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AUSTROADS TECHNICAL SPECIFICATION ATS 3110
Supply of Polymer Modified Binders

Austroads

Contents

1. Scope

1.1 Austroads Technical Specification ATS 3110 sets out the requirements for the supply of polymer modified binders (PMBs) and crumb rubber modified binders for use in both sprayed sealing and asphalt applications.

2. Referenced Documents

2.1 The following documents are referenced in this Specification or are relevant to this Specification:

Australian / New Zealand Standards

AS/NZS 2341.4:	Methods of testing bitumen and related roadmaking products: determination of dynamic viscosity by rotational viscometer
AS 2341.18:	Methods of testing bitumen and related roadmaking products: determination of softening point (ring and ball method)
AS/NZS ISO 9001:	Quality Management Systems: Requirements.

Austroads	
ATM-101	Method of sampling polymer modified binders, polymers and crumb rubber
ATM-102	Protocol for handling modified binders in preparation for laboratory testing
ATM-103	Mass change or loss on heating of polymer modified binders after rolling thin film oven (RTFO) treatment
AGPT/T108	Segregation of polymer modified binders
ATM-111	Handling viscosity of polymer modified binders (Brookfield Thermosel)
ATM-112	Flash point of polymer modified binders
AGPT/T121	Shear properties of polymer modified binders (ARRB elastometer)
ATM-122	Torsional recovery of polymer modified binders
AGPT/T125	Stress ratio of bituminous binders using the Dynamic Shear Rheometer (DSR)
ATM-132	Compressive limit of polymer modified binders
AGPT/T142	Rubber content of crumb rubber modified bitumen – Soxhlet method
AGPT/T143	Particle size and properties of crumb rubber
AGPT/T144	Morphology of crumb rubber – bulk density test
AGPT04F	Guide to Pavement Technology Part 4F: Bituminous Binders
AP-G41-15	Bituminous Materials Safety Guide
AP-C87-15	Austroads glossary of terms (2015 edition)

Australian Flexible Pavement Association (AfPA)	
Advisory Note 7	Guide to the heating and storage of binders for sprayed sealing and asphalt manufacture.

3. Definitions

3.1 In addition to the definitions in AP-C87-15, the following definitions apply to this Specification:

Field-produced crumb rubber modified binders: Those binders that are simple blends of bitumen and crumb rubber which are blended close to the application site and are used within a short time frame (in no case more than 2 hours travelling time from the blend site).

Batch: The quantity of polymer modified binder stored in a single tank by the manufacturer at any particular time. The binder in the storage tank is deemed to be a new batch whenever new material is added to the storage tank.

3.2 Refer to the Austroads *Guide to Pavement Technology Part 4F: Bituminous Binders* (AGPT04F-17) for details of the classification system applicable to PMBs.

4. Quality System Requirements

4.1 The PMB must be manufactured under a quality management system which is certified to AS/NZS ISO 9001 by a JAS-ANZ accredited certifier (or accredited by another Accreditation Body Member of the International Accreditation Forum).

5. Manufacture of Binders

5.1 The manufacturer must implement a documented process control system to produce PMBs of a consistent quality conforming to the requirements of this Specification.

5.2 As a minimum, the process controls must include:

a) a method for determining and controlling the formulation during the production process;

b) keeping records of the composition of the constituent materials for each batch; and

c) recording sampling frequencies and test results.

5.3 The manufacturer must:

a) operate an Inspection and Test Plan (ITP) which demonstrates that the PMB complies with this specification and includes testing of the PMB, analysis of results (including control charts);

b) ensure that all PMB supplied can be traced to the production batch and associated test report; and

c) ensure that procedures/guidelines for the handling, storing, and transport of the binders that ensures homogeneity and conformity at the time of incorporation into the works are readily available to the Principal and Contractor.

6. Sampling and Testing of Binders

6.1 Representative samples of PMBs must be obtained in accordance with ATM-101. PMB samples must be prepared for testing using ATM-102.

