Specification for

Hot binder distributors for road surface dressing

UDC 625.75.088 (083.71)

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Road Engineering Standards Policy Committee (RDB/-) to Technical Committee RDB/22, upon which the following bodies were represented:

British Aggregate Construction Materials Industries
British Tar Industry Association
Chemical Industries Association
County Surveyors' Society
Department of Transport
Engineering Industries Association
Federation of Manufacturers of Construction Equipment and Cranes
Institution of Highways and Transportation
Mastic Asphalt Council and Employers' Federation
Refined Bitumen Association Ltd.
Road Emulsion Association Ltd.
Road Surface Dressing Association

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Contents

Foreword

This British Standard has been prepared under the direction of the Road Engineering Standards Policy Committee and is a revision of BS 1707:1970 which is withdrawn.

This standard applies to certain mobile or transportable machines for distributing bituminous binders in the surface dressing of roads by mechanical means, or by hand spraying.

This standard sets down certain basic mechanical requirements for binder distributors but recognizes the opportunities which exist for some features to be enhanced with further advances in technology and the techniques of surface dressing.

This standard establishes requirements for the uniformity of distribution of the binder. It specifies test procedures to establish that the mechanical equipment is capable of meeting the requirements for uniformity of transverse distribution, and also specifies a new test to establish that the machinery complies with the required level of distribution in the field.

Attention is drawn to the Road Vehicles (Construction and Use) Regulations 1986 and the Health and Safety at Work etc. Act 1974.

Particular attention is drawn to the potential fire hazard arising from the transport and distribution of hot bituminous binders.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies requirements for machines for transporting and distributing hot binder during the surface dressing of roads. The machines may be mobile or transportable. This standard specifies the following:

a) mechanical requirements for distributors;

b) requirements for tanks;

c) requirements for measuring the volume of binder and its temperature;

d) requirements for ensuring the uniformity of longitudinal and transverse distribution of binder.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the following definitions apply.

2.1
binder

tar, bitumen, tar/bitumen mixtures, or emulsions of these materials, all of which may include additives

2.2
rate of spread

the number of litres of binder (at the specified temperature of application) applied to 1 m^2

2.3
mobile distributor

a distributor which may be either a trailer or a self-propelled road vehicle

2.4
transportable distributor

a distributor, intended for travelling short distances at low speeds, which would normally be carried to a distant site on another vehicle

NOTE Distributors for hand spraying are usually transportable; mechanical distributors are usually mobile.

3 Binder distributors

3.1 For distributors with closed tanks the actual capacity of the distributor shall be 10 % greater than the nominal capacity.

NOTE The nominal capacity of the distributor should be specified by the purchaser.

3.2 Mobile distributors shall be provided with a means of two-way communication between the driver of the distributor and the spray bar operator.

3.3 Operating instructions shall be supplied with each machine to enable the operator to ensure that the specified rate of spread is obtained.

3.4 Distributors shall be fitted with thermometers complying with **4.4**.

4 Binder tanks

4.1 Venting

Tanks shall be vented and provided with a screened manhole of minimum clear opening of 600 mm diameter.

4.2 Insulation

The tank and the exposed feed and return pipes from the tank to the means of application shall all be insulated with non-combustible material.

The insulating material shall be protected and retained in position to ensure that it does not deteriorate in use or become impregnated with binder.

The temperature drop in a full load of binder, at an initial temperature of 150 °C, with the atmospheric temperature between 15 °C and 20 °C, shall be not more than 20 °C after 8 h, when the tank and its contents are at rest.

4.3 Heaters

4.3.1 Tanks shall be provided with a means of heating capable, when full, of raising the temperature of the contents at a minimum rate of 14 °C/h.

4.3.2 Tanks shall be provided with an automatic cut out system to prevent heating when the binder level in the tank falls-to within 300 mm of the top of the burner tubes when measured on level ground.

4.3.3 Heating tubes shall be of seamless construction.

4.4 Measurement of temperature

Distributors shall be fitted with thermometers to show both the temperature at which the binder is being drawn off for application and the temperature of the binder in the tank.

