Road Emulsion Association Limited

Technical Data Sheet No.1

Bitumen Road Emulsion

Revised by the Association's Technical Committee - August 2025

1. Introduction

Bitumen is a product from the distillation of crude petroleum and is produced in a wide range of grades whose properties vary from hard and brittle to soft and viscous at service temperatures. Many of these grades are used for road maintenance and construction and to facilitate its use it is necessary to temporarily reduce their viscosity. This reduction can be achieved by the use of solvents, or by applying heat, or by a combination of solvents and heat, or by emulsification.

2. Bitumen Road Emulsion

Bitumen emulsions are heterogeneous, two-phase fluid systems consisting of two immiscible liquids, bitumen and water, stabilised by an emulsifier. The bitumen is dispersed throughout the continuous aqueous phase in the form of discrete particles, typically 1.0 to 10 microns in diameter, which are held in suspension by electrostatic charges imparted to the bitumen particles by an emulsifier. Emulsions in which the bitumen particles are positively charged are known as Cationic Emulsions and those in which the particles are negatively charged as Anionic Emulsions. It is vitally important that the two types of emulsion are never mixed as this causes rapid coagulation of both.

2.1 Characteristics

The main advantage of Bitumen Road Emulsions is that the relatively high viscosity of cold bitumen is retained in a form which can be used easily at comparatively low ambient temperatures, such that when the bitumen is released from the emulsion the correct grade is made available for its intended purpose. The process whereby the bitumen is released from the emulsion is known as "breaking" and involves the formation of a continuous film of bitumen from the individual discrete particles originally present in the emulsion. The breaking of Anionic bitumen emulsions involves the substantial removal of water, mainly by evaporation but also by absorption through surfaces in contact, particularly those of mineral aggregates. For Cationic emulsions a significant factor which contributes towards the breaking, in addition to removal of water, is a physiochemical effect which involves adsorption of positively charged emulsifiers on to negatively charged surfaces in contact, thus assisting in the destabilisation of the emulsion. For this reason, Cationic emulsions possess good adhesive properties with respect to adhesion of the residual bitumen to mineral aggregates and are by far the most widely used type of emulsion used in road applications in the UK. Anionic emulsions are the most widely used in non-road or "industrial" applications. The intrinsic rate of break of bitumen emulsions is controlled by the careful selection of emulsifiers used in the emulsion during manufacture and can be selected to be from very rapid to very slow depending upon the particular application. Other factors which influence the rate of break in the field include weather conditions and mechanical forces such as rolling, trafficking and mixing operations.

2.2 Specifications

Historically BS 434-1 [1] defined the nomenclature and specifications of bitumen emulsions in the UK. For Anionic emulsions BS 434-1 is still in use, but European Standard BS EN 13808 [2] is now used to define the grades of Cationic bituminous emulsions.

2.3 Uses

Table 1 provides a summary of the various processes in which emulsions are normally used with references to REA Technical Data Sheets (that are freely available on www.rea.org.uk) where further information can be found.

Table 1. TYPICAL USES OF ROAD EMULSIONS

Use	Purpose	REA TDS Nos
Bond Coat	Provision of an adhesive film between surfaces	5, 7
Coated Stone	Production of macadam for stockpiling	11
Concrete Curing	Curing of pavement quality concrete	6
Grouting	In-situ stabilisation of surfacings	7, 8
Lean Mix	Curing of lean mix and other cementitious bases	6
Mist Spraying	Rejuvenation of deteriorating surfaces	12
Patching & Velocity Patching	General repairs	8
Pre-mixing	Production of macadam for immediate use	11
Retread/Regen	In-situ recycling of existing surfacing	7,10
Sealing of Formation and Sub-bases	Means of maintaining moisture equilibrium	6, 7
Slurry and Micro Surfacing	Production of slurry for surface sealing	7, 9
Surface Dressing	Sealing and re-texturing of surfacings	4, 7, 8

2.4 Advantages of using Bituminous Emulsions include:-

1. High viscosity bitumen is retained in a form which may be used at low temperatures.

2. Because of the low temperature of application and of storage, the possibility of thermal degradation of the binder is minimised.

