SURFACE DRESSING BINDERS

1. INTRODUCTION

Surface dressing comprises spraying the road surface with a film of binder followed by the application of a layer of stone chippings. After rolling and light trafficking, any excess of chippings is swept up. After the dressing has stabilised it is opened to traffic. The main functions of surface dressing are:

a. To seal the road surface against ingress of water
b. To arrest any surface disintegration
c. To improve skid resistance and texture

It is the combination of chippings of suitable quality and size, held in place by an effective binder, which results in satisfactory surface dressing. Road Note 39 provides sound guidance on surface dressing design and practice.

In Road Note 39, which should be considered as essential reading, the selection of the correct size of chippings and the required rate of binder application is based on:

a. The number of medium and heavy vehicles of more than 1.5 tonnes unladen weight per lane, per day.
b. The hardness of the road relative to surface temperature characteristics.
c. The degree of difficulty – i.e. to what extent it is subjected to braking, turning and accelerating stresses
d. The existing condition of the road to be re-surfaced.

Precise requirements or specification of the finished dressing.

It should be noted that Road Note 39 contains essentially general and “target” recommendations providing sound overall basic guidance. These recommendations must be considered, together with any specialised information available on binders or local conditions, in order that the best possible work specification is devised.

Surface dressing binders should be CE marked and comply with BS EN 13808:2013 “Bitumen and bituminous binders-Framework for specifying cationic bituminous emulsion”.

Information on bitumen emulsions, CE marking and BS EN 13808 can be found in “Technical data sheet No1 Bitumen Emulsion” on the Road Emulsion Association website: http://www.rea.org.uk/technical.htm.
2. THE FUNCTIONS AND PROPERTIES OF BINDERS

2.1 Functions

The functions of the binder in surface dressing are

- to provide adequate adhesion between the chippings and the road surface
- to seal the surface of the road against ingress of water
- To arrest disintegration of the existing road surface

Any other function of the binder is dependent on the nature of the road and the traffic stresses applied to the surface dressing. It is unlikely that all binders will prove to have properties which will give optimum performance under all conditions. Nevertheless, to achieve the benefits of these functions, certain properties will be common to all binders.

2.2 Properties

The following properties are necessary if binders are to be used successfully for surface dressing:

- they must be sufficiently fluid to spray
- they must be sufficiently fluid to “wet” the road surface and the chippings
- they must be sufficiently stiff (i.e. have sufficient cohesive strength) to hold the chippings against traffic forces in both the early stages and longer term
- they must not become so brittle in cold weather that chipping loss occurs
- they must not become so soft in hot weather that loss of chippings and bleeding occurs

2.3 Viscosity

The word “fluid” as used in the paragraph above indicates the ease with which a binder can flow. Fluidity can be considered in terms of viscosity.

The viscosity of surface dressing binders varies with temperature. As the temperature rises, the viscosity decreases. Use is made of this property in order to select the appropriate temperature for spraying each binder. The spraying temperature is regulated to provide the correct viscosity, to achieve good transverse distribution across the spray bar and to secure “wetting” of the road surface and the chippings (i.e. to achieve a good “bond”).

If the viscosity is too high, it is unlikely that an even transverse distribution will be achieved. Furthermore, good wetting will not occur and chippings will be lost. However, if the viscosity is too low the material could flow off the high points of the road and pool in the low spots, or run off the road altogether. Once again, the transverse distribution could be compromised.
3 BINDERS AVAILABLE

The binders used contain bitumen either as unmodified penetration grade or modified using polymeric additives. When in their normal state the binders will be too viscous to spray and therefore has to be treated to allow application at lower temperatures.

In order to achieve a workable viscosity for application, bituminous binders are treated using the process of emulsification:

The process of emulsification allows the bitumen to be dispersed as very small micron sized droplets in an aqueous soap solution. The low viscosity of the water aids application, yet once applied, the water is lost leaving only the stiff bitumen.

Bitumen emulsions have the benefit of:

- enabling a binder of higher viscosity (once the emulsion has broken) to be applied to the road at a lower temperature
- can be used on damp (but not wet) roads using damp chippings. The bond is achieved once the emulsion is “broken”.