The thermometers shall be accurate to within ± 3 °C.

Provision shall be made for the installation of a thermometer probe in the feed to the spray bar.

NOTE When required by the purchaser, distributors should be equipped with remote reading electronic digital thermometers.

4.5 Contents measurement

The tank shall have a dipstick clearly marked with the serial number of the tank to which it belongs.

The dipstick shall be positively located, e.g. fitted into a guide, and shall be calibrated and clearly marked to show the contents of the tank at any level within an accuracy of ± 1 % of the nominal capacity.

The tank shall be equipped with a contents indicator which is read from the outside.

NOTE An on-board weighing system or volume metering system should be provided when required by the equipment purchaser.

4.6 Marking

Each tank shall have attached to it a marking plate bearing the following information:

a) manufacturer's name;

b) nominal capacity;

c) minimum load for safe operation of heater;

d) serial number;

e) the number and date of this British Standard, i.e. BS 1707:1989[1)].

5 Mechanical distribution systems

5.1 Supply system

5.1.1 The supply system to the nozzles shall be such that all nozzles in use commence spraying simultaneously with a full spray at the start of a run and shut off simultaneously and cleanly at the end of a run.

5.1.2 Means shall be provided to control and maintain the working rate of spread, for any width of spray, without the necessity for frequent manual adjustment.

5.1.3 Means shall be provided for cleaning all nozzles and pipes of binder after spraying.

5.1.4 Means shall be provided for introducing additives into the tank on the suction side of the pump.

5.1.5 Two strainers shall be provided. One, in which the maximum dimension of any aperture is 3 mm, shall be located on the suction side of the pump. The other, in which the maximum dimension of any aperture is 2 mm, shall be located between the pump and the spray bar.

The total area of the apertures shall be not less than seven times the cross-sectional area of the pipe to which the strainer is fitted. The strainer shall be easily removable for cleaning and shall be designed in such a way that all of the binder will pass through it.

5.1.6 For constant pressure systems, two pressure gauges shall be fitted to show the binder pressure in the supply pipe between the strainer and the spray bar shut off valve. The gauges shall be visible from the operator's position.

The gauges shall be so designed and arranged that they respond readily to changes in pressure.

The gauges shall have a range of at least twice and not more than three times the working pressure and shall have a resolution of 0.15 bar[2)]. The gauges shall comply with BS 1780.

5.2 Spray bar

5.2.1 Provision shall be made for varying the number of nozzles in use to suit variations in the width of road to be covered.

5.2.2 Slotted jet nozzles shall be so mounted that their correct alignment is positively set and maintained. Plain screwed connections shall not be used unless supplemented by a positive locking device.

5.2.3 Each spray bar shall have attached to it a marking plate bearing the manufacturer's name and the spray bar serial number.

5.3 Hood

If the distribution mechanism produces a spray liable to be diverted by wind, a protective hood shall be provided covering the spraying attachment, extending close to but not touching the ground, and not impeding the spray.

5.4 Draw-off cock and hand-spraying lance

5.4.1 Provision shall be made for fitting a draw-off cock to which a hand-spraying lance can be attached.

5.4.2 The flexible pipe for the hand-spraying lance shall be not less than 15 mm bore, shall be not less than 3.0 m long and shall be made of a material that will resist deterioration following contact with the hot binder.

The pipe and its unions shall be capable of withstanding four times the normal working pressure of the system.

5.4.3 The hand-spraying lance shall be fitted with thermally-insulated adjustable handles, and a shut-off valve shall be provided between the pump and the spray nozzle.

5.4.4 The spray nozzle for the hand-spraying lance shall be of a type which delivers a uniform spray.

5.5 Performance

5.5.1 *General.* Mechanical distributors shall be capable of spreading the binder on the road with the uniformity of distribution specified in **5.5.2** and to a specified rate of spread in accordance with **5.5.3**.