6.2 Binders must be tested in accordance with the Test Methods specified in Tables 8.1, 8.2 and 8.3. Crumb rubber used in the production of crumb rubber binders must be tested in accordance with the Test Methods specified in Table 8.4.

6.3 The minimum frequency of testing must be in accordance with Tables 9.1 and 9.2.

6.4 Unless specified otherwise, the properties listed in Tables 8.1 to 8.4 refer to testing of samples taken at the point of manufacture.

6.5 Sampling must be undertaken by a person who is competent in that sampling procedure. If requested, the Contractor must provide training records demonstrating evidence of that person's competency.

6.6 The manufacturer must nominate in its Quality Management System the tests to be carried out prior to batch release of factory blended binders. At a minimum, this must include the requirements set out in Table 8.1 and 8.2.

7. Records

7.1 The Contractor must ensure that the following records are made available prior to, or with, the delivery of the PMB:

a) Test results, from a NATA accredited laboratory, demonstrating that the PMB has been sampled and tested in accordance with Tables 8.1 to 8.4 and complies with the properties specified in those tables.

b) A delivery docket giving at least the following information:

i) name and address of the manufacturer;

ii) location and date of manufacture;

iii) polymer modified binder class;

iv) production batch number;

v) storage and heating information (i.e. location, date, time, temperature; and

vi) certification that the PMB has been sampled prior to release from the manufacturer and complies with this Specification.

8. Properties of Binders

8.1 PMB properties must comply with the values specified in the following tables:

Sealing Class Binders:	Table 8.1
Asphalt Class Binders:	Table 8.2
Field-Produced Crumb Rubber Modified Binders:	Table 8.3

Table 8.1: Properties of Polymer Modified Binders for Sprayed Sealing Applications

Test method	Class / Binder property	S10E	S15E	S20E	S25E	S35E	S9R[1]	S15R[1,6]
AS/NZS 2341.4 or ATM-111[2]	Viscosity at 165 °C (Pa.s) max.[2]	0.55	0.55	0.6	0.9	0.55	1.5	4.5[2]
ATM-122	Torsional recovery at 25 °C, 30 s (%)	22–50	32–62	38–70	55–80	16–32	15-45	25–55
AS 2341.18	Softening point (°C)	48–64	55–75	65–95	82–105	48–56	50-60	55–65
AGPT/T125	Stress ratio at 10 °C min.	TBR[3]	TBR	TBR	TBR	TBR	TBR	TBR
AGPT/T121	Consistency 6% at 60 °C (Pa.s) min.[4]	300	400	500	900	250	400	800
AGPT/T121	Stiffness at 15 °C (kPa) max.	140	140	NA[5]	NA	180	NA	180
AGPT/T121	Stiffness at 25 °C (kPa) max.	NA	NA	35	30	NA	NA	NA
ATM-132	Compressive limit at 70 °C, 2 kg (mm) min.	NA	NA	NA	NA	NA	0.1	0.2
AGPT/T108	Segregation (%) max.	-8 to +8	-8 to +8	-8 to +8	-8 to +8	-8 to +8	-8 to +8	-8 to +8
ATM-112	Flash point (°C) min.	250	250	250	250	250	250	250
ATM-103	Mass Change (%)	-0.6 to +0.6	-0.6 to +0.6	-0.6 to +0.6	-0.6 to +0.6	-0.6 to +0.6	-0.6 to +0.6	-0.6 to +0.6

