

Sampling and examination of bituminous mixtures for roads and other paved areas —

**Part 112: Method for the use of road
surface hardness probe**

ICS 93.080.20

Confirmed
January 2010

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee B/510, Road materials, to Subcommittee B/510/2, Surface dressings, sprays and slurry surfacing, upon which the following bodies were represented:

Bitumen Modifiers Association
 British Civil Engineering Test Equipment Manufacturers' Association
 Coldmac Ltd.
 County Surveyors' Society
 DETR — Highways Agency
 Energy Institute
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 Quarry Products Association
 Refined Bitumen Association
 Road Emulsion Association Ltd.
 Road Surface Dressing Association
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 Co-opted members

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 25 June 2004

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Amendments issued since publication

Amd. No.	Date	Comments

The following BSI references relate to the work on this British Standard:
 Committee reference B/510/2
 Draft for comment 00/105086 DC

ISBN 0 580 43922 4

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Foreword

This part of BS 598 has been prepared by Subcommittee B/510/2, Surface dressings, sprays and slurry surfacing. It determines the penetration of a standard probe at a known temperature into a road surface. This data may be used when carrying out surface dressing design in accordance with Road Note 39, *Design Guide for Road Surface Dressing* [1].

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 5 and a back cover.

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1 Scope

This British Standard describes a method to determine the penetration of a standard probe into the road surface and the temperature at which this is carried out, usually prior to the application of surface dressing as part of the design process.

NOTE This data is required for the determination of road surface hardness as part of the Road Note 39, *Design for Road Surface Dressing* [1].

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the reference cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 598-100, *Sampling and examination of bituminous mixtures for roads and other paved areas — Part 100: Methods for sampling for analysis*.

BS 598-102, *Sampling and examination of bituminous mixtures for roads and other paved areas — Part 102: Analytical test methods*.

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS 598-100 apply.

4 Principle

A hemispherically-ended steel rod is forced into the surface under a constant load for a constant time and the depth of penetration is measured. The road surface temperature is recorded.

5 Apparatus

5.1 Probe, capable of applying a force of (340 ± 10) N to a probe of hardened steel (4.0 ± 0.1) mm in diameter and machined to a rounded shaped tip (approximately hemispherical) (see Figure 1). The probe shall be clean.

5.2 Electronic thermometer, accurate to ± 1 °C, for measuring the road surface temperature; the measuring element shall be an unsheathed thermocouple.

5.3 Means of linear measurement, either a ruler graduated in millimetres or a dial gauge modified with a sleeve fitted around the plunger.

5.4 Timer, a clock with a sweep hand accurate to ± 1 s in 5 min.

6 Calibration

The probe shall be calibrated at least annually and dependent upon use. Other equipment shall be calibrated at the frequency stated in BS 598-102.

