PART R27

SUPPLY OF ASPHALT

CONTENTS

1. GENERAL

.1 This Part specifies the requirements for the supply of Hot Mix Asphalt (HMA), with and without an Additive, and Warm Mix Asphalt (WMA) including the design and manufacture of the following:

(a) Coarse Dense Mix Asphalt (AC10, AC14 & AC20);

(b) Fine Dense Mix Asphalt (FineAC7, FineAC10 & FineAC14);

(c) Open Graded Asphalt (OG10 & OG14); and

(d) Stone Mastic Asphalt (SMA7 & SMA10).

.2 In the event of any inconsistency, ambiguity or discrepancy between any of the Contract Documents, the following order of precedence will apply:

1. This Part
2. Austroads Guide to Pavement Technology Part 4B “Asphalt”
3. AS2150 “Hot Mix Asphalt - A Guide to Good Practice”
4. Industry documentation.

.3 The following definitions apply to this Contract:

"AAPA" means Australian Asphalt Pavement Association.

“Additive” means an organic, chemical, or emulsion product used to assist in the compaction of asphalt.

“AS 2150” Australian Standard: Hot Mix Asphalt-A Guide to Good Practice

“Austroads 4B” Guide to Pavement Technology Part 4B Asphalt.

"Asphalt Mix Design Assessment" is a documented assessment of a submitted asphalt mix design with an Asphalt Mix Register Number provided by DPTI.

"Asphalt Mix Register Number" is a mix approval number provided by DPTI to an accepted nominated mix. All mixes are placed on DPTI’s Asphalt Mix Register and monitored by DPTI.

"Coarse Asphalt Mix" (AC) means asphalt of a coarse nature suitable for Medium, Heavy and Very Heavy Duty applications unless used in Fine Asphalt Mix applications or expressly noted otherwise.

"Fine Asphalt Mix" (FineAC) means asphalt of a fine nature suitable for Light to Medium Duty applications and suitable for DPTI patch maintenance, bikeways, footpaths, car parks and Local Government residential streets.

“Hot Mix Asphalt” (HMA) means an Asphalt Mix manufactured and compacted at standard temperatures. It may also mean Hot Mix Asphalt manufactured at standard temperatures but with the addition of an “Additive” to assist in meeting compaction requirements.

"Nominated Mix" means an asphalt mix design proposed by the Contractor.

"Nominated Combined Aggregate Grading" means the Contractor's target design gradings for the Nominated Mix.

"Nominated Binder Content" means the Contractor's target design binder content for the Nominated Mix.

"Process Control" means a controlled documented system of practices and procedures used to monitor and control the product inputs, equipment and manufacturing processes to ensure the product replicates the product design.

"**Production Mix**" means manufactured product at an asphalt plant.

"RAP" means Reclaimed Asphalt Pavement.

"SDS" means Safety Data Sheets.

"Special Process" means the Contractor's documented and demonstrated techniques to achieve the requirements of this Part.

"Warm Mix Asphalt" (WMA) means Hot Mix Asphalt manufactured and compacted at lower temperatures with the addition of an "Additive" or by using the foaming technique.

2. QUALITY REQUIREMENTS

Process Control

.1 The Contractor must develop and implement a Process Control System. The following requirements must be submitted to DPTI for the asphalt plant to obtain approved process control:

(a) Monthly RAP & Asphalt Production test results in electronic spreadsheet format;

(b) Audit Samples;

(c) Monthly process control charts and invitation to process control meeting; and

(d) Monthly asphalt plant computing data outputs to match with samples being taken.

Quality Plan, Procedures and Documentation

.2 Further to the requirements of Part G20 "Quality System Requirements", the Contractor must prepare and implement a Quality Plan that at a minimum, includes detailed procedures and documentation for:

(a) Mix Design

(b) Manufacture of Mixes

(i) The asphalt production plant, including company brand, mixing type, capacity, year of manufacturing, functionalities, special abilities, silos, computer control system and production history.

(ii) The laboratory NATA Accreditation certificate, approved tests, and calibration schedule.

(iii) Process control requirements, which include a description of the flow of materials and the processes carried out on them from input materials to the plant through to delivery of asphalt to the customer. It must incorporate a flow diagram and identification of the key elements of the manufacturing process requiring monitoring, measurement or verification.

(iv) Control of aggregates transferred from quarry stockpiles and delivered to an asphalt plant.

(v) Control of Reclaimed Asphalt Pavement (RAP) transferred from stockpiles and delivered to an asphalt plant.

(vi) Requirements for labelling of storage bays and silos and bituminous tanks.

(vii) Requirements for heating, temperature control and insulation of tanks.

(viii) Requirements for controlling delivery of binders into the correct tanks.

(ix) Control requirements for binders, foam, additives, admixtures, fillers and reclaimed asphalt.

(x) Plant calibration and maintenance.

(xi) Description of the characteristics of any hot storage system and define its mode of operation.

(xii) Handling, storage and delivery of asphalt mixture to ensure the minimum of segregation, degradation or binder drain down and that the asphalt remains within the specified temperature range.

(c) Inspection and Test Requirements

(i) An Inspection and Test Plan, vide Clause G20.7 "Inspection and Testing", which includes a schedule for monitoring and measuring the performance of the process (as identified in the key process element identification) and products. At a minimum, it must meet the requirements of Clauses R27.6 and R27.7 and Attachment R27A.

(ii) Constant monitoring and statistical analysis of records to verify process capability and product characteristics.

(iii) A Calibration Schedule, which includes daily visual inspection of all equipment and calibration of weighting equipment, admixture dispensers, flow meters, batching or proportioning systems and temperature monitoring equipment (vide Clause G20.7.4 "Inspection, Measuring and Test Equipment"). At a minimum, it must meet the requirements of Attachment R27A.

.3 If not provided previously the procedures and documentation must be submitted at least 10 days prior to the commencement of supply.

.4 Provision of the procedures and documentation listed in this Clause shall constitute a **HOLD POINT**.

.5 The Contractor must use test procedures in accordance with Table 10 “Test Procedures” (refer http://www.dpti.sa.gov.au/materials_technology_documents/test_procedures2) to verify conformance with this Part.

