STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard METHODS OF TESTING BITUMEN AND RELATED ROADMAKING PRODUCTS

AS 2341.13 DETERMINATION OF DURABILITY OF BITUMEN

1 SCOPE. This standard sets out a method for the accelerated ageing of bitumen to determine the durability from the time required for bitumen to reach a viscosity level associated with distress in pavement surfacings.

NOTES:

1. The results of the test may be used to predict likely durability of a bitumen in sprayed surfacings and in thin asphalt surfacings which are permeable to air.
2. The method takes too long for it to be used for 'day-to-day' quality control and it is intended for occasional checking of quality, particularly where there has been a change in refinery crude feedstock and/or processing.

2 REFERENCES. The standard requires reference to the following Australian and British standards:

AS 1681	Electrically-heated Ovens in which Flammable Volatiles Occur: Type 1 Ovens
AS 2008	Residual Bitumen for Pavements
AS 2341.5	Determination of Apparent Viscosity by 'Shell' Sliding Plate Microviscometer
AS 2341.10	Determination of the Effect of Heat and Air on a Moving Film of Bitumen (Rolling Thin Film Oven (RTFO) Test)
BS 593	Laboratory Thermometers
IP	Standard Thermometers

3 APPLICATION. This test is applicable to Class 50, Class 170 and Class 320 bitumens specified in AS 2008 which have been subjected to the Rolling Thin Film Oven (RTFO) test treatment described in AS 2341.10, Clause 6(a) to (e).

NOTES:

1. When the relatively non-volatile residual bitumens used for paving purposes are tested by this method, the hardening produced by the treatment is mainly due to chemical attack by oxygen.
2. If the test is used to evaluate other types of bituminous paving binders, a check should be done to determine whether the observed hardening is caused, in part, by evaporation of volatile constituents.

4 PRINCIPLE. A known amount of bitumen from the RTFO treatment, dissolved in toluene, is placed in sample bottles in an oven. The oven is heated and the solvent evaporated with an atmosphere of carbon dioxide in the bottles, to deposit an approximately 20 μm thick, even film of the bitumen on the walls of the bottles.

The carbon dioxide is replaced by air and the bitumen films in the bottles are exposed in the (darkened) oven at a temperature of 100°C for selected periods.

After exposure, the bitumen is scraped from the walls of the bottles and mixed. Its apparent viscosity is then measured on the 'Shell' sliding plate microviscometer.

To find the time of exposure required to reach the specified apparent viscosity level (SAVL) (5.67 log Pa.s at 45°C at a shear rate of 5×10^{-3} s^{-1}), exposures are done initially for four and eight days. From the results obtained for these two exposure times, and assuming a linear relationship between log apparent viscosity and exposure time, the time required to reach the SAVL is estimated.

A further exposure for this estimated time is then done to obtain a third result. If this result is sufficiently close to the SAVL, the time to reach the SAVL is computed. If it is not, the pattern of the three results obtained on a log apparent viscosity/time plot is examined and a new estimate of the required exposure time is made.

A fourth exposure is then done for this time. Usually only testing at three exposure times is required.

5 APPARATUS. The following apparatus is required:

(a) *Oven.* The oven used in this test is the same as the oven required for the RTFO test, as described in AS 2341.10 but with some additional requirements.

The oven shall be electrically-heated and have forced draft air circulation. (See Fig. 1 for such details as dimensions and direction of air flow.)

The door shall be fitted with a symmetrically located inspection window, 300 mm wide and 200 mm high, consisting of sheets of heat-resistant glass separated by a sealed air space. (A removable cover for this window should be provided.)

Ventilation of the oven shall be provided, at the top, by two symmetrically placed circular openings 25 mm in diameter and, if necessary, at the bottom, by one or two symmetrically placed openings of the same total area.

The oven shall be provided with a circular carriage, with openings and clips for firmly holding eight glass sample bottles in a horizontal position parallel to the shaft (see Figs 2(a) and 2(b) and Fig. 3). This carriage shall be rotated in a vertical plane at a speed of 15 ± 0.5 r/min by a shaft which is preferably supported by external ball bearings.

d