Notes

1. *Class S9R and S15R binders must be manufactured by the incorporation of crumb rubber derived from used vehicle tyres.*
2. *L series Brookfield is recommended together with spindle SC4-31, except in the case of S9R and S15R classes where spindle SC4-29 is recommended. The shear rate involved in determining viscosity by AS/NZS 2341.4 and ATM-111 must be calculated and recorded. ATM-111 has been retained in Table 8.1 to allow laboratories sufficient time to adopt AS/NZS 2341.4.*
3. *'TBR' throughout = to be reported.*
4. *Consistency 6% at 60 °C of S10E and S35E must be determined using mould B (breakpoint of 5 mm and a test speed of 1.5 mm/s). Other grades must be tested using mould A (breakpoint of 10 mm and a test speed of 1 mm/s).*
5. *'NA' throughout indicates that the property is considered not applicable for that PMB class.*
6. *S45R has been renamed to S15R*

Table 8.2: Properties of Polymer Modified Binders for Asphalt Applications

Test method	Class / Binder property	A35P	A20E	A15E	A10E	A5E	A18R[1]
AS/NZS 2341.4 or ATM-111[2]	Viscosity at 165 °C (Pa.s) max.[2]	1.1	0.6	0.9	1.1	0.9	6.2
ATM-122	Torsional recovery at 25 °C, 30 s (%)	6–30	38–70	55–80	60–86	25-40	30-70
AS 2341.18	Softening point (°C)	62–74	65–95	82–105	88–110	82-105	62-80
AGPT/T125	Stress ratio at 10 °C min.	TBR[3]	TBR	TBR	TBR	TBR	TBR
AGPT/T121	Consistency 6% at 60 °C (Pa.s) min.[4]	1000	500	900	1000	2500	1000
AGPT/T121	Stiffness at 25 °C (kPa) max.	120	35	30	30	NA	NA[5]
AGPT/T121	Stiffness at 25 °C (kPa) min.	NA	NA	NA	NA	90	NA
ATM-132	Compressive limit at 70 °C, 2 kg (mm) min.	NA	NA	NA	NA	NA	0.1
AGPT/T108	Segregation (%) max.	-8 to +8	-8 to +8	-8 to +8	-8 to +8	-8 to +8	-8 to +8
ATM-112	Flash point (°C) min.	250	250	250	250	250	250
ATM-103	Mass Change (%)	-0.6 to +0.6	-0.6 to +0.6	-0.6 to +0.6	-0.6 to +0.6	-0.6 to +0.6	-0.6 to +0.6

Notes

1. *Class A18R binders must be manufactured by the incorporation of crumb rubber derived from used vehicle tyres.*
2. *L series Brookfield is recommended together with spindle SC4-31, except in the case of the A18R class where spindle SC4-29 is recommended. The shear rate involved in determining viscosity by AS/NZS 2341.4 and ATM-111 must be calculated and recorded. ATM-111 has been retained in Table 8.2 to allow laboratories sufficient time to adopt AS/NZS 2341.4.*
3. *'TBR' throughout = to be reported.*
4. *Consistency 6% at 60 °C of all grades must be tested using mould A (breakpoint of 10 mm and a test speed of 1 mm/s).*
5. *'NA' throughout indicates that the property is considered not applicable for that PMB class.*

Table 8.3: Properties of Field-Produced Crumb Rubber Binders

Property	Method	S9RF[1,2]	S15RF[1,2]	S18RF[1,2]	A27RF[3]
Nominal rubber concentration (%)		9	15	18	25–30
Rubber content by analysis (%) min.	AGPT/T142	7	13	16	–
Torsional recovery (%) min.	ATM-122	15	25	30	–
Softening point (°C) min.	AS 2341.18	50	55	62	–
Consistency 6% at 60 °C (Pa.s)[4]	AGPT/T121	Report	Report	Report	–

Notes:

1. *Specification for two grades of crumb rubber (see Table 8.4) available for either of the sealing classes.*
2. *For sealing grade field produced crumb rubber binders, sampling is to be untaken from the mixing vessel after digestion but prior to the addition of cutter oil. Samples must be free of diluents for subsequent testing to be meaningful. The agreed digestion period (at mixing temperature) must be completed before sampling.*
3. *'Dry mix' asphalt is normally based on an asphalt mix design with the crumb rubber added at, typically, 25% crumb rubber in the total binder. Size 30 is normally used for the 'Dry mix' asphalt system.*
4. *Consistency 6% at 60 °C of all field produced crumb rubber binder grades must be tested using mould A (breakpoint of 10 mm and a test speed of 1 mm/s).*