3. MATERIALS

Quality of Materials

.1 Materials must comply with the following:

Binder, Flux and Cutter	Part R25 "Supply of Bituminous Materials"
Aggregate, Sand a Mineral Filler	Part R15 "Supply of Pavement Materials”
Tack Coat	AS 1160 "Bitumen Emulsions for Construction and Maintenance of Pavements"
	AS 2157 "Cutback Bitumen"
Hydrated Lime Fil	AS 1672.1 "Limes for Building".
Rejuvenating Age	Rejuvenating agent must comply with recognised standards for such materials. Diesel is not considered a suitable rejuvenating agent. Rejuvenation agent must be fully disclosed for mix assessment includ submission of Safety Data Sheets.

Reclaimed Asphalt Pavement Material

.2 Reclaimed asphalt pavement material (RAP) must be obtained from milling or excavation of existing asphalt pavements or asphalt plant waste.

.3 For the use of RAP within asphalt mixes the Contractor’s Quality Plan must include a Reclaimed Asphalt Pavement Management Plan and Industry Code of Practice meeting the following minimum requirements:

(a) RAP must be crushed and screened as necessary to ensure a maximum size no greater than the maximum size of asphalt being produced and to achieve a reasonably well graded, free flowing, and consistent product.

(b) The processed RAP of each size must be placed in separate stockpiles not exceeding 1000 tonne and represent a Lot. Each Lot must be tested for binder content, gradings, viscosity and moisture content at a minimum of one per lot. Test results must be traceable to the asphalt mix containing the RAP.

(c) RAP that has been stockpiled for some time and has bound together in some way must be reprocessed, to ensure that it is in a free flowing state at the time of use.

.4 A minimum of one kilogram sample per lot must be provided to the DPTI for auditing.

4. MIX REQUIREMENTS

.1 Mix requirements must comply with the requirements of the latest edition of AUSTROADS 4B, except as varied below.

Nominated Mixes

.2 All submissions of nominated mixes must be in accordance with Attachment R27B “Assessment and Registration of Asphalt Mix Designs”.

.3 The Contractor must submit to DPTI details of each asphalt mix proposed, together with a Certificate from a laboratory with appropriate NATA registration, stating that each asphalt mix and its constituents meet the requirements of this Part at least:

(a) 10 working days for new mix designs; or

(b) 5 working days for revised mixes before commencing production of asphalt.

.4 Submission of the details of nominated mixes and Certificate(s) shall constitute a **HOLD POINT**.

Compliance with Nominated Mixes

.5 If the Contractor has previously submitted the nominated mix to DPTI, and has a current Asphalt Mix Register Number and the mix has not been varied in accordance with Clause 4.1.3 "Variations to Nominated Mixes", the following must be submitted:

(a) Description of the Job Mix Formula (JMF); and

(b) A copy of the latest Asphalt Mix Design Assessment.

.6 Submission of the above information shall constitute a **HOLD POINT**.

.7 The Contractor must monitor the production results of all its registered mixes, and must submit a summary of previous mix production data for the submitted mix and to include:

(a) Plot of voids verses binder content, max density verses binder content;

(b) Summary sheet of JMF data in an electronic spreadsheet format;

(c) Process control plots of binder content, max density, production voids & in-situ voids; and

(d) Summary of associated non-conformances and dispositions.

.8 Where the analysis of the production test data shows that the Design Air Voids Target requires a different binder content to the nominated binder content, an alternative mix design must be submitted.

Variations to Nominated Mixes

.9 The Contractor must submit a new nominated mix in compliance with Clause 4.1.1 “General" if:

(a) The Contractor proposes to vary the proportions of the constituents in a nominated mix; or

(b) The Contractor proposes to change the source of supply of any constituent; or

(c) The Asphalt Mix Register Number is withdrawn by DPTI.

Mobile Plants

.10 The Contractor must submit the asphalt mix history (including mix production data) and details of the nominated mobile plant in accordance Clause 2 “Quality Requirements”.

.11 Plant settings and mix design parameters must be met before proceeding with the permanent works and shall constitute a **HOLD POINT**.

.12 A proposal to use plant fuel other than liquefied petroleum gas (LPG), liquefied natural gas (LNG), petrol or diesel shall constitute a **HOLD POINT**.

Wearing Course

.13 Asphalt Binder and Mix types for wearing course must comply with the following:

(a) Coarse Dense Mixes must be modified binders using A15E, A35P, A40P or A5E.

(b) Open Graded Mix (OG) must be modified binders using A15E.

(c) Stone Mastic Asphalt (SMA) must be modified binders using A15E or A5E.

(d) Fine Dense Mixes must be Class C170 binder for light duty. Class C320 may also be used for light duty pavements subject to approval.

.14 All wearing course layers must contain at least 1% added hydrated lime. A levelling course that is trafficked more than 30 days is deemed to be a wearing course.

.15 Design of asphalt mixes must also meet the requirements of Part R35 “Surface Characteristics”.

Coarse Dense Mix Asphalt

.16 Mix properties for the design and production control of coarse dense mix asphalt excluding RAP must meet the requirements of Table 4.3(a) "Mix Properties of Coarse Dense Mix Asphalt" & Table 4.3(b) "Mix Properties of High Flexural-Modulus Coarse Dense Mix Asphalt". The grading envelopes must meet the requirements of Table 4.3(c) "Mix Grading Envelopes" and production tolerances on grading and binder content must comply with Table 11 in AS 2150.

