

Bitumen road emulsions (anionic and cationic) —

Part 2: Code of practice for use of bitumen road emulsions

UDC 625.856.063:665.775.5

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW



Document Sharing Hub

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Road Engineering Standards Committee (RDB/-) to Technical Committee RDB/14 upon which the following bodies were represented:

- British Aggregate Construction Materials Industries
- County Surveyors' Society
- Federation of Civil Engineering Contractors
- Greater London Council
- Institute of Petroleum
- Institution of Civil Engineers
- Institution of Highway Engineers
- Institution of Municipal Engineers
- Road Emulsion Association Ltd.
- Society of Chemical Industry
- Coopted member

This British Standard, having been prepared under the direction of the Road Engineering Standards Committee, was published under the authority of the Board of BSI and comes into effect on 29 February 1984

© BSI 01-1999

First published as BS 2542
December 1954
First revision as BS 2542
December 1960
Second revision as BS 434-2
October 1973
Third revision February 1984

The following BSI references relate to the work on this standard:
Committee reference RDB/14
Draft for comment 80/13166 DC

ISBN 0 580 12839 3

Amendments issued since publication

Amd. No.	Date of issue	Comments
4757	December 1984	Indicated by a sideline in the margin

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 Information to be supplied by the purchaser	1
3 Materials	1
4 Design	1
5 Work on site	2
6 Repair of potholes and depressions	3
7 Surface dressing	3
8 Formation: sub-base and base sealing	6
9 Grouting	7
10 Retreading	8
11 Premixing	9
12 Coated stone	10
13 Mist spraying	11
14 Tack coating	11
15 Curing of pavement quality concrete	11
16 Slurry sealing	11
17 Miscellaneous uses	12
Appendix A Wet track abrasion test	14
Table 1 — Classes of emulsion for normal uses	1
Table 2 — Rates of application of chippings	4
Table 3 — Target rates of application for lane traffic categories 4 and 5 (cold emulsion)	5
Table 4 — Target rates of application for lane traffic categories 2, 3, 4 and 5 (K1-70 emulsion applied hot)	6
Table 5 — Target rates of application of K1-70 emulsion for impervious hard shoulders	6
Table 6 — Typical rates of application for grouting	7
Table 7 — Typical mixtures	9
Table 8 — Grading of aggregate for slurry sealing	12
Publications referred to	Inside back cover

Foreword

This revision of this Part of this British Standard, prepared under the direction of the Road Engineering Standards Committee, contains recommendations for the use of anionic and cationic emulsions for road and other uses. It supersedes the 1973 edition which is withdrawn.

Many minor alterations have been made to the previous edition of this standard as a result of users' experience and a major alteration has been made to the recommendations for the target rates of application of emulsions for surface dressing.

NOTE Emulsions are normally sold by mass, but as gauging by mass under site conditions is impracticable, the rates of application are given throughout this standard as litres per square metre (L/m^2). One kilogram of cold emulsion is normally 0.98 L to 1.0 L depending upon the composition, temperature, etc. and one kilogram of K1-70 at the spraying temperature (75 °C to 85 °C) is 1.02 L to 1.03 L, so that within the limits shown for various applications litres and kilograms to 0.1 can be considered as synonymous.

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 16, 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 Part of BS 434 provides guidance on the general usage of anionic and cationic bitumen emulsions on roads and other surfaces which are specified in Part 1 of this standard.

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

2 Information to be supplied by the purchaser

2.1 The guidance given in this clause is intended to assist the purchaser in clearly indicating his requirements to the supplier for the purpose of either a quotation or an order.

2.2 When the purchaser is in no doubt as to the type of treatment required, the emulsion supplier need only be provided with the following information:

- a) the class and binder content of emulsion;
- b) quantity and type of container;
- c) the date and place of delivery.

2.3 When the purchaser requires advice as to the most suitable treatment, the following general information should be given to the emulsion supplier:

- a) the location and area to be treated;
- b) the type of treatment;
- c) the condition and nature of existing surfacing and the type of traffic carried;
- d) the approximate date (time of year) when the work is to be carried out.

2.4 When the roadwork is to be carried out by the contractor, the highway engineer should provide a full specification.

2.5 The time schedule should include dates for:

- a) the completion of preliminary work, if any;
- b) the delivery of materials;
- c) the start of various sections of the roadwork;
- d) the completion of various sections of the roadwork.

3 Materials

3.1 Emulsion. The class or classes of emulsion for normal uses are given in Table 1 for convenience, but reference should be made to the detailed recommendations given in the remainder of this standard.

