

COMMENTARY TO AG:PT/T111 - HANDLING VISCOSITY OF POLYMER MODIFIED BINDERS (BROOKFIELD THERMOSEL)

PREFACE

This polymer modified binder test method was prepared by the Bituminous Surfacing Research Reference Group on behalf of the Austroads. Representatives of Austroads, ARRB Group and the Australian Asphalt Pavement Association have been involved in the development and review of this test method.

FOREWORD

Bituminous binders, including polymer modified binders (PMBs), are normally handled and applied at elevated temperatures. The recommended temperature of application will be one at which the binder is sufficiently fluid to enable pumping, spraying, or mixing with aggregate. The maximum viscosity of a binder at its recommended application temperature is commonly specified to ensure that normal handling and application is possible with standard equipment.

SCOPE

This test method sets out the procedure for determining the apparent viscosity of PMBs at temperatures above 100°C, using the Brookfield Thermosel rotational viscometer.

Further Development

There are no further plans for the development of this test method.

HANDLING VISCOSITY OF POLYMER MODIFIED BINDERS (BROOKFIELD THERMOSEL)

1 REFERENCED DOCUMENTS

The following documents are referred to in this method:

AUSTROADS

AG:PT/T101 Method of sampling polymer modified binders, polymers and crumb rubber

AG:PT/T102 Protocol for handling polymer modified binders in the laboratory

2 APPARATUS

The following apparatus is required:

- a. **Brookfield viscometer** – L series or R series, models DV-I, DV-II, DV-III and dial reading.
- b. **Brookfield Thermosel** - Brookfield Thermosel temperature unit with Model 74R, or suitable equivalent, temperature control device.
- c. **Forced convection oven** - able to maintain a temperature in the range 60°C to 200°C, with a setpoint accuracy better than $\pm 5^\circ\text{C}$.
- d. **Balance** - a suitable balance of 500 g capacity, readable to 0.1 g.
- e. **Spatula** – flat bladed, stainless steel spatula.

3 PROCEDURES

3.1 General

PMBs are complex mixtures of polymers and a variety of petroleum products. If handled in accordance with the directions of the suppliers, there should be no significant risk. The hazard of burns with PMBs is greater than with standard bitumens, due to the (normally) higher handling temperatures. It is recommended that notices, describing the action to be taken in the event of bitumen or PMB burns, should be displayed in the laboratory in the areas where bitumen and PMBs are handled. A suitable warning could be as follows:

WARNING: HOT BITUMEN & PMBs CAN CAUSE BURNS

The following precautions should be taken when handling bitumen, or PMBs:

- a. Eye protection, such as safety glasses and/or face shields, shall be worn when handling hot bitumen or PMBs.

- b. Heat-resistant gloves, with close fitting cuffs, and other suitable protective clothing, shall be worn when handling hot bitumen or PMBs.
- c. There shall be no smoking while handling hot bitumen or PMBs.
- d. While the material is still cold, loosen the lid of the sample container (invert the can and warm the lid, if necessary), or punch a hole in the lid.
- e. Examine the cold sample for the presence of water. If water is present, drain most of it out, and blow with clean compressed air to evaporate the free water.

3.2 Sample Preparation

Samples for testing shall be provided in accordance with AG:PT/T101 and AG:PT/T102.

3.3 Handling Viscosity

The procedure for determining the handling viscosity shall be as follows:

- a. Set the Thermosel temperature control device to the desired temperature (see Note 2) and allow it to equilibrate, as indicated by cycling of the controller.
- b. Select the appropriate spindle (see Note 3) and place it in the oven or Thermosel for at least 5 minutes prior to use.
- c. Remove the heated sub-sample in the pouring container from the oven, then stir thoroughly and gently with a spatula for 30 seconds to assure uniformity of the binder. Avoid trapping air.
- d. Transfer sufficient sample (by mass) to the pre-heated sample chamber to give the correct volume at the temperature of test for the spindle employed (see Note 4).
- e. Insert the sample chamber into the Thermosel using the extracting tool.
- f. Cover the sample chamber with the insulating cap and condition the sample for approximately 10 minutes.
- g. Fit the hot spindle to the viscometer by lowering it into the sample and align the assembly.
- h. Allow the system to reach equilibrium temperature by conditioning it for a further 20 minutes.
- i. Turn on the motor and select a speed that gives a reading close to mid scale, or higher, if possible (see Note 5).
- j. Take readings at three intervals of one minute (see Note 6).

4 INFORMATION TO BE REPORTED

The following information shall be reported:

- a. Handling Viscosity, in Pa.s (see Note 7).

- b. Temperature of test, in °C.
- c. Brookfield viscometer model number.
- d. Spindle model number.
- e. Rotational speed.

5 PRECISION

No inter-laboratory testing has been conducted for the range of PMBs currently available. The precision for bitumen is given below:

- a. *Repeatability* - Duplicate values by the same operator shall not be considered suspect unless they differ by more than 3.5 percent.
- b. *Reproducibility* - Values reported by each of two laboratories, representing the arithmetic average of duplicate determinations, shall not be considered suspect, unless they differ by more than 14.5 percent.

Notes

- 1. The Brookfield Model LV is considered the reference instrument.
- 2. The nominally specified temperature is 165°C.
- 3. Spindle SC4-31 will meet the requirements of most PMBs in the high temperature region (150°C to 180°C) for a L series instrument.
- 4. A quantity of 10 mL is sufficient for the SC4-31 model spindle. Alternatively, a level approximately 3 mm up the spindle shaft is appropriate.
- 5. For users of a R series Thermosel, the maximum torque is 10 times that of the L series. It is recommended that the rotational speed (shear rate) of the test be limited to the maximum level achieved in the L series instrument. When using a digital display instrument, ensure that the scale is reset to zero before use.
- 6. The readings should be stable for three one minute intervals (not an average of the three, especially at high temperatures where shear thinning may occur). For some high percentage SBS modified binders, a steady reduction in reading may occur. In these cases, the highest reading should be recorded.
- 7. If the Brookfield viscometer is not a direct reading type, report the viscosity as the mean of the three readings taken.

AMENDMENT RECORD

Amendment No.	Clauses amended	Action	Date
1	Commentary Page	New	June 2005
	Footer and header	Format	
	Applied revised test method number	Format	
	Applied new styles	Format	
2	New test method number applied	Substitution	March 2006
	Notes moved to separate section	Format	

Key

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