[1)] Marking BS 1707:1989 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

[2)] 1 bar = 10^5 N/m^2 = 100 kPa.

5.5.2 *Depot test*. When tested in accordance with Appendix A, the amount of binder collected on any 50 mm wide tray within the effective width, the length of the tray being parallel to the direction of travel of the distributor, shall not differ from the mean amount over the effective width by more than 15 %. Furthermore, the mean of the amount of binder collected in any four adjacent trays within the effective width shall not differ from the mean over the effective width by more than 10 %. If a non-uniform transverse distribution is specified the mean amount of binder collected in any tray shall not differ by more than 15 % from the specified variation.

For the purpose of calculating the mean amount collected, the effective width shall be the whole sprayed width, less a margin of 150 mm along each side.

The amount of binder received on the 150 mm margin at either side of the effective width of the spray shall:

a) be not less than 75 % nor more than 115 % of the mean amount per 150 mm of the effective sprayed width for machines intended for butt jointed work;

b) be not less than 45 % nor more than 85 % of the mean amount per 150 mm of the effective sprayed width for machines intended for lap jointed work.

5.5.3 *Field test*. When tested in accordance with Appendix B, the rate of spread found on each test pad shall not vary from the specified rate by more than 10 % (with the exception of the 150 mm margin at either side of the effective width).

NOTE The specified rate of spread is likely to be between 0.25 L/m^2 and 3.0 L/m^2.

Appendix A Method of test for uniformity of transverse distribution of binder (depot tray test)

A.1 General

The conditions prevailing during the test shall be comparable with those occurring during typical operations as regards:

a) viscosity of binder;

b) temperature of binder;

c) pressure at the spray bar;

d) height of spray bar above test surface.

NOTE A light fuel oil complying with table 2, class E of BS 2869-2:1988 may be used instead of binder. (See Transport and Road Research Laboratory Supplementary Report 737, Surface dressing: testing binder distributors for uniformity of transverse distribution.)

A.2 Apparatus

A.2.1 *Wheeled trolley*, capable of running on steel rails over a catchpit, and of carrying a set of containers with a minimum capacity of 500 L.

A.2.2 *Steel rails*, of sufficient length to allow the trolley to lie clear of the spray before the test and of a depth such that, with containers fitted on the trolley, the top rim of each container is horizontal and the same distance below the nozzles of the spray bar as the road surface would be under normal working conditions.

A.2.3 *Means of containing the hot binder*. This should take the form of either of the following:

a) one large container subdivided into smaller containers by means of internal partitions;

b) a set of smaller individual containers, the rim of each container being lipped on one side in order that the containers can overlap and prevent binder escaping.

In either instance, the dimensions of each small container should be 1 000 mm long × 150 mm deep, and the distance from the centre of one small container across the width of the container to the centre of the neighbouring small container should be 50 mm. The containers should be made of low carbon steel of thickness 0.9 mm to 2 mm.

The containers should extend to a width of 150 mm greater than the full spray width of the distributor.

Examine each container for damage before each test and replace them if such damage is likely to affect the test.

A.2.4 *Steel rule*, graduated in millimetres.

A.3 Procedure

A.3.1 Arrange the test so that the distributor can operate for a sufficient period to obtain the normal working conditions.

A.3.2 Back the distributor into position with the spray bar over the catch pit, with the spray bar horizontal and at right angles to the containers. Make a preliminary spray to ensure that all nozzles are functioning and that the machine is in normal working condition.

A.3.3 Push the trolley (**A.2.1**) and containers (**A.2.3**) underneath the spray hood; commence the spraying and maintain for a period of time sufficient almost to fill the containers. Withdraw the trolley to the previous position.