3.2 Aggregate. Unless otherwise stated, the aggregate should comply with BS 63 or BS 1984. In cases where the purpose of the aggregate is also to provide a skid resistant wearing surface, the minimum polished stone value of the aggregate (determined in accordance with BS 812) appropriate to the intensity and speed of traffic carried should be specified.

4 Design

4.1 General. Except for class K1-70, bitumen emulsions are fluid enough to be applied at atmospheric temperatures without heating and their viscosities are not materially affected by changes of temperature. Unlike hot-applied binders, they remain fluid immediately after application. The viscosity of emulsion used on a steep gradient should therefore be as high as is compatible with the conditions and method of application, in order to prevent undue flow of emulsion down the gradient.

Table 1 — Classes of emulsion for normal uses

Use	Clause	Emulsion class anionic	Emulsion class cationic
Coated stone	12	A2-57	K2, K3
Concrete curing	15	A1-40, A1-55	K1-40, K1-60
Grouting	9	A1-60, A1-55	K1-60, K1-70
Lean mix sealing	8	A1-40, A1-55	K1-40, K1-60
Mist spraying	13	A1-40	K1-40
Patching	6	A1-60, A1-55	K1-60
Premixing	11	A2-50, A2-57, A3	—
Retreading	10	A2-50, A3	K2
Sealing formation and sub-base	8	A1-60, A1-55	K1-60, K1-70
Slurry sealing	16	A4	K3
Surface dressing and sealing	7	A1-60, A1-55	K1-60, K1-70
Tack coating	14	A1-40	K1-40
Miscellaneous	17	By agreement between the highway engineer and the supplier	

Bitumen emulsions can normally be applied to damp surfaces with satisfactory results but, since they contain water, they are liable to be adversely affected by frost or rain during or directly after application. Work should therefore not be carried out in frosty or wet weather. However, cationic emulsions tend to break more rapidly than anionic and, particularly class K1-70, are less susceptible to rain. In surface dressing and premixing, abnormally hot weather may also cause difficulty and traffic should, if possible, be kept off the road for a few hours after the work is completed.

Special attention is drawn to the fact that anionic and cationic emulsions cause mutual coagulation if mixed together. Therefore, any equipment which has or may have been employed for cationic emulsions should be thoroughly cleaned before it is again used for anionic emulsions or vice versa.

4.2 Breaking of emulsions. Breaking is indicated by a change in colour of the emulsion from brown to black. The rate of break of an emulsion is dependent upon the following factors:

- a) the composition of the emulsion;
- b) the rate of evaporation of the water, which in turn is dependent upon wind conditions, relative humidity, atmospheric temperature, rate and method of application;
- c) the porosity of the surface to which the emulsion is being applied and the consequent removal of water by capillary attraction;
- d) the chemical and physical influences of the aggregate with which the emulsion comes in contact;
- e) the mechanical disturbance of the emulsion/aggregate system during laying and rolling or by the action of traffic.

When the breaking of the emulsion is likely to be delayed, for instance when evaporation is slow, it is desirable that traffic should be kept off the work for as long as possible after rolling, or at least until it is clear that the emulsion has broken, if the treated section cannot be closed to traffic, then the speed of the traffic should be kept as low as possible and should not exceed 30 km/h (20 m.p.h) until the emulsion has broken.

Lightly coated chippings may be used with the emulsion but, as this can delay the breaking, allowance should be made for this by suitable traffic control.

5 Work on site

5.1 Health and safety when handling

5.1.1 General principles. Bitumen emulsions are safe and without risk to health when properly used. This does not obviate the need for working methods that avoid direct skin contact with the emulsions and adequate protective clothing (overalls, gloves, etc.) should be worn. Protective clothing should be maintained in a sound condition and cleaned or washed regularly. Drums of emulsion should not be heated without reference to the manufacturer.

5.1.2 Cleaning methods. Unbroken emulsion may be removed from any surface by washing with cold water but this method is ineffective for the removal of residual bitumen adhering to tools or appliances or to the person. In such cases, kerosine will assist the removal of the bitumen and protective gloves should be worn to minimize skin contact.

If kerosine is used on the skin, it is essential that it is subsequently removed by thorough washing with soap and water. The use before work of a barrier substance on the skin will usually dispense with the need for kerosine or other skin cleaners, other than soap and water.

5.2 Protection and storage of materials. Drums or other containers should be stored under clean conditions. Emulsions can be damaged by the freezing of the water contained within them and therefore the drums should be protected from freezing. If the storage period exceeds 1 month, the drums should be turned or inverted at least once a month.