TABLE 4.3(a) - MIX PROPERTIES OF COARSE DENSE MIX ASPHALT

CHARACTERISTIC		GYRATORY CYCLE No.	AC10	AC14	AC20	AC14HB
Nominal Mix Sieve Size (mm)			9.5	13.2	19	13.2
Design & Production Air Voids Target (%)	Medium Duty (MD)	80	4.0	4.0	4.0	2.5
	Heavy Duty (HD)	120	4.0	4.0	-	-
Production Air Voids Tolerance (%)			Target ± 1.5	Target ± 1.5	Target ± 1.5	Target ± 1.5
Binder Film Index (BFI) (µm) - Minimum	Medium Duty	80	8.5	8.5	8.5	10.0
	Heavy Duty	120	8.0	8.0	-	-
Indirect Tensile Strength (ITS) (kPa)			Report Only	Report Only	Report Only	Report Only

TABLE 4.3(b) - MIX PROPERTIES OF HIGH FLEXURAL-MODULUS COARSE DENSE ASPHALT

CHARACTERISTIC		GYRATORY CYCLE No.	AC10 A5E
Nominal Mix Sieve Size (mm)			9.5
Design & Production Air Voids Target (%)	Light Duty (LD)	50	4.0
	Medium Duty (MD)	80	4.0
Production Air Voids Tolerance (%)			Target ± 1.5
Binder Film Index (BFI) (µm) - Minimum	Light Duty	50	9.5
	Medium Duty	80	8.5
Indirect Tensile Strength (ITS) (kPa)			Report Only

TABLE 4.3(c) - COARSE DENSE MIX GRADING ENVELOPES[(1)]

SIEVE	AC10		AC14 and AC14HB		AC20	
26.5					100	100
19			100	100	92	80
13.2	100	100	92	80	82	66
9.5	92	80	83	67	70	53
6.7	82	66	70	54	60	43
4.75	70	52	60	43	51	34
2.36	48	34	42	28	36	23
1.18	34	21	30	19	27	14

0.6	24	14	21	12	19	10
0.3	17	8	16	7	14	6
0.15	11	5	10	6	9	5
0.075	7	4	6	3	6	3

(1) Aggregate gradings with percentage passing sieve size (mm), in accordance with AS 1152.

Fine Dense Mix Asphalt

.17 Mix properties for design and production control of fine dense mix asphalt excluding RAP must meet the requirements of Table 4.4(a) "Mix Properties of Fine Dense Mix Asphalt". The grading envelopes must meet the requirements of Table 4.4(b) "Mix Grading Envelopes of Fine Dense Mix Asphalt" and production tolerances on grading and binder content must comply with Table 11 in AS 2150.

TABLE 4.4(a) - MIX PROPERTIES OF FINE DENSE MIX ASPHALT		
CHARACTERISTIC	**FineAC7**	**FineAC10**
Light Duty Design (Gyratory Cycles)	50 cycles	50 cycles
Nominal Mix Sieve Size (mm)	6.7	9.5
Minimum Binder Content (%)	6.0	5.7
Design & Production Air Voids Target (%)	4.0	4.0
Production Air Voids Tolerance (%)	Target ± 1.5	Target ± 1.5
Target In-situ Voids (%) (refer to Spec R28)	2.0 – 5.0	2.5 – 6.0
Binder Film Index (µm) Minimum	8.0	8.0

TABLE 4.4(b) - MIX GRADING ENVELOPES OF FINE DENSE MIX ASPHALT(1)				
SIEVE (mm)	**FineAC7**		**FineAC10**	
13.2				100
9.5		100	100	90
6.7	100	90	90	75
4.75	90	75	77	63
2.36	65	51	56	43
1.18	47	35	41	30
0.6	33	23	29	20
0.3	22	15	20	13
0.15	14	9	13	8
0.075	8	5	8	5

(1) Aggregate gradings with percentage passing sieve size (mm), in accordance with AS 1152.

Coarse / Fine Dense Mix Asphalt Including RAP

.18 In addition to the requirements of this clause, Dense Mix Asphalt incorporating Reclaimed Asphalt Pavement must meet the design requirements of Clause 4.3 "Coarse Dense Mix Asphalt" or Clause 4.4 "Fine Dense Mix Asphalt" and the following:

(a) For wearing course mixes, the proportion of RAP in the total mix must not exceed 10% for “Coarse Dense Mix Asphalt” and 20% for “Fine Dense Mix Asphalt”;

(b) For asphalt mixes with 10% RAP or less added, no added binder or rejuvenation is required;

(c) For levelling, intermediate and base course mixes, the proportion of RAP in the total mix must not exceed 50%; excepted for asphalt mixes using polymer modified binders (PMB) must not exceed 20%;

(d) For asphalt mixes with 10% or greater (5% increments) RAP content in the total mix, the actual percentage added must be approved by DPTI; and

(e) For asphalt mixes with higher than 10% RAP incorporation must use the following additional design components of binder rejuvenation:

(i) Extract RAP Binder to determine binder content and viscosity.

(ii) The Resilient Modulus of RAP Mixes to be the same as equivalent Virgin Mixes in accordance with Table 27B(b). Testing frequency is one test (a pair of production pat per sample) per 10 production samples per mix.

(iii) Regular Indirect Tensile Strength (ITS) testing (on a daily production basis) to confirm strength equivalence to mix without addition of RAP as noted on Asphalt Mix Design Assessment.

(iv) Rejuvenating Agent must be a softer grade bitumen and low volatility oil (if required) capable of combining with bitumen to counteract hardening and produce a lower viscosity grade of binder.

Open Graded Asphalt

.19 The following applies to Open Graded Asphalt (OG):

(a) mix properties for the design and production control must comply with Table 4.6(a) "Mix Properties of Open Graded Asphalt";

(b) the grading envelopes must comply with Table 4.6(b) "Mix Grading Envelopes";

(c) production tolerances on grading and binder content must comply with Table 11 in AS 2150;

(d) the design and production must be to Medium Duty category (80 gyratory cycles);

(e) cellulose fibres may be added to reduce binder drain down; and

(f) RAP content is not permitted.

TABLE 4.6(a) - MIX PROPERTIES OF OPEN GRADED ASPHALT

CHARACTERISTIC	OG10	OG14
Nominal Mix Sieve Size (mm)	9.5	13.2
Hydrated Lime (%) - Minimum	1.0	1.0
Design Air Voids Target (%)	20	20
Production Air Voids Tolerance (%)	18 – 23	18 – 23
Binder Content Target (% by mass)	5.6	5.3

TABLE 4.6(b) - MIX GRADING ENVELOPES (1) ~~(2)~~

SIEVE (mm)	OG10		OG14	
19			100	100
13.2	100	100	100	85
9.5	100	85	70	45
6.7	65	35	45	25
4.75	45	20	25	10
2.36	20	10	15	7
1.18	14	6	12	6
0.6	10	5	10	5
0.3	8	4	8	4
0.15	7	3	7	3
0.075	5	2	5	2

(1) Aggregate gradings with percentage passing sieve size (mm), in accordance with AS 1152.