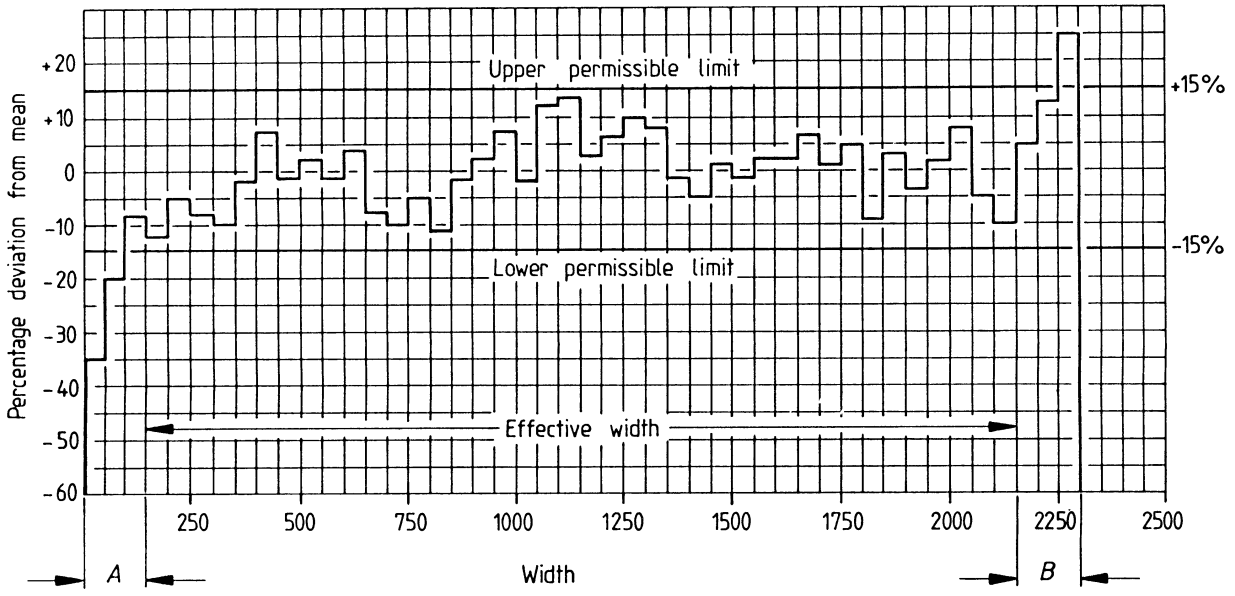
A.3.4 Use the rule (**A.2.4**) to measure the depth of binder in each container, including those containers beyond the effective width. Dip the rule into each container in the same position as near the centre as possible.

It is essential that the true level of the liquid is measured and the reading is not obscured by the froth that can collect on the surface of the liquid.

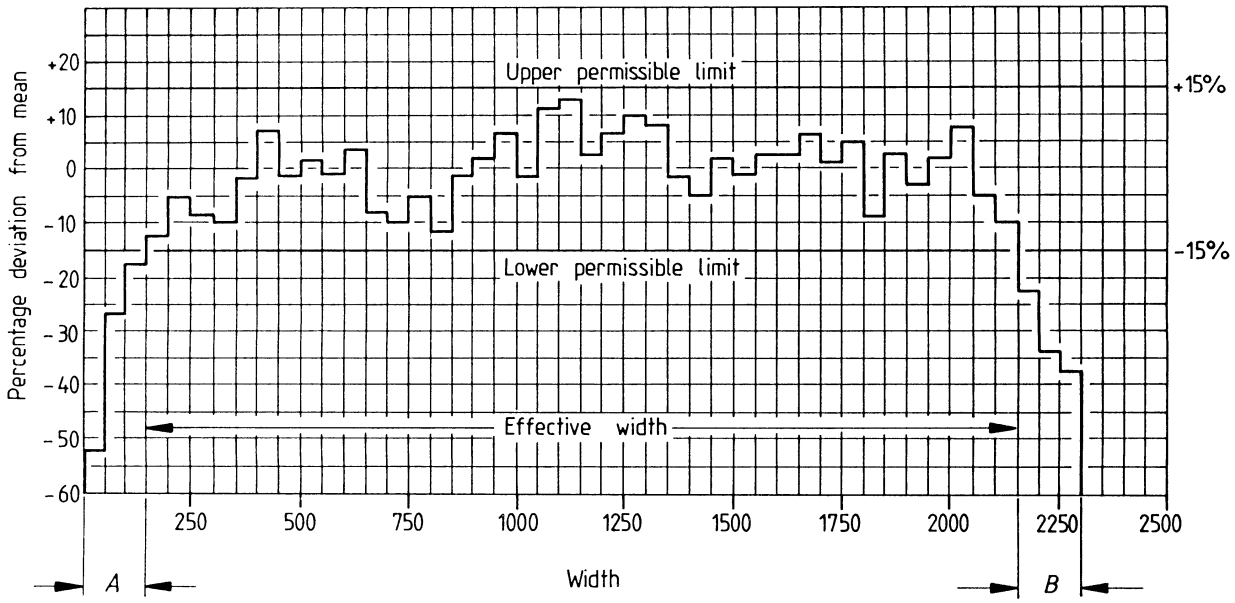
Distributors with expanding bars should be tested under conditions of maximum extension and, if required, at intermediate positions of the bar.