3. Emulsions have “built-in” wetting and adhesion properties.

4. The low temperature of application & storage minimises hazards from fuming and improves safety.

5. Fire risk is minimised.

6. Energy use is minimised by the low temperature of storage & application giving significant environmental benefits.

Emulsions can and are being further developed to play an ever-important role in an increasingly energy conscious age. The Road Emulsion Association is actively involved in this programme.

3. Selection of Appropriate Classes from BS EN 13808

3.1 Nomenclature

BS EN 13808 [2] uses a maximum of seven terms in the identification of a bituminous emulsion. These terms describe the following properties of the emulsion Particle Polarity, Binder Content, Binder Type and Breaking Behaviour and their use is illustrated in Table 2.

Table 2 Denomination of the abbreviation terms

Position	Letters	Denomination	Supporting document
1	C	Cationic bituminous emulsion	EN 1430 (particle polarity)
2 and 3	2 digit number	Nominal binder content in %(m/m)	EN1428 (water content) or EN 1431 (recovered binder + oil distillate)
		Indication of binder type	
4	B	Paving grade bitumen	EN 12591 (specification for paving grade bitumen)
5 (where applicable)	P	Addition of polymers	EN 14023 (specification framework for polymer modified bitumens)
5 or 6 (where applicable)	F	Addition of more than 3%(m/m) of flux based on emulsion	The type of flux may optionally be indicated by replacing the F by Fm (for mineral flux) or Fv (for vegetable flux
5 or 6 or 7	from 2 to 10	Relative breaking behaviour	EN 13075-1 (breaking value), and EN 13808 (table 2)

The grade of bituminous base binder, as described by EN 12591, EN 14023, or EN 13924, may optionally be appended to the emulsion abbreviation terms.

Examples for abbreviation terms:-

C69B3

Cationic bituminous emulsion with a nominal binder content of 69% produced from paving grade bitumen and having a Class 3 breaking value.

C69BP3

Cationic bituminous emulsion with a nominal binder content of 69% produced from bitumen, containing polymers and having a Class 3 breaking value.

C60BF4 40/60

Cationic bituminous emulsion with a nominal binder content of 60% produced from bitumen, containing more than 3% flux, having a Class 4 breaking value and produced using 40/60 penetration grade bitumen.

Note

i) This technical data sheet provides a basic interpretation of grade descriptions. Emulsions could potentially be specified with any combination of classes, but this would lead to unrealistic grades of emulsion. Therefore, the National Annex to BS EN 13808 provides further guidance for the selections and specification of emulsion grades.
ii) BS EN 13808 is only applicable to Cationic grades of emulsion as Anionic grades continue to be specified in BS 434-1.

3.3 Polymer Modified

The uses of Polymer Modified Bitumen Emulsions have increased dramatically in the road maintenance industry and are specified by BS EN 13808. In view of this situation, the Specification for Highway Works Clauses 918, 919, 920, 922 [3], and their Notes for Guidance have specified properties for emulsions for Slurry Surfacing, Surface Dressing and Bond Coats, Tack Coats & other Bituminous Sprays. BS EN 13808 provides a single specification to adequately categorise these materials.

3.4 UKCA/CE marking

At the end of June 2013, the Construction Products Regulation (CPR) was fully implemented in all EU member states. Since then, Construction products covered by a harmonised European standard (EN) have a legal requirement to be CE marked in order to place them on the European market. The UK withdrew from the European Union in January 2020 and in January 2021 introduced its own UKCA mark. A transition period for implementation of the UKCA mark was introduced but this period has been extended indefinitely meaning that both CE and UKCA Marking can continue to be used.

References

[1] BS 434-1:2011+A1:2016 Bitumen road emulsions - Part 1: Specification for Anionic bitumen road emulsions.

[2] BS EN 13808:2013 Bitumen and bituminous binders – Framework for specifying Cationic bitumen emulsions.

[3] Manual of Contract Documents for Highway Works, Volume 1, Specification for Highway Works Series 900 Road Pavements – Bituminous Bound Materials.

For further information on all REA Technical Data sheets please look on the "Technical Datasheets" webpage on www.rea.org.uk

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