Stone Mastic Asphalt

.20 The following applies to Stone Mastic Asphalt (SMA):

(a) mix properties for the design and production control must meet the requirements of Table 4.7(a) "Mix Properties of Stone Mastic Asphalt";

(b) the grading envelopes must meet the requirements of Table 4.7(b) "Mix Grading Envelopes";

(c) production tolerances on grading and binder content must comply with Table 11 in AS 2150;

(d) the design and production must be to Medium Duty category (80 gyratory cycles);

(e) minimum of 0.3% (by mass) cellulose fibre to reduce binder drain down must be added and the nominated mix submission must include details of the filler, fibre type and source; and

(f) RAP content is not permitted.

TABLE 4.7(a) - MIX PROPERTIES OF STONE MASTIC ASPHALT		
CHARACTERISTIC	**SMA7**	**SMA10**
Nominal Mix Sieve Size (mm)	6.7	9.5
Hydrated Lime (%) - Minimum	1.0	1.0
Design Air Voids Target (%)	3.5	3.5
Production Air Voids Tolerance (%)	3.0 – 5.0	3.0 – 5.0
Binder Content Target (% by mass)	7.0	6.5
Binder Film Index (BFI) (µm) - Minimum	-	9.5
Indirect Tensile Strength (ITS) (kPa)	Report Only	Report Only

TABLE 4.7(b) - MIX GRADING ENVELOPES [(1)]				
SIEVE (mm)	**SMA7**		**SMA10**	
13.2				100
9.5		100	100	90
6.7	100	85	55	30
4.75	62	30	40	20
2.36	35	20	28	15
1.18	28	16	24	13
0.6	24	14	21	12
0.3	20	12	18	10
0.15	16	10	14	9
0.075	12	8	12	8

(1) Aggregate gradings with percentage passing sieve size (mm), in accordance with AS 1152.

Job Mix Formula

.21 The nominated mix will be assessed by DPTI for compliance with the requirements of this Part. An Asphalt Mix Design Assessment will be supplied to the Contractor and will incorporate:

(a) Mix Register Number.

(b) Production grading tolerances.

(c) A "Job Mix Formula" (JMF) comprising of Combined Grading, Binder Content, Max Density, Bulk Density, Design Target Air Voids, Binder Film Thickness, RAP Percentage, Indirect Tensile Strength & Resilient Modulus.

5. MANUFACTURE OF MIXES

General

.1 Mixes must be manufactured to replicate the JMF in accordance with AS 2150, Clause 7 "Manufacturing and Storage of Mix".

.2 Mixes must not exhibit drainage of the binder and/or contain less than 95% of aggregate particles that are not fully coated with binder as determined by AS 2891.11.

.3 Asphalt must be manufactured so that its properties comply with the requirements specified in Clause 12 "Verification Requirements and Records".

Manufacturing Controls

.4 Plant temperatures and mixing times must be maintained in a range sufficient to ensure a homogenous mix without causing deleterious effects to the binder through overheating and within the manufacturer's specifications as detailed in AAPA Advisory Note 7. The binder temperature used for storage/transport must not exceed the values shown against the binder class indicated in Table 5.2.

TABLE 5.2 - MAXIMUM BINDER TEMPERATURE	
BINDER CLASS	**MAX. TEMPERATURE(ºC)**
170	180
320	185
600	195

.5 The above maxima may be increased by up to 10ºC when additives such as polymers or scrap rubber are incorporated in the binder.

.6 Spray temperature of the binder into a pugmill type environment must be such as to minimise oxidation or drainage of the binder.

.7 The temperature of the mix delivered into each truck must be recorded on the weighnote.

Manufacture of Mixes Including RAP

.8 In batch mixing plants, the RAP must be either:

(a) metered into the asphalt plant after heating and drying of aggregates;

(b) added directly to the weigh hopper with other aggregate materials, for each batch; or

(c) weighed separately and added direct to the pugmill.

.9 If necessary, batch mixing time must be increased to ensure adequate heat transfer and dispersion of RAP. In drum mixing plants, RAP must be protected from excessive temperatures by a combination of entry point to drum and shielding from direct flame contact.

Manufacture of Asphalt with Additive or Foaming Technique

.10 Subject to prior approval, the Contractor may use an additive or foaming technique:

(a) to manufacture at standard temperatures but air and pavement placement temperatures are reduced in Clause R28.(HMA),

(b) to manufacture at standard temperatures but time until placement is extended and mix placement temperature reduced (HMA), or

(c) to manufacture asphalt at lower temperatures (WMA).

.11 Where placement temperature is reduced, compaction requirements must still be in accordance with Part R28 “Construction of Asphalt Pavements”.

.12 The Contractor must provide the testing temperature of gyratory compaction when additives or foaming technique are used in accordance AS2891.2.2:2014.

.13 The propriety product of the additive used must be fully disclosed in accordance with Clause 4.1 “Nominated Mixes”.

6. PRODUCTION SAMPLING AND TESTING

General

.1 The Contractor must conduct sampling and testing of asphalt and binder for control and verification purposes during manufacture. Minimum sampling and testing frequency for each mix type in a 24 hour period must be as shown in Table 6.1.

TABLE 6.1 - ASPHALT SAMPLING AND TESTING FREQUENCY			
Sampling & Testing Frequency	**Fixed Asphalt Plant and approved(1) Process Control (tonne)**	**Fixed Asphalt Plant without approved(1) Process Control (tonne)**	**Mobile Asphalt Plant (tonne)**
1	30 - 150	30 - 100	0 - 30
2	151 - 400	101 - 250	31 - 100
3	Additional sample/test each 300 tonne > 400	251 - 400	101 - 250
4		Additional sample/test each 300 tonne > 400	251 - 400
5			Additional sample/test each 300 tonne > 400

(1) As documented in Asphalt Mix Design Assessment

.2 For Fine Dense Mixes meeting the requirements in this Part, sample rate is one per lot (a lot defined as a day's production).

.3 For Coarse Dense Mixes, Stone Mastic Asphalt & Open Graded Asphalt meeting the requirements of this Part, sample rate is in accordance Table 6.1 "Asphalt Sampling and Testing Frequency".