A.3.5 Express the results as a percentage deviation from the mean for all the 50 mm units over the effective width.

A.3.6 Record the results of the test in the form indicated in Figure 1. (An example of a typical record sheet is shown in Figure 2.)



(a) For butt jointed work



(b) For lap jointed work

NOTE The binder falling on widths A and B is ignored in calculating the mean distribution.

Figure 1 — Typical results of test for uniformity of transverse distribution of binder

WORKSHEET – HOT BINDER DISTRIBUTOR

BS 1707 : 1989 clause **5.5.2** and appendix A

BASED ON SPRAYING TIME OF 1 MINUTE

Excluding 3 trays from each end

Date ☐ **Job no.** ☐

Company ☐

Depot ☐

Machine number ☐

Binder: Cut-back Tar-bit K1-70 Road tar

Polymer type ☐

Nominal viscosity: s at 40 °C (not tested)

Spray bar: Ashurst Coleman Bristowes Phoenix

Acmar Breining

Number of jets ☐ Outlet size:

Spacing:

Spray height: O/S ☐ N/S ☐

Bar width: ☐ ☐

Standard Expanded Expanding

Fillers: ☐ Satisfactory ☐ Not satisfactory

Lagging: ☐ Satisfactory ☐ Not satisfactory

Hood: ☐ Satisfactory ☐ Not satisfactory

Pressure gauges:

N/A ☐

O/S ☐

Test ☐

Thermometers: °C / °F

Bar ☐

Tank ☐

Test ☐

Remarks:

Tested by: .....

Tray no.	Dip mm	Deviation	
		mm	%
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
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39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
		Total	
		Mean	

Tray no.	Dip mm	Deviation	
		mm	%
51			
52			
53			
54			
55			
56			
57			
58			
59			
60			
61			
62			
63			
64			
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86			
87			
88			
89			
90			
91			
92			
93			
94			
95			
96			
97			
98			
99			
100			
		Total	
		Mean	

Figure 2 — Example of a record sheet for depot tray test

Appendix B Method of test for the determination of rate of spread of binder

B.1 General

This test is intended to determine the rate of spread of binder as it is being applied to a road surface during a normal surface dressing operation.

The procedure involves spraying binder on to a continuous strip of absorbent disposable test pads, which are subsequently separated and weighed.

NOTE The means of assembling a continuous strip can take the form of a polyethylene backing sheet as described in this method, but, provided the main principles of the test remain unaffected, alternative backing systems (e.g. a pair of timber strips) may be used.

When used as an in situ control test, it is important that the result is calculated on site and immediately conveyed to the supervisor. If the test results do not comply with **5.5.3** or if the test operator is not completely confident that the distributor is performing satisfactorily, a second test should be carried out.

