement for Vertical Level

The levels of the top surface of any course are calculated from the design finished levels less the total course thickness(es) overlying that course. The measured levels determined by survey must not vary from the calculated levels for a course by more than the tolerance shown in Table R117.9.

Where the new asphalt wearing course is required to match the surface levels of a road structure (e.g. tie-in to existing pavement or bridge joints, pavement gutter, utility access point, etc), the pavement must be constructed so as to drain the surface of water and match the surface levels of the existing road structure, unless otherwise directed by the Principal.

Dispositions for nonconformity must be approved before a subsequent course is placed.

Table R117.9 – Allowable Tolerances for Survey Levels

Course	Below Calculated Level (mm)	Above Calculated Level (mm)
Wearing Course	0	10
Top Intermediate Course	5	10
Other Intermediate Courses	10	10
Corrective Course	15	10

4.3.3 Requirement for Horizontal Location

The survey location of any point on the surface of a course for level determination must be located within 25 mm from the corresponding point determined from the Drawings.

4.4 SURFACE SHAPE

4.4.1 Determination of Surface Shape

Determine and report the surface shape in accordance with Test Method RMS T183.

The maximum Lot size must be in accordance with RMS Q and extended to include the adjacent longitudinal joints, transverse joints and tie-ins. Carry out testing at the frequency as specified in Table R117/L.5 of Annexure R117/L.

4.4.2 Requirement for Surface Shape

The surface of the course including longitudinal and transverse joints must not pond water.

The surface shape of the course within the traffic lane must not deviate from the bottom of a straight edge laid in any direction by more than the tolerances shown in Table R117.10. Where the deviations from a straight edge for an existing surface exceed 10 mm, carry out rectification of those areas before a new asphalt layer is placed, unless directed otherwise by the Principal.

Correct any nonconformities before testing ride quality and before a subsequent course is placed.

Table R117.10 – Maximum Deviation From Straight Edge Placed Within Traffic Lane (mm)

Course	Through Carriageway < 70 kph Traffic Speed (Ramps & Roundabouts)	Through Carriageway ≥ 70 kph Traffic Speed
Corrective Course	15	10
Intermediate Course	10	5
Wearing Course	5	3

4.5 RIDE QUALITY

4.5.1 Determination of Ride Quality

If specified in Annexure R117/A, determine the ride quality (IRI_S) from measurements of longitudinal profile taken by a vehicular laser profilometer where the ride quality is the IRI_S determined in accordance with Test Method RMS T188 and the Lot is a Section within the test lane as defined in the Test Method.

Develop an Inspection and Test Plan (ITP) for ride quality that meets the requirements of the Specification. Define the Lots and the start and end locations for testing in your ITP.

Supply the Principal with copies of the RMS Accreditation Certificates for each vehicular laser profilometer driver and operator proposed for use in the Works.

4.5.2 Requirement for Ride Quality

The surface of the wearing course must have a smooth longitudinal profile, and

- (a) when construction of the underlying pavement forms part of the contract; or
- (b) when asphalt is placed in more than one layer, including any corrective course over a pavement constructed by others;
- (c) when the scope of the work targets a ride quality;

the ride quality of each Lot must not exceed an International Roughness Index (IRI_S) of 1.56 m/km.

Where a single layer of asphalt is placed over pavement constructed by others, the ride quality of each Lot must not exceed the IRI_{Sa} values determined as follows:

$$IRI_{Sa} = 0.2 + (0.6 \times IRI_{Sb}), \text{ or } 1.56 \text{ m/km, whichever is the greater}$$

where: IRI_{Sa} is the IRI_S after placing the asphalt layer (m/km)

IRI_{Sb} is the IRI_S before placing the asphalt layer (m/km)

Where a single layer of asphalt is placed over a pavement constructed by others, determine and report the ride quality of the existing surface prior to the work. Lots of the existing surface must be selected such that they coincide with Lots of the finished work.

5 CONFORMITY

Verify conformity with the Specification by sampling and testing, and providing records of process control.

5.1 HOMOGENEITY

All asphalt must be homogenous in appearance.