.4 The following tests & calculations must be performed and reported on each production sample:

(a) Combined Grading;

(b) Binder Content;

(c) Maximum Density;

(d) Bulk Density;

(e) Air Voids;

(f) Indirect Tensile Strength (ITS) (one test per mix per day only); and

(g) Binder Film Index (BFI).

.5 Test results and calculations of production mix must be supplied to the Principal within 24 hours.

Audit Samples

.6 The Contractor must provide audit samples using DPTI's random selection template for product auditing purposes in accordance MAT-PC063 "Random Sample Template" for the following:

Asphalt

From each production mix sample, the Contractor must provide a single sample (6L tin) of a minimum 11kg asphalt for retention by DPTI. These samples may be used for product auditing purposes.

The Contractor must submit asphalt audit samples using Random Sample Template (selection rate of 1 in 1).

Residual Bitumen

The Contractor must provide one sample per type per delivery (minimum of 1 litre) for product auditing purposes. Audit samples are not required where a DPTI arrangement exists.

Polymer Modified Binder

The Contractor must provide one sample per type per delivery (minimum of 1 litre) for product auditing purposes.

.7 All samples must be delivered to DPTI's Materials Laboratory at 19 Bridge Road, Walkley Heights at a minimum monthly intervals or as requested by the Principal. The Contractor may dispose remaining random asphalt samples after a minimum of 30 days.

.8 All samples must be a minimum of 11 kg and clearly labeled on the side of the container in clear indelible ink or paper sticker and must include: materials, mix type, sample number, date of sampling and asphalt mix design register number and project.

.9 The samples will be stored at DPTI's expense. The Contractor must provide documentation to confirm that the samples have been received at DPTI's Laboratory, and submit this as part of the Lot package. All samples must be clearly marked and traceable to the relevant Lot in accordance with Part G20 "Quality System Requirements".

7. PROPERTY VARIATIONS OF PRODUCTION ASPHALT

.1 In replicating the JMF properties, production mix variations must not exceed the limits shown in Table 11 of AS 2150.

.2 Variations of the Production Air Voids from the Design Air Voids Targets must not exceed the Limits of Production Air Voids Tolerance in:

(a) Table 4.3(a) "Mix Properties of Dense Mix Asphalt";

(b) Table 4.4(a) "Mix Properties of Fine Dense Mix Asphalt";

(c) Table 4.6(a) "Mix Properties of Open Graded Asphalt; and

(d) Table 4.7(a) "Mix Properties of Stone Mastic Asphalt".

.3 The Contractor must ensure that the moisture content of production asphalt is less than 0.2%.

8. STORAGE OF ASPHALT

.1 Asphalt must be stored in accordance with AS 2150, Section 7.5 "Storage of Mix".

9. DELIVERY OF MIX

.1 Mix must be transported to site in a manner which does not result in a deterioration of the properties of the mix or contamination of the mix. The Contractor must ensure that transport operations are arranged in a manner which ensures continuous placing of asphalt. If haulage distance is measured for the purpose of payment, the haulage distance must be calculated from the Nominated Asphalt Plant which is closest to the work site, regardless of whether it is sourced from any other plant for any reason (including breakdown). The haulage distance includes the loaded trip only and excludes the return trip.

10. TEST PROCEDURES

.1 The Contractor must use the following test procedures (refer http://www.dpti.sa.gov.au/contractor_documents) to verify conformance with the Specification:

TEST	TEST PROCEDURE
Sampling of Raw Materials:	
• Aggregates & Processed RAP	TP 226
• Bitumen & Polymer Modified Binder	AS 2008
• Mineral Filler	TP 226
Sampling of Asphalt	TP 425
Compaction of Asphalt Test Specimens using a Gyratory Compactor	TP 428
Determination of the Maximum Density of Asphalt - Water Displacement Method (Duplicate sample testing not required)	AS 2891.7.1
Bulk Density of Compacted Asphalt Specimens:	
• Presaturation Method for Dense Graded and SMA	AS 2891.9.2
• Mensuration Method for Open Graded	AS 2891.9.3
Measurement of Thickness or Height of Compacted Asphalt	ASTM D3549
Voids - Calculation	AS 2891.8
Binder Film Index - Calculation	AS 2891.8

TEST	TEST PROCEDURE
Binder Content: - Pressure Filtration Method - Ignition Oven Method	AS 2891.3.3 TP 473
Stripping Potential of Asphalt – Tensile Strength Ratio (TSR)	AGPT/T232
Static Indirect Tensile Test (ITS)	TP 460
Extractions of Bituminous Binder from Asphalt	AGPT/T191
Design of Bituminous Binder Blends to a Specified Viscosity Value	AGPT/T193
Characterisation of the Viscosity of RAP Binder using the Shear Rheometer (DSR) Asphalt Binder Viscosity	AGPT/T192 TP 664
Asphalt Particle Loss	AGPT/T236
Asphalt Binder Drain-Off	AGPT/T235
Particle Size Distribution by Dry Sieving	AS 1141.11
Voids in Dry Compacted Fillers	AS 1141.17
Moisture Content	AS 2891.10
Specific Surface	AS 2350.8
Loss on Ignition	AS 3583.3
Water Soluble Fraction of Filler	AS 1141.8
Deformation Resistance of Asphalt Mixtures by the Wheel Tracking test	AGPT/T231
Fatigue Fife of Compacted Bituminous Mixes Subject to Repeated Flexural Bending	TP477
Determination of the Resilient Modulus of Asphalt – Indirect Tensile Method	AS2891.13.1

11. HOLD POINTS

.1 The following is a summary of Hold Points referenced in this Part:

CLAUSE REF.	HOLD POINT	RESPONSE TIME
2.0	Submission of Quality Plan (if not provided previously)	20 working days
4.4	Submission of the details of Nominated Mixes and Certificate(s)	20 working days
4.16	Submission of Job Mix Formula	15 working days
4.11	Submission of Trial mix data from a mobile plant	As required

12. VERIFICATION REQUIREMENTS AND RECORDS

Test Records & Verification for Asphalt Mix Design Initial Assessment

.1 The Contractor must undertake the testing specified in this Part & Table R27B(d) and must supply written evidence of compliance.