The process by which the bitumen emulsion reverts to its original water and bitumen components is known as “breaking”. The break of an emulsion is often indicated by a progressive change in colour from brown to black. This break is a complex process in which, initially, bitumen separates from the water in the emulsion onto the road and onto the applied chippings. The final stage of break involves the loss of water by evaporation so that a continuous adhesive film of binder is produced. The loss of water from an emulsion will be delayed if the road surface is very wet or if there is a high level of moisture in the air (i.e. if it is very humid). These conditions will unduly prolong the breaking period. Because emulsions contain water, they must be protected from frost whilst in storage.

Properties associated with modified bitumen binders;

The majority of materials sprayed today contain modification in many forms, chiefly of synthetic elastomers, plastomers or natural elastomers.

The benefits of such modification can be seen in the fact that they exhibit:

- higher resistance to shear
- increased tenacity of bond
- reduced susceptibility to extremes of temperature

In simple terms, this increases the performance of the binder in service particularly in the following areas:

a) increasing the temperature at which the binder begins to soften, reducing the occurrence of bleeding and fatting at stress areas
b) improves the low temperature adhesion and elasticity during the serviceable life of the binder (reduced embrittlement)
c) improved elasticity to bridge hairline cracks
d) improved early stability in the dressing
e) improved long term adhesion of the dressing  
f) improved longer term durability of the dressings as thicker binder films can be applied  
g) extends the life of the dressing, particularly when high quality aggregate is used

4 SELECTION OF BINDERS TO MEET SITE REQUIREMENTS

Good results can be achieved with all binders given proper preparation, design, execution and after-care. However, the matching of binders to sites representing different degrees of difficulty requires care.

4.1 Specification

Emulsions used for surface dressing should be CE marked and comply with BS EN 13808. Bituminous binders used in emulsions for surface dressing are specified in terms of performance and are split into 4 categories based on the level of cohesion of the residual binder.

1) Non-Modified  
2) Intermediate  
3) Premium  
4) Super Premium

Note:- For CE Marking there is no cohesion requirement for non-modified binders.

Further information is available in technical data sheet No.4 “Surface Dressing With Bitumen Emulsions” on the REA website:-  

Guidance on binder choice and surface dressing design can be found in Road Note 39 Issue 7 available for download from the TRL:  
https://trl.co.uk/reports/RN039

5 HANDLING OF SURFACE DRESSING BINDERS

All surface dressing binders, are hot at spraying temperatures. The exception is C60B type emulsion which is sometimes used for footway dressing. They must, therefore, be handled with care.

Advice on the handling of binders is contained in the RSTA “Operators’ Guide to the Safe Use of Surface Dressing Sprayers” which forms Section 7 of this Code of Practice.

6 CHANGING THE TYPE OF BINDER USED IN A SPRAYING MACHINE

Emulsion binders are proprietary in nature and are formulated by the producer to give the required properties. The targeted properties will be related to:
1) Stability to Shear and Storage.
2) Viscosity for application.
3) Breaking performance on application.
4) End performance binder properties.

Different classes of emulsion from the same or different producer may vary chemically and therefore may not be compatible on mixing. Prior to changing binder types in spraying machine the contractor should check compatibility with the supplier to avoid unnecessary changes to the emulsion properties.
APPENDIX A

FEEDBACK ON THIS DOCUMENT
Any observations, feedback or complaints relating to the content of this document or the process described herein should be addressed (using the form below) to:

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APPENDIX B

DOCUMENT CONTROL

Issue Statement

Issue 5                                          2008
Issue 6                                          2011
Issue 7                                          2014
Issue 8                                          2015
Issue 9                                          2018

REVISION LIST – AMENDMENTS MADE IN THIS ISSUE

<table>
<thead>
<tr>
<th>Revision</th>
<th>Page</th>
</tr>
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<tbody>
<tr>
<td>Document significantly reduced in content to avoid duplication with Technical Data Sheets produced by The Road Emulsion Association.</td>
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