British Standard

BRITISH STANDARD

BS 598-109: 1990
Incorporating Amendment No. 1

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

Part 109: Methods for the assessment of the compaction performance of a roller and recommended procedures for the measurement of the temperature of bituminous mixtures

ICS 75.140; 93.080.20

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/36 upon which the following bodies were represented:

British Aggregate Construction Materials Industries

British Civil Engineering Test Equipment Manufacturers' Association

British Tar Industry Association

County Surveyor's Society

Department of the Environment (Property Services Agency)

Department of Transport (Highways)

Department of Transport (Transport and Road Research Laboratory)

Institute of Asphalt Technology

Institute of Petroleum

Institution of Civil Engineers

Institution of Highways and Transportation

Mastic Asphalt Council and Employers' Federation

Mastic Asphalt Producers' Association

Refined Bitumen Association Ltd.

Sand and Gravel Association Ltd.

Society of Chemical Industry

Coopted members

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Contents

Foreword

This part of BS 598 has been prepared under the direction of the Road Engineering Standards Policy Committee. It is a revision of clause **9** and appendix A of BS 598-3:1985, which are deleted from that part by amendment.

As BS 598 is revised each of the tests or collection of related tests will be issued as a separate part of this standard. The complete revision will eventually comprise the following parts:

— *Part 100: Methods for sampling for analysis;*

— *Part 101: Preparatory treatment of samples for analysis;*

— *Part 102: Analytical test methods;*

— *Part 103: Method for the recovery of soluble bitumen for examination;*

— *Part 104: Methods of test for the determination of density and compaction;*

— *Part 105: Methods of test for the determination of texture depth;*

— *Part 106: Methods of test for the determination of the stability index of pitch bitumen binders;*

— *Part 107: Method of test for the determination of the composition of design wearing course rolled asphalt;*

— *Part 108: Methods of test for the determination of the conditions of the binder on coated chippings and the rate of spread of coated chippings;*

— *Part 109: Methods for the assessment of the compaction performance of a roller and recommended procedures for the measurement of the temperature of bituminous mixtures.*

It has been assumed in the drafting of this British Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 4, an inside back cover and a back cover.

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1 Scope

This part of BS 598 describes a method for assessing the compaction performance of a roller and gives recommended procedures for measuring the temperature of coated mixtures.

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 part of BS 598 the definitions given in BS 6100 apply.

3 Assessment of the compaction performance of a roller

3.1 General

The procedure is used to obtain an indication of the compaction performance of any particular type of roller compared with the minimum 8 t roller traditionally specified for compacting rolled asphalt. The procedure takes the form of pilot-scale compaction trials and can be used to determine whether a particular roller can achieve an acceptable level of compaction compared with an 8 t roller. Where a roller manufacturer can show that such a procedure has been carried out with a particular make and model of roller, it will not normally be necessary for further assessment trials to be carried out (see also BS 594-2), providing that information is supplied which will make it possible for the same type and mode of operation to be followed.

3.2 Procedure

Proceed as follows.

a) Ensure that the conditions of the trial are such that the ease of compacting the material is equal to or less than that for the conditions of the contract, e.g. the trial material is of the same composition as that to be laid in the contract (or is known to be at least as difficult to compact) and the temperatures of rolling in the trial are no higher than those of the contract. Compact the material on a structure of realistic stiffness.

b) Operate the alternative machine and conventional 8 t roller side by side over the trial material laid by a paving machine in one pass. The effects of variations in temperature and mix composition that may occur in the longitudinal direction along the laid asphalt are thus eliminated as the effectiveness of both rollers will be equally affected. Do not move the rollers laterally between successive passes as in normal site work.

c) Ensure that the layout of the trial is as shown in Figure 1, and carry out four and eight roller passes for the trials.

NOTE The standard 8 t roller should preferably be a tandem machine to facilitate counting passes; each pass will consist of one front and one rear wheel coverage of the machine.

d) To determine the mean density of each trial area, remove cores from each area as shown in the experimental layout in and measure their densities in accordance with clause **4** of BS 598-104:1989

3.3 Assessment

The effectiveness of the alternative machine shall be satisfactory for the purposes of this method if at each pass level investigated the mean density achieved is at least as high as that obtained with the conventional 8 t roller. Comparison of machines, however, shall take account of the respective covering capacities; the product of the width of the alternative roller and its speed in the trial shall be sufficiently great to result in a rate of compaction at least equal to that provided by the conventional roller.

4 Recommended procedures for the measurement of the temperature of coated mixtures

4.1 General

The temperatures of the mixed materials are specified in the appropriate clauses of BS 594 and BS 4987, and the recommendations in **4.2** to **4.6** are for guidance on the instruments and the method to be used in measuring the temperatures.