Test Records & Verification for Plant Production

.2 The Contractor must undertake the testing specified in this Part and Table 12.2 this Clause and must supply written evidence of compliance within the Lot Package.

.3

TABLE 12.2 - PLANT PRODUCTION TESTING					
CLAUSE REF.	**SUBJECT**	**PROPERTY**	**TEST PROCEDURE**	**TEST FREQUENCY**	**ACCEPTANCE LIMITS**
5.2	Manufacturing Controls	Temperature at manufacture	Thermometer reading or infrared gun	Each truckload	Refer Clause 5.2 "Manufacturing Controls"
6.0	Production Sampling & Testing	Binder Content & Combined Grading	AS 2891.3.3	Refer Clause 6.1	Refer Clause 4.3, 4.4, 4.6 & 4.7 and Asphalt Mix Design Assessment
		Bulk Density	AS 2891.9.2 AS 2891.9.3	Refer Clause 6.1	Report Only
		Absorption of Compacted Specimens	AS 2891.9.2	Refer Clause 6.1	≤ 2.0% for AC20 ≤ 1.0% for SMA
		Maximum Density	AS 2891.7.1	Refer Clause 6.1	Report Only
		Voids on Compacted Specimens	AS 2891.8	Refer Clause 6.1	Refer Clause 4.3, 4.4, 4.6 & 4.7 and Asphalt Mix Design Assessment
		Binder Film Index (BFI) (1)	AS 2891.8	Refer Clause 6.1	Refer Clause 4.3, 4.4 & 4.7
		Indirect Tensile Strength (ITS)	TP 460	Refer Clause 6.1	Refer Clause 4.3

(1) Absorption for RAP component assumed to be zero.

ATTACHMENT R27A

ASPHALT INSPECTION TEST AND VERIFICATION

TABLE R27A(a) - PLANT INSPECTION SCHEDULE			
CONTROL AREA	**INSPECTION/TEST**	**PURPOSE**	**FREQUENCY**
Cold feed bins	As set out in quality plan	To ensure correct feeding of plant	a) On installation. b) As set out in quality plan.
Dryer Drum	As set out in quality plan	To ensure correct heating and drying of aggregates	As set out in quality plan
Hot feed bins	As set out in quality plan	To ensure correct batching	As set out in quality plan
Binder	Tank temperature Penetration or softening point	To check storage temperature To check for binder hardening(1)	a) Daily b) In case of doubt
Additive Silos	As set out in quality plan	To ensure correct feed rates for additives	As set out in quality plan
Mixed asphalt	Temperature	To ensure temperature conforms	a) Every batch or continuously

(1) Binder can harden during storage, particularly when circulated. The quality plan should state the 'safe' storage period for binder in its tank configuration and require testing if that period is exceeded without fresh deliveries. In the absence of other information, a period of two weeks should be adopted

TABLE R27A(b) - INSPECTION AND TEST FREQUENCIES FOR ADDITIVES(2)		
INSPECTION/TEST	**PURPOSE**	**FREQUENCY**
Appropriate tests to determine intrinsic properties	To confirm characteristics of product or check compliance with specification	a) Source approval prior to initial use b) As stated in the quality plan
Inspection of delivery ticket	To check that consignment is as ordered and from the correct source	Each delivery
Organoleptic check of consignment	For comparison with normal appearance	Each delivery, if practicable; otherwise in accordance with quality plan

(2) This table may include the results of tests and inspections by the additive supplier as part of the Process Control System

TABLE R27A(c) - INSPECTION/TEST FREQUENCIES FOR ASPHALT TO BE DELIVERED		
PRODUCT INSPECTION/TEST	**PURPOSE**	**FREQUENCY**
Organoleptic check on mixed asphalt	For comparison with normal appearance with respect to grading, evenness of mixing and adequacy of coating	Every load
Temperature	To ensure material conforms with Clause 5 or other requirements	a) As required under Process Control b) Whenever samples are taken
Grading, Binder Content, Voids, Maximum Density and Binder Film Index	To ensure material conforms to Clause 4	

TABLE R27A(c) - INSPECTION/TEST FREQUENCIES FOR ASPHALT TO BE DELIVERED		
PRODUCT INSPECTION/TEST	**PURPOSE**	**FREQUENCY**
Other design characteristics	To assess conformity	As detailed in quality plan
Suitability of delivery vehicles by visual assessment	To check adequacy of insulation	Prior to first use and in case of doubt
Cleanliness of delivery vehicles by visual assessment	To avoid contamination	Every load prior to loading1

TABLE R27A(d) - PLANT CALIBRATION REQUIREMENTS			
ITEM OF PLANT	**INSPECTION/TEST**	**PURPOSE**	**MINIMUM FREQUENCY**
Weighing equipment	Visual inspection	To ascertain that weighing equipment is functioning correctly	Daily
	Testing of weighing accuracy	To ensure accuracy within quality plan requirements	a) On installation (3) b) Annually c) In case of doubt
Admixture dispensers	Organoleptic inspection	To ascertain that the dispenser is functioning correctly	First batch of the day containing admixture
	Test for accuracy	To ensure accuracy within quality plan requirements	a) On installation (3) b) Annually c) In case of doubt
Flow meters	Comparison of the actual amount with the metered amount by reconciliation	To ensure accuracy within quality plan requirements	a) On installation (3) b) Annually c) In case of doubt
Batching system (on batch plants)	Comparison of actual mass of constituents in the batch with the intended mass using the method prescribed in the quality plan	To ascertain the batching accuracy in accordance with the quality plan	a) On installation (3) b) Annually c) In case of doubt
Proportioning system (on continuous plants)	Comparison of actual mass in a measured period of time with the intended mass using the method prescribed in the quality plan	To ascertain the accuracy in accordance with the quality plan	a) On installation (3) b) Annually c) In case of doubt
Temperature Monitoring equipment	Visual	To ascertain the equipment is functioning correctly	Daily
	Test of accuracy	To ensure correct temperatures are recorded	a) On installation(3) b) Annually c) In case of doubt

(3) or after comprehensive repair.

