

1. Introduction

Surface dressing with bitumen emulsion is a well established road surface treatment process. In recent years there has been a marked increase in the technical performance of emulsion binders and onsite application techniques, which in turn has seen enhanced performance and durability of the finished dressings. This development has primarily been due to the increased usage of polymer modified emulsion binders and the use of encapsulation treatments. Surface dressing binders are specified according to the framework specification BS EN 13808 [1].

2. Process and Benefits

Surface dressing is designed as a repair and maintenance process and as such it is critical that the system is used at the appropriate time in the life of the pavement. If this is applied correctly, the life of the structure can be enhanced significantly. Subsequent surface dressings can be applied on top to extend the pavement life. It should, however, be noted that if the existing surface condition is not suitable, other systems should be considered.

The benefits of this type of process are many and varied and include the following: -

- Cost effective when compared to many other existing systems.
- Reduced traffic disruption during application.
- Speed of process.
- Improved health and safety aspects over hot mix alternatives.
- Potential reduction in Carbon footprint.

Surface dressing emulsions have been specifically designed to enable even application through the spraybar yet resist flow once on the road. The emulsion can be applied at temperatures between 65 and 90°C according to supplier's recommendations. Temperatures above 90°C must be avoided to reduce the risk of product degradation (due to localised boiling).

3. Surface Dressing Systems

There are a variety of surface dressing processes that can be applied, and it is important that the most appropriate is selected to suit the specific site conditions (see below).

For guidance as to the most applicable design process, TRL Road Note 39 [2] should be used.

Examples of typical designs are: -

3.1 Single Binder Application

- **Single Surface Dressing.** A layer of binder followed by a layer of single sized aggregate chippings.
- **Racked-in Surface Dressing.** A layer of binder followed by a double layer of chippings (large single sized chippings followed by smaller single size chippings).

3.2 Double Binder Application

- **Double Surface Dressing** a layer of binder followed by a layer of single sized larger chippings, followed by a second layer of binder and a final application of single sized smaller chippings.

- **Inverted Double Surface Dressing (Pad Coat Technique)** This method utilises a layer of binder followed by a layer of small single sized chippings followed by another layer of binder and a final application of larger single sized chippings.

3.3 Sandwich Surface Dressing

Where road surfaces are binder rich, or in hot weather on heavily trafficked single carriageways, a layer of chippings can be spread prior to a single surface dressing being applied.

4. Emulsions

Surface dressing emulsions in the UK are designed around the specification BS EN 13808 [1] and TRL Road Note 39 [2]. Almost exclusively, cationic surface dressing emulsions used in the UK have a minimum binder content of 67% and are usually polymer modified.

BS EN 13808 [1] is a framework guide for specification. As such, there are a number of classes which can be selected to define the emulsion characteristics. A number of the characteristics define the properties of the emulsion whilst a number define the properties of the recovered (residual) binder.

The emulsion is generally defined according to properties relating to: -

- Chemical nature (C for Cationic)
- Binder content (nominal binder content)
- Indication of type of binder and in some instances the specific grade
- If there is polymer modification
- If the binder contains flux at greater than 3 % (m/m)
- Breaking value of the emulsion

For example, a typical surface dressing binder in use in the UK may be abbreviated as C69BP3. This shows the emulsion is cationic, with a nominal binder content of 69%, contains paving grade bitumen, polymer (no reportable flux content) and a class 3 break index according to BS EN 13808 [1].

Viscosity is an important factor to ensure even application through the spraybar, yet resistance to run off on the road. BS EN 13808 [1] allows various test methods to be utilised for measuring viscosity. Reference to the supplier for further guidance is recommended.

It is important to note that the characteristics of the emulsion do not reflect those of the residual binder. Emulsion characteristics may be very similar in application and analysis, though the properties of the binder can differ significantly, even ranging from a non-modified to a super-premium binder (see below).

Regarding the Residual binder, there are a number of properties which can be reported such as penetration and softening point.

However, in the UK the most specified parameter is Cohesion according to the Vialit Pendulum test. Essentially there are 4 classes of emulsion performance; related to the level of cohesion of the residual binder as below: -

- Class 2 - Super-premium (Vialit cohesion by Pendulum $\geq 1.4 \text{ J/cm}^2$)
- Class 3 - Premium (Vialit cohesion by Pendulum $\geq 1.2 \text{ J/cm}^2$)
- Class 4 - Intermediate (Vialit cohesion by Pendulum $\geq 1.0 \text{ J/cm}^2$)
- Class 5 - Conventional (Vialit cohesion by Pendulum $\geq 0.7 \text{ J/cm}^2$)

For more complete performance and classification information, suppliers' Technical Data sheets should be referenced. Where emulsion samples are required, guidance should be sought from BS EN 58 [3].

5. Aggregates

The cleanliness, dust content and physical and chemical properties are critical to the success of the process. Excess dust on the aggregates can interfere with the adhesion of the binder to the aggregate. For this reason, damp chippings are preferable to dry chippings. Guidance for application and specification can be found in TRL Road Note 39 [2] and BS EN 13043 [4].

6. Application

Surface dressing requirements should be referenced against BS EN 12271 [5]. Critical controls should be on even and accurate application of the emulsion to the design levels, accuracy of application of the chippings, effective rolling and subsequent traffic control. Continued after-care is essential for the success of the surface dressing process.

7. Encapsulation

Encapsulation enables Surface Dressing chippings to be locked into the surface, resulting in a safer drive, especially for cyclists and motorcyclists. It also gives an aesthetic appearance to the road surface and can enable the carriageway to be trafficked quickly following application.

8. 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 EN 13808:2013 Bitumen and bituminous binders - Framework for specifying cationic bituminous emulsions
- [2] Road Note 39: Design Guide for Road Surface Dressing - published by Transport Research Laboratory
- [3] BS EN 58:2012 Bitumen and bituminous binders. Sampling bituminous binders
- [4] BS EN 13043:2002 Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas
- [5] BS EN 12271:2006 Surface dressing -Requirements

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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