Areas of asphalt that exhibit segregation, cracking, ravelling, bony or fatty material, or have been damaged during construction must be rectified or replaced.

Any proposal by you that the Principal accepts non-homogeneous and/or segregated material or work must be in writing and must show:

- (a) the technical reasons for acceptance;
- (b) compliance with the Specification; and
- (c) sub-Lotting that minimises performance risk to the surface and structure of the pavement.

5.2 SAMPLING

Nominate all sampling locations, frequencies and test methods in your PROJECT QUALITY PLAN.

In addition to the requirements of Annexure Q/L of RMS Q, and unless otherwise specified or agreed with the Principal, boundaries of sub-Lots represented by a single tested sample are deemed to be the midpoints in production between the sample points for the purpose of Clause B2 in Annexure R117/B of this Specification.

When the Principal requests loose asphalt samples for testing, you must riffle and/or quarter the samples.

All samples, including core samples, must be delivered in sealed and labelled containers.

5.3 TESTING

5.3.1 Minimum Frequency of Testing

The minimum frequency of testing is specified in Annexure R117/L. Nominate an appropriate frequency where a minimum frequency of testing is not specified.

You may propose in writing to the Principal that a reduced minimum frequency of testing be accepted in accordance with RMS Q. Support your proposal with a statistical analysis verifying consistent process capability and product characteristics.

In the event of a nonconformity, a reduced frequency of testing must revert immediately to the specified minimum frequency of testing. You can request a reduction in the minimum frequency of testing when you can demonstrate again by statistical analysis that you have gained a consistent process capability and product characteristics.

5.3.2 Maximum Lot Size

The maximum Lot size must conform to RMS Q.

5.3.3 Time for Submission of Test Results

Complete and report to the Principal:

- (i) the tests for binder content, combined particle size distribution and air voids in laboratory compacted mix within one working day of placing the asphalt.
- (ii) the tests for insitu air voids, course thickness and course shape within three working days of placing the asphalt.

5.4 PROCESS CONTROL

Employ a capable process and implement process control in accordance with or exceeding the requirements of Australian Asphalt Pavement Association Implementation Guide IG-3.

5.5 NONCONFORMITIES

If a Lot fails to conform to the Specification, such failure will constitute a nonconformity under the Contract.

If a nonconformity is not accepted in accordance with Annexure R117/B2, rectify or replace the Lot.

ANNEXURE R117/A – PROJECT SPECIFIC REQUIREMENTS

The requirements below apply to the following pavement types in the project:

Insert pavement types (and locations if applicable).

Use multiple copies to cater for different pavement designs within the same project.

Course	Nominal Size of Asphalt (mm)	Class of Binder (Clause 2.1.5)	Specified Course Thickness (mm) (Clause 4.2.1)
Wearing			
Intermediate 1			
Intermediate 2			
Corrective 1			
Corrective 2			
Footpath Mix			

Clause	Description	Requirement *
3.3	Material Transfer Vehicle required: - Wearing course - Intermediate courses	Yes / No Yes / No
3.3	Paving in echelon required: - Wearing course - Intermediate courses	Yes / No Yes / No
3.11	Placement trial required:	Yes / No
4.5.1	Measurement of ride quality of pavement required: - Existing pavement - Finished pavement	Yes / No Yes / No

* Delete as applicable

Measure the following pay items by area (refer Annexure R117/B): *(List pay items)*

Other Project Specific Requirements: *(List requirements)*

ANNEXURE R117/B – MEASUREMENT AND PAYMENT AND DISPOSITION OF NONCONFORMITIES

Refer to Clause 1.3.2.

B1 MEASUREMENT AND PAYMENT

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

A lump sum price for any of these items will not be accepted.

Where an item of work required is not specifically covered by the measurement and payment descriptions for the pay items in the Schedule, due allowance must be made in one or more of the other pay items to allow for this item of work at the time of tendering.

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

(a) Measurement by Mass

Unless specified otherwise in Annexure R117/A, the quantity of asphalt must be measured by mass and the unit of measurement is the “tonne”.