ATTACHMENT R27B

ASSESSMENT AND REGISTRATION OF ASPHALT MIX DESIGNS

1. SUBMISSION

The Contractor must submit the mix design together with supporting documentary evidence and laboratory and plant test results for mix and material properties to DPTI.

The following details of Nominated Mix (NM) must be submitted:

(a) Constituent materials:

(i) Aggregates - source, geological type,

(ii) Added Mineral Filler - type, source

(iii) Binder - source, class or grade,

(iv) Bitumen Adhesion Agent - name, type, source, SDS,

(v) Relevant test results verifying material properties for the above mentioned materials.

(b) Mix Design:

(i) Design mix maximum density.

(ii) Nominated combined aggregate grading and binder content.

(iii) Test results of the properties in tables of Clause 4 – "Mix Requirements" of each nominated mix.

(iv) Details of mixing plant location, description capacity, history and any relevant information in accordance Clause 2 "Quality Requirements".

(c) Test Results of representative material of each nominated mix produced by the mixing plant from which the asphalt is to be supplied.

(d) Manufacturer's instructions of any additive including submission of SDS.

TABLE R27B(a) - NOMINATED MIXES - TESTING REQUIREMENTS

CHARACTERISTIC (1)	FineAC7	FineAC10	AC10	SMA7	SMA10	AC14	OG10	OG14	AC20
Gyropac Gyratory Compaction									
Raw Aggregate Grading –Individual Sizes (%)	YES	YES	YES	YES	YES	YES	YES	YES	YES
Total Aggregates, Sand & Fillers Absorption (%)	YES	YES	YES	YES	YES	YES	YES	YES	YES
Mix Design Proportions	YES	YES	YES	YES	YES	YES	YES	YES	YES
Combined Gradings (%)	YES	YES	YES	YES	YES	YES	YES	YES	YES
Maximum Density (t/m3)	YES	YES	YES	YES	YES	YES	YES	YES	YES
Voids (%)	YES	YES	YES	YES	YES	YES	YES	YES	YES
Binder Content (%)	YES	YES	YES	YES	YES	YES	YES	YES	YES
Binder Film Thickness (BFT) (µm)	YES	YES	YES	YES	YES	YES	NO	NO	YES
Indirect Tensile Strength (ITS) (kPa)	YES	YES	YES	YES	YES	YES	YES	YES	YES
Tensile Strength Ratio (TSR) (3) (%)	YES	YES	YES	NO	NO	YES	NO	NO	YES
RAP (%) and Viscosity Treatments	YES	YES	YES	NO	NO	YES	NO	NO	YES
Viscosity (pa.s) (2)	YES	YES	YES	NO	NO	YES	NO	NO	YES

(1) Including asphalt dense mixes containing RAP and WMA.

(2) For asphalt dense mixes containing RAP in accordance Clause 4.5.

(3) Tensile Strength Ratio testing must be added to laboratory mix design for mobile plants and must exceed 75%.

Testing must be carried out on representative material of each NM progressively of:

(a) Laboratory prepared mix; and

(b) Plant prepared mix from which the asphalt is to be applied.

When requested, the Contractor must submit a sample of 100 kg of loose asphalt of the nominated mix for verification of performance testing undertaken by DPTI.

2. NOMINATED MIX PERFORMANCE TEST REQUIREMENTS

The Contractor must conduct testing on plant produced mix upon receipt of Asphalt Mix Design Assessment in accordance with Tables R27B(b) & R27B(c).

TABLE R27B(b) - NOMINATED MIXES - MIX PERFORMANCE TEST PROPERTIES (1)

ASPHALT MIX CHARACTERISTIC		WHEEL TRACKING	FLEXURAL FATIGUE DPTI: TP477	RESILIENT MODULUS (1)
No.	Mix Type (including RAP & WMA)	AG:PT/T231 (mm)	Minimum MICRO-STRAIN @ 1 Million Cycles	AS2891.13.1 (MPa) ± 1,000 MPa
1	AC10M320	3.0 ≤ WT ≤ 6.0	180 με	4,800 MPa
2	AC14M320	3.0 ≤ WT ≤ 6.0	170 με	4,600 MPa
3	AC20M320	3.0 ≤ WT ≤ 6.0	150 με	4,300 MPa
4	AC14H320	≤ 3.0	160 με	4,300 MPa
5	AC14M320H	≥ 6.0	200 με	5,200 MPa
6	AC10H35P	≤ 2.0	160 με	6,000 MPa
7	AC14H35P	≤ 2.0	150 με	5,800 MPa
8	AC10H15E	≤ 3.0	300 με	2,700 MPa
9	AC14H15E	≤ 3.0	290 με	2,700 MPa
10	AC10M35P	≤ 3.0	170 με	5,500 MPa
11	AC14M35P	≤ 3.0	160 με	5,300 MPa
12	AC10M15E	≤ 4.0	330 με	2,400 MPa
13	AC14M15E	≤ 4.0	310 με	2,500 MPa
14	AC10M5EP	≤ 2.0	225 με	6,500 MPa
15	AC14M5EP	≤ 2.0	200 με	6,600 MPa
16	SMA7M15E	-	-	-
17	SMA10M15E	≤ 3.0	350 με	2,000 MPa
18	SMA10M5EP	≤ 3.0	250 με	5,000 MPa

(1) Minimum Testing Frequency (per Calendar Year). The Contractor must carry out performance testing if the total asphalt amount is greater than 5,000t per mix per calendar year and for special asphalt mixes including SMA10 or as requested by DPTI Asphalt Engineer. The Contractor must also carry out additional performance testing for every 20,000t per mix per calendar year.

The Nominated Mixes must be tested as required by Table R27B(c) and to meet the requirements of R27B(b).

TABLE R27B(c) - NOMINATED MIXES - TESTING REQUIREMENTS									
CHARACTERISTIC[(1)]	**FineAC7**	**FineAC10**	**AC10**	**AC14**	**AC20**	**SMA7**	**SMA10**	**OG10**	**OG14**
Gyratory Compaction									
Tensile Strength Ratio (TSR) (%)	NO	NO	YES	YES	YES	NO	NO	NO	NO
Slab Compaction									
Resilient Modulus	NO	NO	YES	YES	YES	YES	YES	NO	NO
Flexural Fatigue	NO	NO	YES	YES	YES	YES	YES	NO	NO
Wheel Tracking	NO	NO	YES	YES	YES	YES	YES	NO	NO

(1) Including asphalt dense mixes containing RAP and WMA.

