1. Commentary

1.1 Preface

This test method was prepared by the Bituminous Surfacing Working Group (BSWG) on behalf of the Austroads Pavements Task Force (PTF). Representatives of Austroads, the Australian Road Research Board (ARRB) and the Australian Asphalt Pavement Association (AAPA) have been involved in the development and review of this test method.

This test method is intended to indicate the presence in a polymer modified binder (PMB) of volatile components, some of which may be emitted as fumes when the PMB is used in pavement construction and maintenance. The presence of volatile components in a PMB can be estimated in the laboratory by determining its change in mass after rolling thin film oven (RTFO) treatment.

The results of this test were traditionally reported in terms of loss on heating, where a positive loss on heating result indicated that a binder sample had lost mass during testing. It has been proposed that an updated version of ATS 3110 will specify that mass change results be reported, rather than loss on heating results, so the testing requirements for PMBs are consistent with those for bitumen in AS 2008. A negative mass change result indicates that a binder sample has lost mass during a test. Loss on heating results are obtained from mass change results by multiplying the mass change result by –1 (negative one).

1.2 Scope

This test method sets out the procedure for the determination of mass change or loss on heating of a PMB due to the effect of heat and air during RTFO treatment.

This test method is applicable to PMBs used in the construction and maintenance of pavements (as specified in ATS 3110).

1.3 Further Development

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

Warning: The use of this Austroads test method may involve hazardous materials, operations and equipment. This Austroads test method does not purport to address the safety issues associated with its use. It is the responsibility of the user of this Austroads test method to establish appropriate work health and safety practices and determine the applicability of regulatory limitations prior to use.

2. References

The following documents are referred to in this method:

Austroads

AGPT/T101 Method of sampling polymer modified binders, polymers and crumb rubber.
AGPT/T102 Protocol for handling modified binders in preparation for laboratory testing.
ATS 3110 Supply of polymer modified binders.

Australian/New Zealand Standards

AS/NZS 2341.1 Methods of testing bitumen and related roadmaking products: precision data – definitions.
AS/NZS 2341.10 Methods of testing bitumen and related roadmaking products: determination of the effect of heat and air on a moving film of bitumen (rolling thin film oven (RTFO) test).

ASTM


The following informative document is provided for information in this method and is not required to perform the test:

Australian Standards

AS 2008 Bitumen for pavements.

3. Apparatus

The required apparatus is described in AS/NZS 2341.10 or ASTM D2872.
4. Procedure

4.1 Sample Preparation

Samples for testing shall be provided in accordance with AGPT/T101 and AGPT/T102.

4.2 RTFO Treatment

(a) Follow the procedure for the RTFO treatment, as described in either AS/NZS 2341.10 or ASTM D2872.

(b) Inspect the bottles at the end of the RTFO treatment and note if there has been sample loss from the bottles (i.e. the sample has flowed out over the lip of the bottles). If sample loss from a bottle is observed, then check the oven level and bottle dimensions. To prevent overflowing issues which may be experienced when very highly modified PMB samples are tested, the use of bottles with an inward lip (as illustrated in the Figure showing the sample bottle in AS/NZS 2341.10) has been found to be effective. If inward lip bottles are utilised when ASTM D2872 is used, then the sample bottle dimensions specified in ASTM D2872 for the lip of the bottles (i.e. 0.06 ± 0.03" or 1.5 ± 0.8 mm) can be disregarded.

(c) After making necessary adjustments (e.g. levelling of the oven or use of a new bottle with an inward lip), repeat the procedure in Section 4.2 (a). If sample loss also occurs in the repeat test, terminate the test and report the issue as instructed in Section 5 (b).

4.3 Mass Change Calculation

Determine the mass change (M) of the PMB in accordance with the method set out in either AS/NZS 2341.10 or ASTM D2872. If ASTM D2872 is used to calculate mass change results, round the average mass change result to the nearest 0.01%.

4.4 Loss on Heating Calculation

Calculate the loss on heating result (L), if required, from the mass change result obtained in Section 4.3 using Equation 1.

\[ L = -1 \times M \]  \hspace{1cm} 1

where

\[
\begin{align*}
L &= \text{loss on heating result (\%)} \\
-1 &= \text{negative one} \\
M &= \text{average mass change result obtained after using the calculation procedure described in Section 4.3 (\%)}
\end{align*}
\]

Average results obtained using AS/NZS 2341.10 or ASTM D2872 shall be rounded to the nearest 0.01% before Equation 1 is used.
5. Reporting

The following information shall be reported:

(a) The mass change or loss on heating result obtained for the sample to the nearest 0.01% if the treatment was not terminated due to loss of sample from a bottle (refer to Section 4.2 (c)).

(b) If the treatment was terminated due to loss of sample from a bottle, then report the test result as the statement ‘Test terminated due to sample loss’.

(c) Any unusual conditions observed in the test, such as visible fumes during sample heating, or failure of the sample to fully coat the inside cylindrical surface or base of a bottle.

6. Precision

6.1 For Test Results Obtained using AS/NZS 2341.10

No inter-laboratory testing has been conducted for the full range of PMBs currently available. The following estimates for judging the acceptability of results with 95% probability (see AS/NZS 2341.1) have been derived from an inter-laboratory precision exercise conducted by Austroads in 1998:

(a) Repeatability: Duplicate mass change (or loss on heating) determinations by the same operator using the same equipment shall not be considered suspect unless they differ by more than 0.06%.

(b) Reproducibility: Mass change (or loss on heating) determinations submitted by each of two laboratories shall not be considered suspect unless they differ by more than 0.2%.

6.2 For Test Results Obtained using ASTM D2872

The acceptability of results obtained using ASTM D2872 shall be determined using mass change results which are rounded according to the requirements of ASTM D2872.

(a) Repeatability: Duplicate mass change determinations by the same operator using the same equipment shall not be considered suspect unless they differ by more than the 95% confidence limit for a single operator in ASTM D2872.

(b) Reproducibility: Mass change determinations submitted by each of two laboratories shall not be considered suspect unless they differ by more than the 95% confidence limit for multi-lab testing in ASTM D2872.
# Amendment Record

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<th>Clauses amended</th>
<th>Action</th>
<th>Date</th>
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<td>New Format Substitution Format</td>
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<td>3</td>
<td>Separated calculations into new section</td>
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<td>June 2006</td>
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**Key**

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