B.2 Safety

Surface dressing operations on highways which are open to normal traffic present particular hazards and the execution of this test, as an interruption to the normal routine, can introduce additional risks. It is therefore essential that the test operator observes all traffic safety procedures as required by the Highway Authority concerned. Moreover, the test operator should plan and execute each individual test with safety in mind. Particular points of safety are given in this appendix where appropriate.

Published Health and Safety precautions relating to the handling of bituminous binders are applicable to this work, and skin protection is of particular importance.

B.3 Apparatus

B.3.1 *Absorbent material*, sufficiently absorbent to prevent bitumen running. It is essential that the material is capable of holding a sprayed film of binder at the maximum anticipated temperature and rate of spread without distortion or loss of binder for any reason during subsequent handling of individual test pads.

NOTE Bitumen-backed carpet tiles have proved to be a satisfactory material, and their use is to be preferred. Other materials including geotextiles may be used, however, provided the above practical requirements are fulfilled.

B.3.2 *Polyethylene backing sheet*, approximately 250 μm thick, roll width at least 3.5 m. (See note to **B.1**.)

B.3.3 *Adhesive tape*, suitable for the particular type of absorbent material selected.

B.3.4 *Balance*, which shall be of a portable electronic type, with a minimum capacity of 1 kg and accurate to 1 g. It is essential that the design is such that the display is not obscured when weighing a test pad.

B.3.5 *Protective gloves*

B.3.6 *Indelible marker*

B.4 Preparation

B.4.1 *Test pad assembly*

Fabrication of the test pad assembly should be carried out in advance of the site visit. Assemblies should be produced in lengths in excess of the proposed test width. Prepare the test pad assembly as follows.

a) Cut out individual 200 mm or 250 mm square test pads from the absorbent material (**B.3.1**). It is essential that all edges be cut clean, straight, and square. Remove any loose particles from the pads.

b) Use the balance (**B.3.4**) to weigh each pad to the nearest gram. Use the marker (**B.3.6**) to record the weight on the back of the pad.

c) Cut out a polyethylene backing strip (**B.3.2**) of width 250 mm or 300 mm (25 mm wider than the pads on either side). The length should be approximately 300 mm in excess of the required overall length of the test pad assembly.

d) Fasten the pads to the backing strip to form a continuous length of pads with no intermediate gaps, ensuring that the pads can be subsequently separated from the backing strip without tearing their undersides. Staples or double-sided adhesive tape should be used for this purpose.

e) Fold the assembly in such a way as to afford convenient storage and transport until required for the in situ test. It is important that distortion or contamination of the test pad assembly, or humidity changes, are avoided during storage and transportation.

B.4.2 *Preparation on site*

Careful selection of the test location is essential for reasons of both safety and consistency of spray. The test location should be level and straight and should afford good visibility. In addition, it is advisable for the test location to be adjacent to a paved working area such as a lay-by, on which the test operator can station the vehicle and where the weighing and calculating may be carried out in safety.

B.4.3 *Weather conditions*

The test should be carried out in dry weather.

B.4.4 ***Preliminary checks on site***

Before the distributor reaches the test location the following checks should be made, and details recorded:

a) temperature of binder;

b) pressure under working conditions;

c) actual road speed.

NOTE 1 Whilst the above checks are not strictly essential to this test, they would become essential to any subsequent decision on corrective action.

NOTE 2 The supervisor and tanker driver should be informed by the test operator of the intention to carry out a test, and a detailed operating procedure should be agreed. Cooperation is essential to ensure that all persons are aware that people will be working amongst and in front of the moving plant.

B.5 Procedure

B.5.1 Before the distributor reaches the selected test location fasten the test pad assembly to the road surface in the anticipated spray path using adhesive tape (**B.3.3**) (or other suitable means) on the polyethylene backing sheet margins. The orientation of the assembly can be either transverse or longitudinal as desired for individual tests. Mark one end of the backing sheet as being "nearside" or "offside" as appropriate.

For safety reasons and to avoid damage to the pad from traffic, this operation should not commence until the approach distance has reduced to approximately 100 m, or as otherwise appropriate to traffic conditions.