The Principal may approve measurement by batch weights using certified scales. The quantity of asphalt in place in the final work must be mutually agreed using the RMS Contract Quantity Agreement Sheet using the tally of the weigh bridge dockets of delivered asphalt less the quantity of asphalt not incorporated in the Works.

Truck weighbridge dockets must be issued at a weighbridge certified by the NSW Office of Fair Trading and collected at the point of delivery.

(b) Measurement by Area

If specified in Annexure R117/A, the quantity of asphalt is measured by area and the unit of measurement is square metre.

The area will be determined from the dimensions shown on the Drawings or as specified for the work in Annexure R117/A.

The measurement of tackcoat sprayed is based on the quantity of residual bitumen. The unit of measurement is the litre determined from sprayer tanker dippings.

Pay Item R117P1 – Supply and Application of Tackcoat (Including Preparation of Surface)

Unless specified otherwise in Annexure R117/A, the quantity of tackcoat used in the work is determined by volume and the unit of measurement is a litre of residual bitumen.

Determine the volume by multiplying the nominated application rate of residual bitumen by the specified area of the road surface to be tackcoated.

Tackcoat applied to faces of joints, kerbs and other structures is deemed to be included in the rate.

Pay Item R117P2 – Light Duty Dense Asphalt in Corrective Courses

R117P2.1 5 mm Nominal Size

R117P2.2 7 mm Nominal Size

R117P2.3 10 mm Nominal Size

R117P2.4 14 mm Nominal Size

R117P2.5 20 mm Nominal Size

Pay Item R117P3 – Light Duty Dense Asphalt in Intermediate Courses

R117P3.1 10 mm Nominal Size

R117P3.2 14 mm Nominal Size

R117P3.3 20 mm Nominal Size

Pay Item R117P4 – Light Duty Dense Asphalt in Wearing Course

R117P4.1 5 mm Nominal Size

R117P4.2 7 mm Nominal Size

R117P4.3 10 mm Nominal Size

R117P4.4 14 mm Nominal Size

R117P4.5 Footpath mix

**Pay Item R117P5 – Light Duty Dense Asphalt Over Existing Pavement
(No Levels Specified)**

R117P5.1 5 mm Nominal Size

R117P5.2 7 mm Nominal Size

R117P5.3 10 mm Nominal Size

R117P5.4 14 mm Nominal Size

R117P5.5 Footpath mix

**Pay Item R117P6 – Light Duty Dense Asphalt Over Existing Pavement
(Levels Specified)**

R117P6.1 5 mm Nominal Size

R117P6.2 7 mm Nominal Size

R117P6.3 10 mm Nominal Size

R117P6.4 14 mm Nominal Size

R117P6.5 Footpath mix

Pay Item R117P7 – Incentives and Deductions in accordance with Annexure R117/B

R117P7.1 All deductions calculated as per Tables R117/B.1, R117/B.2 and R117/B.5

R117P7.2 All incentives calculated as per Tables R117/B.6

Incentives and deductions under this pay item are not subject to rise and fall adjustments.

B2 DISPOSITION OF NONCONFORMITIES

B2.1 General

If the nonconformity is not accepted in accordance with Annexure R117/B.2.2, the nonconforming material must be replaced or the nonconforming section of work must be either replaced or corrected.

The cost of rectifying nonconformities, including any restoration work to any underlying or adjacent surface or structure, which becomes necessary as a result of such replacement or correction, will be borne by you. Materials removed from the site by you must be replaced with materials that conform to this Specification.

B2.2 Acceptance of Nonconformities

You may propose in writing to the Principal that pre-determined dispositions be applied to nonconformities for the following properties:

- (a) Combined particle size distribution and binder content in asphalt
- (b) Insitu air voids
- (c) Ride quality.

Deductions apply to the schedule rate for the quantity of asphalt represented by the test sample and will be recorded against Pay Item R117P7.1.

B2.2.1 Combined Particle Size Distribution and Binder Content

Deductions in accordance with Table R117/B.1 will be applied to accepted nonconformities in combined particle size distribution and binder content provided that:

- (a) For any individual sieve size and the binder content, nonconformities greater than twice the production tolerance specified in Table R117.5 will not be accepted, and
- (b) Deductions are cumulative and nonconformities will not be accepted if combined deductions exceed 20%.