3. ASPHALT MIX DESIGN ASSESSMENT PROGRESSION

The following general stages apply to an asphalt mix design:

(a) Laboratory assessment,

(b) Plant production assessment,

(c) Performance testing assessment,

(d) Field Inspection (for surface course mixes).

On an ongoing basis, the following applies to an asphalt mix design:

(e) Plant production assessment including process control monitoring,

(f) Performance testing on a minimum yearly basis.

If at any stage DPTI deems a mix to be unsatisfactory, the registration may be withdrawn as indicated in Clause R27.4.1.3 “Variations to Nominated Mixes”.

4. LABORATORY ASSESSMENT

The laboratory mix design must incorporate the requirements of Clause R27.4 including following minimum requirements:

(a) Design grading curve based on raw aggregate gradings,

(b) Five point binder content verses voids laboratory analysis (washout binder content not required) using standard bitumen,

(c) Determination of design binder content at required target air voids,

(d) Provision of all R27.4.8 requirements

(e) Plant trial of mix to verify aggregate gradings and design binder content,

The Contractor must undertake the testing specified in this Part & Table R27B(d) and submit the mix design together with supporting documentary evidence and laboratory and plant test results for mix and material properties to DPTI.

TABLE R27B(d) – INITIAL MIX DESIGN TESTING					
CLAUSE REF.	**SUBJECT**	**PROPERTY**	**TEST PROCEDURE**	**TEST FREQUENCY**	**ACCEPTANCE LIMITS**
3.1	Materials for Asphalt	Binder, Flux and Cutter	Refer Clause 3.1	Refer Clause 3.1	Refer Clause 3.1
		Aggregate, Sands & Mineral Filler	Refer Clause 3.1	Refer Clause 3.1	Refer Clause 3.1
		Hydrated Lime	Refer Clause 3.1	Refer Clause 3.1	Refer Clause 3.1
3.2	Reclaimed Asphalt Pavement Material (RAP)	Binder Content (wash out) & Grading	AS 2891.3.3	Refer Clause 3.2	Report Only
		Asphalt Binder Viscosity	TP 664	Refer Clause 3.2	Report Only
		Moisture Content	AS 1289.B1.3	Refer Clause 3.2	Report Only
4.0	Mix Requirements	Total Absorption by Combined Agg.	AS 2891.9.2	Attachment R27B	Report Only
		Mix Design Proportions	Refer PC044	Attachment R27B	Report Only
		Binder Content & Combined Grading	AS 2891.3.3	Attachment R27B	Refer Clause 4.3, 4.4, 4.6 & 4.7 and Asphalt Mix Design Assessment
		Bulk Density	AS 2891.9.2 AS 2891.9.3	Attachment R27B	Report Only
		Absorption of Compacted Specimens	AS 2891.9.2	Refer Table 6.1	≤ 2.0% for AC20 ≤ 1.0% for SMA
		Maximum Density	AS 2891.7.1	Attachment R27B	Report Only
		Voids on Compacted Specimens	AS 2891.8	Attachment R27B	Refer Clause 4.3, 4.4, 4.6 & 4.7 and Asphalt Mix Design Assessment
		Void in Mineral Aggregate (VMA)	AS 2891.8	Attachment R27B	Refer Clause 4.3 & 4.4
		Tensile Strength Ratio (TSR)	AGPT/T232	Attachment R27B	Refer Clause 4.3 & 4.4
		Binder Film Index (BFI)	AS 2891.8	Attachment R27B	Refer Clause 4.3 & 4.4
		Indirect Tensile Strength (ITS)	TP 460	Attachment R27B	Refer Clause 4.3
		Viscosity of the Binder of the Combined Mix Containing RAP	AGPT/T192	Attachment R27B	Refer Clause 4.5

DPTI will compare the mix design and test results submitted with the requirements contained in:

(a) Parts R15 & R27.

(b) AS 2150, Sections 4, 5 and 6.

(c) AGPT04B-14 Guide to Pavement Technology – Part 4B: Asphalt.

5. PLANT PRODUCTION ASSESSMENT

The Contractor must submit all production test data to DPTI and the following analysis:

(a) Sieve data is within the design grading curve envelope;

(b) Binder content and air voids meet the nominated binder content; and

(c) Constructed pavement air voids confirm mix design suitability.

When satisfied that the mix meets the specified requirements, DPTI will note the summary of test results and give notice for performance testing via the Asphalt Mix Design Assessment.

6. INITIAL PERFORMANCE TESTING ASSESSMENT

The Contractor must undertake performance testing on the NM and submit performance test results to DPTI.

7. REGULAR MIX DESIGN ASSESSMENT

The Contractor must submit asphalt plant production test data and material test data to DPTI to support the NM.

The Contractor must demonstrate to DPTI the following:

(a) The average air voids determined from production tests per mix are within ± 0.2% from target for 25 consecutive discrete samples.

(b) The average binder content determined from production tests per mix must not be lower than 0.05% from the nominated binder content for 25 consecutive discrete samples.

8. REGULAR PERFORMANCE TESTING ASSESSMENT

Performance testing must be undertaken in accordance with Tables R27B(a) and R27B(b) and submit them to DPTI.

9. Registration

DPTI will maintain a register of assessed asphalt mixes. DPTI will not issue additional mix register numbers if asphalt mixes are equal or less than 10% RAP incorporation, Warm Mix Asphalt Additives or Foaming Technique are used. The “Mix Design Assessment” will consist of 5 pages, with a summary page that can be issued to the client. The “Registered Mix” number will be of the form:

AASSDBBBZ-CCC-XXXX

where: AA = Mix Type

SS = Nominal Mix Size (mm)

D = Duty Type

B = Binder Type

Z = additional suffix, e.g., L for Hydrated Lime, R for Regular, H for High Binder, and for inclusion of RAP, each 5% is given a number (1 to 9 for 5% through 45%).

CCC = Contractor’s name and plant

TXXX = sequential number for each mix combination, beginning at T001