8.2 Crumb rubber used to the manufacture of crumb rubber binders must be:

a) processed from waste tyres generated in Australia;

b) processed by a supplier accredited with Tyre Stewardship Australia or another organisation approved by the Principal; and

c) free from cord, wire, fluff and other deleterious material.

d) meet the properties included in Table 8.4.

Table 8.4: Properties of Crumb Rubber

Test	Method	Size 16	Size 30
Grading	AGPT/T143		
passing 2.36 mm		100	100
passing 1.18 mm		80 min.	100
passing 600 µm		10 max.	60 min.
passing 300 µm		–	30 max.
Particle length (mm) max.	AGPT/T143	3	3
Bulk density (kg/m^3)	AGPT/T144	Report	Report
Water content (%) max.	AGPT/T143	1	1
Foreign materials – metallic iron (%) max.	AGPT/T143	0.1	0.1

9. Frequency of Testing

9.1 The frequency of testing of PMBs and field produced crumb rubber binders must comply with the values specified in the following tables:

Polymer Modified Binders:	Table 9.1
Field-Produced Crumb Rubber Modified Binders:	Table 9.2

Table 9.1 Minimum Frequency of Testing of Polymer Modified Binders

Binder property	Polymer Modified Binders for Sprayed Sealing Applications	Polymer Modified Binders for Asphalt Applications
Viscosity at 165 °C (Pa.s)	Each batch	Each batch
Torsional recovery at 25 °C, 30 s (%)	Each batch	Each batch
Softening point (°C)	Each batch	Each batch
Stress ratio at 10 °C	Monthly	Monthly
Consistency 6% at 60 °C (Pa.s)	3-monthly(1)	3-monthly
Stiffness at 15 °C (kPa) or Stiffness at 25 °C (kPa)	3-monthly(1)	3-monthly
Compressive limit at 70 °C, 2 kg (mm)	3-monthly	3-monthly
Segregation (%)	3-monthly	3-monthly
Flash point (°C)	Annually	Annually
Mass change (%)	Annually	Annually

Notes:

1. For classes S10E, S15E and S20E, the minimum testing frequency is 1-monthly.

Table 9.2 Minimum Frequency of Testing Field-Produced Crumb Rubber Binders

Property	Minimum testing frequency
Rubber content by analysis (%)	Weekly
Torsional recovery (%)	Weekly
Softening point (°C)	Weekly
Consistency 6% at 60 °C (Pa.s)	Weekly

Annexure A: Summary of Hold Points, Witness Points and Records

The following is a summary of the Witness Points / Hold Points that apply to this specification and the Records that the Contractor must supply to the Principal to demonstrate compliance with this specification.

Paragraph	Hold Point	Witness Point	Record
7.1 a)			Test Results
7.1 b)			Delivery docket

Amendment Record

Amendment no.	Clauses amended	Action	Date
-	New specification	New	January 2020
1	Table 8.1: addition of properties for S9R grade; S45R renamed to S15R; change to the way segregation and mass loss limits are expressed.	Substitution	June 2023
	Table 8.2: addition of properties for A18R and A5E grades; removal of A25E grade; modification of A35P properties to reflect changes in polymer sources; change to the way segregation and mass loss limits are expressed.	Substitution	
	Table 8.3: addition of properties for S9RF grade.	Substitution	
	Table 8.4: removal of properties for the maximum % of foreign materials other than iron.	Substitution	

Key

Format	Change in format
Substitution	Old clause removed and replaced with new clause
New	Insertion of new clause
Removed	Old clauses removed