Table R117/B.1 – Deductions for Combined Particle Size Distribution and Binder Content

	% by which nonconformity exceeds production tolerance (Clause 2.4.2)	Deductions (% of schedule rate)
Combined Particle Size Distribution Element	(% by mass of total aggregate)	
Pass 37.5 mm AS sieve	Each 2 or part thereof	1
Pass 26.5 mm AS sieve	Each 2 or part thereof	1
Pass 19.0 mm AS sieve	Each 2 or part thereof	1
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
Binder Content for	(% by mass of total asphalt mix)	
20 mm asphalt or smaller	Each 0.1 or part thereof	3

B2.2.2 Insitu Air Voids

Deductions in accordance with Table R117/B.2 will be applied to accepted nonconformities in excess of the upper characteristic insitu air voids provided that nonconformities will not be accepted when the upper characteristic insitu air voids exceeds the specified limit by more than 2.0%.

Table R117/B.2 – Deductions for Nonconforming Insitu Air Voids

Insitu air voids is outside of specified limit V_U by	Deduction (in per cent of value of Lot)
< 0.5%	2.5%
0.5% – 1.0%	15%
1.1% – 1.5%	30%
1.6% - 2.0	50%
> 2.0%	Reject

B2.2.3 Ride Quality

Deductions in accordance with Table R117/B.3 must be applied to accepted nonconformities in ride quality provided that the nonconformities will not be accepted when the ride quality exceeds the specified limit by more than 0.80 m/km.

Table R117/B.3 – Deductions for Ride Quality

Ride quality in excess of specified limit by (m/km)	Deduction (in per cent of value of Lot)
< 0.25	2
0.25 – 0.43	4
0.44 – 0.61	8
0.62 – 0.80	16

B3 INCENTIVES

It may be proposed in writing to the Principal that pre-determined incentives be applied in accordance with Table R117/B.4 to the ride quality of the asphalt wearing course, provided that:

- (a) the Lot conforms to all requirements of this Specification, and
- (b) for all three adjacent Lots in all directions, the ride quality is conforming.

Table R117/B.4 – Incentives for Ride Quality

Ride quality below specified limit by (m/km)	Incentive (in per cent of value of Lot)
< 0.44	0
0.44 – 0.61	1
0.62 – 0.80	2
> 0.80	3

Incentives apply to the schedule rate for the quantity of asphalt represented by the test sample and must be recorded against Pay Item R117P7.2.

ANNEXURE R117/C – SCHEDULES OF HOLD POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.3.3.

C1 SCHEDULE OF HOLD POINTS

Clause	Description
2.2.1	Progression to higher RAP Level
2.3.1	Submission of the nominated mix(es)
3.6.2	Placing of asphalt in non-conforming layer thicknesses
3.8	Placing of the nominated mix (including placement trial)
3.11	Placing of the nominated mix

C2 SCHEDULE OF IDENTIFIED RECORDS

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

Clause	Description of Identified Record
1.3.4	Project specific project quality plan
1.3.4	RAP Management Plan
2.1.5	Documentary evidence of the binder conformity for each delivery
2.3.1	Documents as detailed for each nominated asphalt mix
2.3.1	Documents as detailed for proprietary information
2.4.3, 2.4.5	Asphalt manufacturing process parameters including process temperatures
3.6.2	Detailed proposal for placing corrective courses and tie-ins in nonconforming thicknesses
3.7	Pavement temperature and weather conditions
3.8	Asphalt temperature at which initial compaction will be commenced
3.9	Notification of proposed application rates for tackcoat.
3.9	Daily record of the average tackcoat application rate in each Lot
3.11	Verification checklist and all listed test reports of the trial section for each combination of materials, mix proportions, equipment, rate of paving and methods for placement, compaction and finishing
4.4.1	The location and frequency of straight edge measurements including testing at longitudinal and transverse joints
5.3.1	Test reports of all specified properties and characteristics at the minimum frequency of testing

ANNEXURE R117/D – PLANNING DOCUMENTS

Refer to Clause 1.3.4. 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.