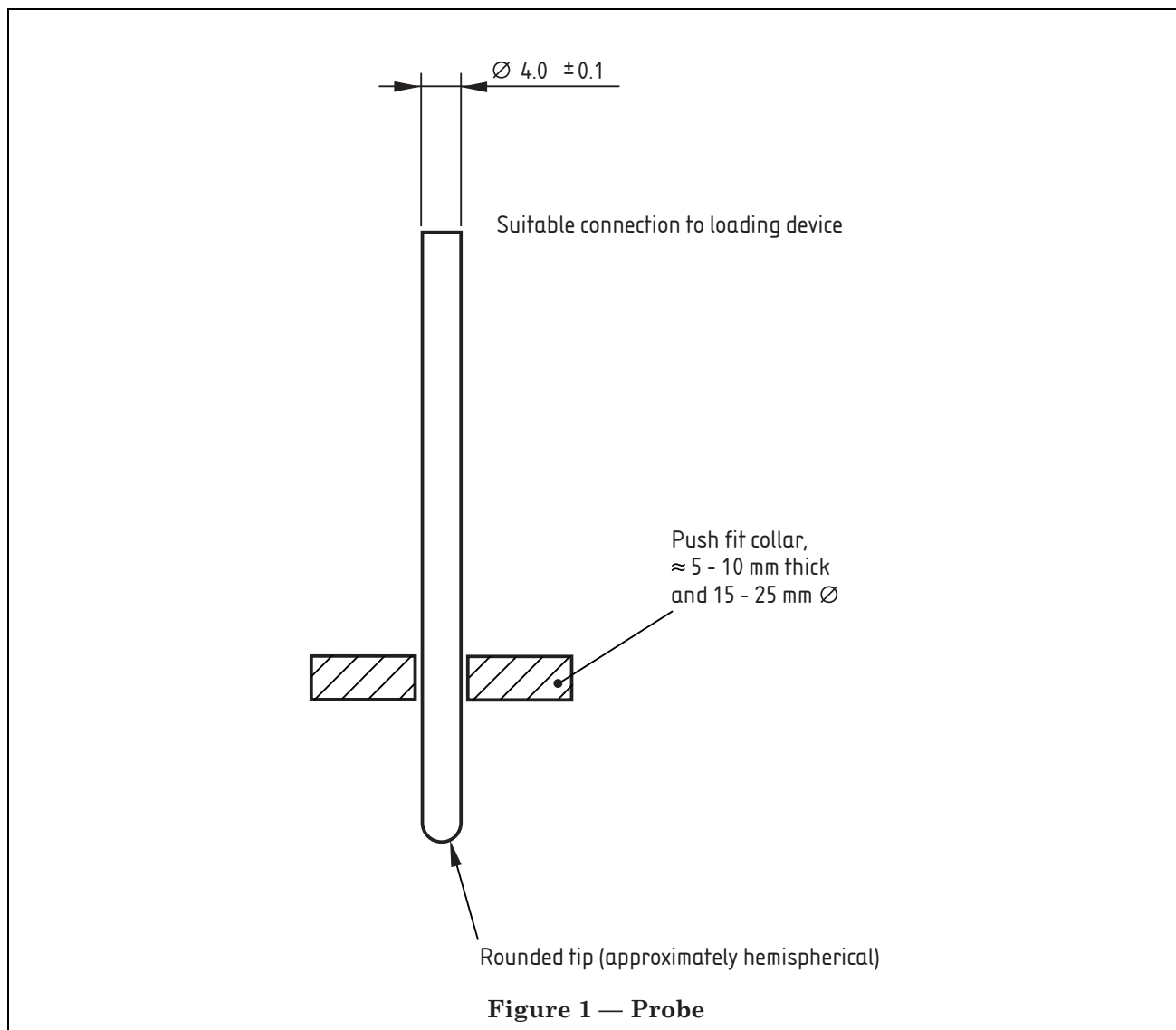


Figure 1 — Probe

7 Procedure

7.1 Measurement of *in situ* penetration

7.1.1 General

In situ measurement shall be made only when the surface temperature is between 15 °C and 35 °C.

NOTE If the temperature is outside these limits then the measurements may be deferred until the road surface temperature complies with the limits or cores may be taken and the test carried out in the laboratory.

7.1.2 Temperature measurement

Measure the road surface temperature with the thermometer for each set of 10 probe measurements to ± 1 °C. To allow for the thermal capacity of the thermometer tip, hold it in one position until the temperature stabilizes and then move it to an adjacent position and the temperature is recorded. One measurement is sufficient for each set of 10 penetration readings.

NOTE 1 A piece of expanded polystyrene has been found to be suitable to hold the probe tip in close proximity to the surface.

NOTE 2 If the temperature moves more than 2 °C between the first and second position of the probe tip, continue moving until the change is 2 °C or less. Record the final temperature only.

7.1.3 Selection of measurement points for testing

NOTE Measurement points are normally in the near-side wheel-track of the traffic lane at the locations required.

7.1.3.1 Mark 10 measurement points at each location where the road hardness is to be determined. These shall be spaced evenly along the road at intervals of approximately 0.5 m.

7.1.3.2 Select the measurement points from a road surface that is visually similar throughout. Position the points such that the probe tip will not be centred on existing large stones present in the road surface.

NOTE Ignore any recently repaired or patched areas of the road pavement, unless these locations have to be measured separately.

7.1.4 *In situ* measurement of road hardness

7.1.4.1 Slide the collar, fitted to the probe to indicate depth of penetration, down the shank until it is flush with the end of the probe.

7.1.4.2 Centre the probe on the first point and maintain the constant calibrated force for a period of (10 ± 1) s, keeping the probe as still as possible in an approximately vertical position.

7.1.4.3 Measure the penetration of the probe to the nearest whole millimetre either with the ruler or by slipping the protruding probe tip into the sleeve of the modified dial gauge until the collar butts up against the sleeve.

7.1.4.4 If the point selected for test is below the surface of the remainder of the road pavement on which the probe collar rests, deduct the measurement of initial projection of the probe from the final figure.

NOTE On worn surfaces, normally under consideration for surface dressing, this deduction is often not required.

7.1.4.5 Repeat **7.1.4.1** to **7.1.4.4** in order to determine the penetration of the probe for the remaining measurement points.

7.1.4.6 The 10 measurements shall be carried out within a 15 min interval.

NOTE This is to ensure that the same temperature measurement applies to all penetration measurements.

7.2 Measurement of penetration from cores

7.2.1 Take one core of 100 mm minimum diameter from the road at each of the measurement points. Transport the cores top-face downwards on a flat surface. Test the core on the top surface as soon as possible after delivery to the laboratory and, in any case, the test shall be completed within 72 h of taking the cores.

7.2.2 Do not allow the samples to be subjected to anything that could modify their response (such as wheel-tracking or high temperatures) prior to the probe measurements being taken.

7.2.3 Fit a collar around the core and fill any gap between the collar and core with plaster of Paris. Maintain the core with its collar at a temperature of (30 ± 1) °C for not less than 4 h nor more than 16 h prior to testing and test within 5 min of removal from the oven.

7.2.4 Determine the probe penetration of each core in accordance with **7.2.1**, **7.2.2** and **7.2.3**.

NOTE As the cores have been brought to a standard temperature, it is not necessary to measure the temperature.

8 Calculations

Calculate the mean of each set of 10 probe measurements and report as the mean probe penetration at the measured road surface temperature.

9 Test report

9.1 Required information

The test report shall include the following information for each test specimen:

- a) the date, time and place of test;
- b) the road number, location and lane;
- c) whether the testing was carried out *in situ* or on cores in a laboratory;
- d) the temperature at which the test was carried out;
- e) the probe penetration at each measurement point and the mean probe penetration;
- f) the name of the person taking technical responsibility for the test;
- g) the number and date of this British Standard, i.e. BS 598-112;
- h) any test conditions and operational details not provided in this British Standard, and anomalies, if any, likely to have affected the results.

NOTE The location information should include sufficient data to:

- a) relocate the test position on site; and
- b) locate the position on a 1:50 000 OS map, e.g. map number and six figure grid reference.

9.2 Optional information

The test report may include the following optional information:

- a) the name of the project;
- b) the shading of the site.

Bibliography

[1] TRL Road Note 39. 5th ed. *Design Guide for Road Surface Dressing*. London: TRL, Crowthorne, Berkshire, 2002.

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