Containers should be well rolled to agitate the contents before use. This applies particularly to emulsions in classes A1-40 and K1-40.

Care should be taken to prevent damage to the containers when handling them and removing the bungs.

Immediately after use, returnable containers should be completely emptied and the bungs and vent plugs replaced.

5.3 Preparation of surface. All mud, dust, leaves, etc. should be removed from the surface to be treated by brushing with hand brooms or with mechanical brooms. In very hot weather, it may be advisable to dampen the road surface with water in order to retard the loss of water from the emulsion, to reduce the rate of break and to encourage wetting of the surface by the emulsion.

It is essential that the road surface is free from standing water before the emulsion is applied.

5.4 Application

5.4.1 Hand application

5.4.1.1 Buckets and brooms. The emulsions may be applied from lipped buckets or cans fitted with duckbill spreaders or baffles and then evenly spread with medium-long bristled brooms or with squeegees. It is advisable to spread the emulsion in one direction only so as to avoid any scrubbing action.

NOTE Pitch-set brooms cannot be cleaned with solvent without the risk of damage. Wire-set brooms are therefore preferred.

5.4.1.2 Barrel trucks. Many different kinds of barrel trucks are available from which the emulsion is discharged directly from the barrel on to an apron, which aids even distribution.

5.4.2 Machine application

5.4.2.1 Small machines for pressure spraying by hand. These may be of two types, either those where the pressure is applied to the emulsion indirectly by means of compressed air, or those where the emulsion itself is pumped. Both types of machine should comply with BS 3136. All hoses and seals should be manufactured of materials resistant to the effects of emulsion and kerosene.

5.4.2.2 Bulk spraying distributors. Where the surface to be covered is of any considerable extent, specially designed bulk spraying distributors should be used for the application of the material. These are generally operated by the manufacturer of the emulsion or by specialist contractors. Distributors for cold applied emulsions should comply with BS 3136 and distributors for class K1-70 emulsions should comply with BS 1707.

NOTE It is not possible to lay down a precise viscosity range for emulsion for spraying as this is partly dependent upon the characteristics of the spraying machine. As a general guide however, a maximum viscosity of 9 degrees Engler (°E) at the temperature of spraying is suggested. If difficulty is experienced, reference should be made to the manufacturer of the emulsion and/or spraying equipment.

5.5 Maintenance of equipment. All mechanical spraying plant should be kept in a clean and sound condition, or inefficient spraying may result.

6 Repair of potholes and depressions

The emulsion should be class A1-60, A1-55 or K1-60.

Potholes and deep depressions should first be cleaned of all loose material and the area should be cut out to a regular shape with all the sides vertical or slightly undercut. If the exposed surfaces are very dry, they should be moistened with water in order to ensure better penetration of the emulsion. The bottom and sides of the hole or depression should be thoroughly coated with emulsion. Clean aggregate of the appropriate size (no larger than about two-thirds of the depth of the hole or complying with nominal size 28 mm of BS 63-2, whichever is the lesser) should be placed in the hole to a thickness slightly greater than its depth and well rammed or rolled in. The minimum amount of emulsion required to coat the stone should then be poured on. The patch should then be covered with clean 10 mm or 6 mm chippings and again rolled or rammed.

Shallow depressions should first be brushed clean and then levelled by the application of a coating of emulsion. Clean chippings of a size approximating to the depth of the depression should be placed in the hole and well rolled in.

NOTE 1 It is strongly emphasized that the minimum quantity of emulsion necessary should be used, for both potholes and depressions, so as to avoid a "fat" spot in the road.

NOTE 2 If repairs are to be made using asphalt or macadam, emulsion should be used to coat the bottom and sides of the prepared hole before infilling.

7 Surface dressing

NOTE The general principles of surface dressing given in this clause are in accordance with Road Note 39 (second edition).¹⁾

7.1 General

7.1.1 Preparation of the surface. Preparation of the surface should be carried out in accordance with 5.3. All potholes and depressions should be made good and allowed to settle down thoroughly under traffic before surface dressing. Some surfaces will require special treatment and attention is drawn to 7.4.

7.1.2 Rate of application of emulsion. The rate of application of emulsion will depend upon the following:

- the density of traffic;
- the nature of the surface to be dressed, e.g. roughness, porosity and hardness;
- the type and size of chipping to be used.

¹⁾ Road Note 39 (second edition). Recommendations for road surface dressing (TRRL/DTp). Available from HMSO.