Clause	Planning Documents
1.3.4	Manufacturer's written recommendations.
2.1	For each constituent material, Lot/stockpile sizes, method of defining each Lot and allocating a unique Lot Number.
	Procurement, handling and storage of each constituent material.
	Nominated particle size distribution and tolerances for each constituent aggregate.
2.3	Development and authorisation of the nominated mix submission.
2.4	For each nominated mix, method of defining each Lot and allocating a unique Lot Number.
	Calibration of the asphalt manufacturing plant, including all weigh scales, flowmeters and thermometers.
	Process control, including plant operating instructions, key temperature targets and records, and response to process control charts.
	Acquisition, storage and handling of binder, including identification and prevention of segregation and/or contamination.
	Control of plant feed proportions, including regular checks on grading and moisture content.
	Daily asphalt manufacturing plan to ensure timely and uninterrupted progress on site.
2.5	Loading, delivery and unloading procedures that maintain adequate mix temperature and do not interrupt progress of the paving train.
3	For each paving and related activity, method of defining each Lot and allocating a unique Lot Number.
	Calibration of all thermometers and other measuring equipment.
	Process control for surface preparation, tackcoating, placing, joint construction, compaction and cleanup, including plant operating instructions, key temperature targets and records, patterns for paving and compaction operations, and process monitoring.
3.3	Allocation of appropriate plant and equipment, including backup in case of breakdown.
3.6	Nominated layer thicknesses where these have not been specified by the Principal.
3.7	Measurement and recording of pavement temperatures and weather conditions.
3.8	Paving and compaction temperature
3.10	Construction joints
3.11	Design, execution and quality verification of a placement trial.
4.2.1	Requirements for course thickness
5.2 & 5.3	Inspection and test plan, including methods and frequencies of sampling, methods and frequencies of testing, verification checklists, and timeframe for submission of test results.

ANNEXURE R117/E – CALCULATIONS

E1 CALCULATION OF CHARACTERISTIC VALUES OF INSITU AIR VOIDS

Calculate the upper (V_U) and lower (V_L) characteristic values of insitu air voids of the Lot as follows:

$$V_U = \bar{a} + ks \quad V_L = \bar{a} - ks$$

where: s = the standard deviation of sub-Lot air voids expressed as a percentage

k = value stated in RMS Q Annexure Q/L Clause L3.2

\bar{a} = the arithmetic mean of insitu air voids expressed as a percentage for all sub-Lots

$$\text{and } a = \left(\frac{MD - BD}{MD} \right) \times 100\%$$

MD = mean maximum density of the Lot determined in accordance with AS2891.7.1 or AS2891.7.3

BD = bulk density of the sub-Lot determined in accordance with

(i) AS2891.9.2 for cores

(ii) AS 2891.14.2 and AS 2891.14.3 for nuclear density gauge

Round and report the values of V_U and V_L to the nearest 0.1%.

E2 CALCULATION OF CHARACTERISTIC VALUE OF THICKNESS

Calculate the upper (T_U) and lower (T_L) characteristic values of thickness for the Lot as follows:

$$T_U = \bar{x} + ks \quad T_L = \bar{x} - ks$$

where: s = the standard deviation of sub-Lot attribute test results

k = value stated in RMS Q Annexure Q/L Clause L3.2

x = the average height of a core (mm) based on measurements taken at four equidistant points at the circumference of the core.

\bar{x} = the arithmetic mean of attribute test results for all sub-Lots

(Note: \bar{x} , x and s are in mm and T is rounded to the nearest whole millimetre.)

ANNEXURE R117/F – REQUIREMENTS FOR RAP LEVEL PROGRESSION

To progress from RAP Approval Level 1L or 1WL to 2L, 2WL, demonstrate that you have met the testing requirements in Tables R117/F.