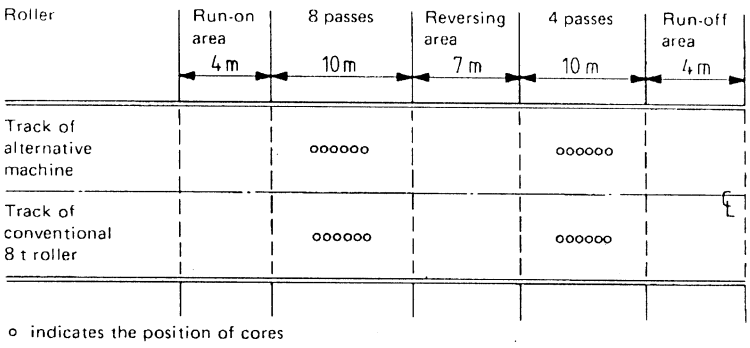

Figure 1 — Typical experimental layout to assess the effectiveness of an alternative roller

4.2 Type of thermometer

4.2.1 Several types of temperature measuring devices are suitable, e.g. electronic thermometers using thermocouples or thermistors, infra-red thermometers or bimetallic rotary thermometers. Thermometers of the latter type are possibly least satisfactory owing to their comparative flimsiness, slow response time and need for frequent recalibration. More robust models are available but robustness is associated with lengthened response time.

With the electronic type, the heat sensing element is very small and is normally mounted in the tip of the probe, and therefore one probe can be used for measuring temperatures of both bulk and laid material. Thermocouple probes available cover a large temperature range, e.g. of (0–400) °C, while those using thermistors are sufficiently accurate only over a limited range, e.g. of (0–100) °C.

The infra-red thermometer has the advantage of portability and permits many instantaneous readings to be taken in a short period of time.

4.2.2 All types of thermometer should have an accuracy of ±2 °C.

4.3 Measurement using probe thermometer

4.3.1 When measuring the temperature of the materials in a lorry or in a heap, the thermometer used should be at least 300 mm long.

4.3.2 When measuring the temperature of the material after it has been laid and during rolling, the temperature probe should have a temperature sensitive element small enough to be completely surrounded by the layer of material to be rolled.

4.3.3 The thermal capacity of the thermometer probe should be as small as possible, consistent with adequate robustness, to minimize the time required to obtain a reliable reading.

4.4 Measurement by hand-held infra-red thermometer

4.4.1 This type of thermometer has the advantage of being very portable and of providing many readings in a short period of time. However, because it depends on heat radiation and not contact as with other thermometer types it is less suitable for certain applications.

4.4.2 The infra-red thermometer should be set to the emissivity range appropriate for bitumen coated mixtures as detailed in the manufacturer's instructions.

4.4.3 When measuring the temperature of moving material, e.g. discharge from a hopper or lorry or in the augers of a paver, temperature reading should be taken by pointing the thermometer at the material from a distance of approximately 0.75 m unless otherwise recommended by the manufacturer.

4.4.4 When measuring the temperature of material in a lorry, in the hopper of a paver, in a heap or as a paved layer, the thermometer should be held at the recommended distance from the material. When appropriate the top 50 mm–100 mm layer of material should be removed and the temperature taken immediately with the thermometer.

4.4.5 If only the temperature at the surface is required, the thermometer should be held at the recommended distance from the surface and the temperature taken.

4.5 Procedure for temperature measuring

Two main principles should be taken into account when measuring temperature. First, when using probe thermometers because of the low thermal capacity and conductivity of coated mixtures, the insertion of a cold thermometer of relatively high thermal capacity will remove sufficient heat from the material to give a low reading of temperature, and second, the temperature can be expected to vary throughout the material.

The following precautions should be taken.

a) Allow the thermometer probe to heat up to approximately the true temperature of the material in one position and then move it quickly to an adjacent position to obtain a measurement.

b) For measurements of temperature in a lorry, take at least four, and preferably six, measurements at evenly spaced intervals down each side of the lorry and at least 500 mm from any edge. Insert the stem into the material to a depth of at least 250 mm or alternatively use an infra-red thermometer as detailed in **4.4**. Average the results.

c) For laid material, take measurements with the temperature sensitive element as close as possible to the mid-depth of the layer. Take at least four, and preferably six, measurements and quote their average.

NOTE When measuring the temperature of asphalt wearing course, because of the short time normally available between laying the asphalt and the chippings being applied or commencement of the rolling, it is unlikely that six measurements can be taken in a small area using a bimetallic thermometer because of the response time. If necessary, more than one thermometer should be used to avoid delays in rolling. Alternatively, an electronic type of instrument or infra-red thermometer can be used to obtain quicker readings

4.6 Calibration

4.6.1 Temperature measuring devices should be calibrated against a reference thermocouple, platinum resistance or reference mercury-in-glass thermometer at least every 6 months.

4.6.2 Infra-red thermometers should be calibrated against a reference thermocouple, platinum resistance or reference mercury-in-glass thermometer, or calibrated electrical source at least every 6 months.

4.6.3 Reference thermocouples, platinum resistance thermometers or electrical sources should be re-calibrated at least once every 2 years and reference mercury-in-glass thermometers at least every 5 years.

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Publications referred to

BS 593, *Specification for laboratory thermometers.*

BS 594, *Hot rolled asphalt for roads and other paved areas.*

BS 594-2, *Specification for the transport, laying and compaction of rolled asphalt.*

BS 598, *Sampling and examination of bituminous mixtures for roads and other paved areas.*

BS 598-104, *Methods of test for the determination of density and compaction.*

BS 4987, *Coated macadem for roads and other paved areas.*

BS 6100, *Glossary of building and civil engineering terms.*

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