B.5.2 When the approach distance has reduced to approximately 30 m, raise the protective hood of the distributor to a height of approximately 20 mm clear of the road surface. This should allow any accumulated binder to drain off.

B.5.3 Allow the distributor to pass over the test pad assembly at its normal specified speed without any discernable throttle variation.

NOTE The test operator should listen to the engine note or other such indications to ensure this.

B.5.4 Stop the distributor when its protective hood has passed clear of the test pads.

B.5.5 Stop other plant, e.g. chipping spreaders, before they reach the test pads.

B.5.6 Note any contamination or excessive pools of binder on the surface of the pads.

B.5.7 Remove the test pad assembly, pulling it clear of adhesive tapes and on to the adjacent working area.

B.5.8 Apply binder to the area of road surface masked by the test pads, and then allow normal operations to resume whilst the test result is determined.

B.5.9 Examine each of the pads and remove any stray chippings from them. Note and discard any unsprayed or partially sprayed pads.

Where stray chippings have been discarded from the pad, these pads should be identified and reported in the event of any spurious results.

B.5.10 Remove each pad in turn from the backing sheet and weigh it. Record the mass to the nearest gram and also the initial pad mass as marked on its underside, before disposing of the pad. Do not discard used pads by the roadside.

NOTE The weighing operation is ideally carried out in a sheltered situation such as within the back of a vehicle.

B.6 Expression of results

B.6.1 Calculate the mass of binder collected (in g) by using the following equation:

$$m_3 = m_2 - m_1$$

where

m_1 is the initial mass of test pad before test (in g);

m_2 is the total mass of test pad after test (in g);

m_3 is the mass of binder collected (in g).

B.6.2 Calculate the volume of binder for each individual pad (in L/m^2)by using the following equation:

$$r = \frac{m_3 \times n}{d \times 1000}$$

where

r is the rate of spread (in L/m^2);

m_3 is the mass of binder collected (in g);

d is the density of binder[a] (in g/mL) at spray temperature;

n is the number of square test pads in 1 m^2, i.e. 25 for 200 mm × 200 mm test pads and 16 for 250 mm × 250 mm test pads.

[a] This figure should be obtained from the binder supplier prior to testing, and should be agreed to by all parties.

B.6.3 Calculate the percentage variation between the rate of spread on each test pad and the specified rate. Also calculate the overall mean result.

B.6.4 Report to the nearest 0.01 L/m^2 the rate of spread result and the variation to the nearest 1 % for each individual pad numbered in sequence from the nearside end of the spray bar for a transverse test (or from the first pad for a longitudinal test). Report also the overall mean result.

B.6.5 The report should also give full details of the preparatory checks, the work being carried out, the materials being used, the specified rate of spread, and any other relevant circumstances. Figure 3 shows a typical record sheet and gives the minimum requirements of a report.

Site: Date:

Contractor: Vehicle number:

Binder type:

Spray pressure (p.s.i.)	Specified:	Found:
Temperature of binder (°C)	Specified:	Found:
Vehicle speed (m/min)	Specified:	Found:

RATE OF SPREAD TEST

Location of test: Lane tested:

Specified rate of spread (/m^2): Test pad size:

	Nearside												Offside			
Pad number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Rate of spread /m^2																
% Variation from specification																
Overall mean /m^2																

Remarks

Figure 3 — Example of a record sheet for determination of rate of spread of binder

blank

Publications referred to

BS 1780, *Specification for bourdon tube pressure and vacuum gauges.*

BS 2869, *Fuel oils for non-marine use.*

BS 2869-2, *Specification for fuel oil for agricultural and industrial engines and burners (classes A2, C1, C2, D, E, F, G and H).*

Transport and Road Research Laboratory Supplementary Report 737, Surface Dressing: testing binder distributors for uniformity of transverse distribution[3)].

[3)] Obtainable from the Technical Information and Library Services, Transport and Road Research Laboratory, Old Wokingham Road, Crowthorne, Berkshire.

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