Table R117/F – RAP level Progression Criteria

Submission Type	Testing
Section A	
Nominated mix submission (to be renewed annually)	(a) Particle size distribution of RAP aggregate washed in solvent and tested in accordance with AS1141.11 (b) Binder content of RAP in accordance with AS 2891.3.1 (c) Recovered binder viscosity of RAP in accordance with RMS T522 (d) Quality of RAP aggregate washed in solvent to comply with RMS 3153
Contract frequency testing (each Lot of RAP used in asphalt production)	(a) Particle size distribution of RAP aggregate washed in solvent and tested in accordance with AS 1141.11 (b) Binder content of RAP in accordance with AS 2891.3.1
Contract frequency testing (daily on RAP incorporated into asphalt)	(a) Moisture content of RAP in accordance with RMS T660 (b) Visual monitoring of incoming RAP by a person experienced in the process
Section B	
Production and placement trial testing (to be repeated annually and at change in nominated mix)	All testing required in Section A, plus: (a) Moisture sensitivity of asphalt containing RAP in accordance with RMS T640 (b) Moisture sensitivity of asphalt containing RAP in accordance with RMS T649

ANNEXURES R117/G TO R117/K – (NOT USED)**ANNEXURE R117/L – MINIMUM FREQUENCY OF TESTING**

The minimum frequency of testing of the materials, production, placing and finished pavement are listed in Tables R117/L.1 to R117/L.5.

Table R117/L.1 – Minimum Frequency of Testing of Asphalt

Quantity of Asphalt Supplied in Each Shift	Minimum Frequency of Testing
Less than 100 tonnes	One per 100 tonnes or part thereof
101 to 300 tonnes	One per 150 tonnes or part thereof
301 to 600 tonnes	One per 200 tonnes or part thereof
Over 600 tonnes	One per 250 tonnes or part thereof

Note: A “shift” must be continuous work not exceeding a period of 12 hours.

Table R117/L.2 – Constituents

Clause	Constituent	Minimum Frequency of Testing⁽²⁾ as per
2.1.1	Coarse aggregates	RMS 3152
2.1.2	Fine aggregates	RMS 3152
2.1.3	Reclaimed asphalt pavement (RAP)	RMS 3153 and Annexure R117/F
2.1.3	Glass granulate aggregate	RMS 3154
2.1.4	Added fillers	RMS 3211
2.1.5	Binder	RMS 3252 and RMS 3253
2.1.7	Bitumen emulsion tackcoat	AS 1160

Notes:

- (1) The nominated mix design submission must also include complying test results for each specified characteristic of each constituent.
- (2) The minimum frequency of testing must be in accordance with the specific RMS Test Method or Australian Standard.

Table R117/L.3 – Asphalt Production

Clause	Characteristic	Test Method / Procedure	Minimum Frequency of Testing
2.1.4	Filler in asphalt – Dry compacted voids	AS 1141.17	One test with each nominated mix submission
2.1.4	Filler in asphalt – Methylene blue value	RMS T659	One test with each nominated mix submission
2.2.1	Binder content	AS 2891.3.1	As per Table R117/L.1
2.2.1	Combined particle size distribution	AS 2891.3.1	As per Table R117/L.1
2.2.2	VMA and air voids in laboratory compacted mix (80 cycles)	RMS T662 AS 2891.7.1 or AS 2891.7.3 AS 2891.8 AS 2891.9.2	As per Table R117/L.1
2.2.3	Moisture content	RMS T660	As per Table R117/L.1
2.4.5	Production temperature of asphalt	Your documented procedure	As specified in PQP
2.4.5	Despatch temperature of asphalt	Your documented procedure	Each delivered load

Table R117/L.4 – Asphalt Placing

Clause	Characteristic	Test Method / Procedure	Minimum Frequency of Testing
3.7	Pavement temperature	Your documented procedure	1 measurement every 2 hours
3.7	Wind velocity	Your documented procedure	1 measurement every 2 hours
3.8	Temperature at initial compaction	Your documented procedure	Each delivered load
3.9	Tackcoat application rate	Your documented procedure	Each paving Lot
5.1	Homogeneity	Visual assessment	Each paving Lot

Table R117/L.5 – Finished Pavement Properties

Clause	Characteristic	Clause / Test Method	Minimum Frequency of Testing
4.1	Insitu air voids	Clause 4.1.2	As specified for relative compaction > 100.0 in RMS Q L3.1
4.2	Course thickness	Clause 4.2.2	As specified for relative compaction > 100.0 in RMS Q L3.1
4.3	Course position	Clause 4.3.2 &	RMS Q

Clause	Characteristic	Clause / Test Method	Minimum Frequency of Testing
		Clause 4.3.3	
4.4	Surface Shape	RMS T183	<p>(a) Within lane: one measurement in longitudinal direction and 1 measurement in transverse direction every 60 m²</p> <p>(b) Longitudinal joint excluding crowns: one measurement per 10 lineal metres</p> <p>(c) Transverse joint: one measurement in each wheel path in each lane except at the boundaries of the contract</p>
4.5	Ride quality	RMS T188	Each Lot as defined in the Test Method T188

ANNEXURE R117/M – REFERENCED DOCUMENTS

RMS Specifications

RMS G10	Traffic Management
RMS Q	Quality Management System
RMS R101	Cold Milling of Road Pavement Materials
RMS 3152	Aggregates for Asphalt
RMS 3153	Reclaimed Asphalt Pavement Material
RMS 3154	Granulated Glass Aggregate
RMS 3211	Cements, Binders and Fillers
RMS 3252	Polymer Modified Binder
RMS 3253	Bitumen for Pavements
RMS 3259	Bitumen Adhesion Agent (Bitumen Classes 170 and 320)
RMS 3269	Bitumen Adhesion Agent (Polymer Modified Bitumen)

RMS Test Methods

RMS T183	Surface Deviation Using a Straightedge
RMS T188	Project Ride Quality (Vehicular Laser Profilerometer)
RMS T230	Resistance to Stripping of Aggregates and Binders
RMS T522	Penetration and Properties of Binder Recovered from Asphalt
RMS T640	Propensity for Moisture Damage in Asphalt (Specimens moulded in the laboratory)
RMS T649	Propensity for Moisture Damage in Asphalt (Cores)
RMS T659	Methylene Blue Value of Road Construction Material
RMS T660	Moisture Content of Bituminous Mixes (Mass Loss Method)
RMS T662	Compaction of Asphalt Test Specimens (using a Gyratory Compactor)

RMS Technical Directions

TD 2013/02	Rhyolite Aggregate for use in Skid Resistant Asphalt Mixes
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Australian Standards

AS 1160	Bituminous emulsions for construction and maintenance of pavements
AS 2150*	Hot mix asphalt - A guide to good practice

Australian Standard Test Methods

AS 1141.11	Particle size distribution - Sieving method
AS 1141.17	Voids in dry compacted filler

AS 1141.50	Resistance to stripping of cover aggregates from binders
AS 2891.1.1	Sampling - Loose asphalt
AS 2891.1.2	Sampling - Coring method
AS 2891.3.1	Bitumen content and aggregate grading - Reflux method
AS 2891.7.1	Determination of maximum density of asphalt - Water displacement method
AS 2891.7.3	Determination of maximum density of asphalt - Methylated spirit displacement
AS 2891.8	Voids and density relationships for compacted asphalt mixes
AS 2891.9.2	Determination of bulk density of compacted asphalt - Presaturation method
AS 2891.13.1	Determination of the resilient modulus of asphalt - Indirect tensile method
AS 2891.14.2	Determination of field density of compacted asphalt using nuclear thin-layer density gauge
AS 2891.14.3	Calibration of nuclear thin-layer density gauge using standard blocks

Austrroads Test Methods and Guides

AG:PT/T231	Deformation resistance of asphalt mixtures by the wheel tracking test
AG:PT/T233	Fatigue life of compacted bituminous mixes subject to repeated flexural bending
AG:PT/T237	Binder film index

AAPA Guides

Advisory Note 7	Guide to the Selection, Heating and Storage of Binders for Sprayed Sealing and Hot Mixed Asphalt
IG-3	Asphalt Plant Process Control Guide