



Road Emulsion Association Limited

## REAL Technical Data Sheet No. 5 - Bond Coating

### Introduction

Tack coating is an established technique of providing a thin adhesive film of bituminous binder between an existing road surface and an overlay or between courses in road construction. Traditionally, overlay materials have included hot rolled asphalt surfacing courses, macadams, slurry surfacings and the like. The function of the tack coat has been to minimise the effect of residual surface dust on the existing surface and provide an adhesive surface for the overlay. Tack coats are also used in patching and inlay work where further functions of priming and waterproofing are necessary. Bond coating is a similar process to tack coating, but is generally used in applications where there is a greater reliance on the strength of the adhesive coat. Modern road courses such as SMA, Thin Surfaces, Porous Asphalts tend to be laid much thinner than traditional surfacings and place greater reliance on the inter-surface bonding layer to reduce the risk of slippage between the two courses and allow traffic stresses to be distributed uniformly. Although the problems caused by surface dust on the road are minimised, it is still fundamentally important to sweep the surface prior to application of the bond coat. A further advantage of a bond coat is that during the paving or rolling of the new overlay, pushing and sliding are reduced, thereby allowing for improved compaction with a resultant increased life expectancy of the surfacing. Many of the modern surfacing layers tend to be more open in texture and consequently more porous. The bond coat therefore has an important contribution to waterproofing and inhibiting water ingress to the structural layers.

### Emulsions for Bond Coating

Traditionally, the majority of tack coats were applied as thin films of C40B4 (K1-40) or A1-40 bitumen emulsion (1) in constructions involving hot rolled asphalt or macadams, as specified by relevant British Standards (2), (3). Such application was sufficient to ensure good adhesion between the existing substrate and various layers of construction material. However, during the 1990's a significant change in construction and maintenance practices occurred in the U.K., notably involving a decline in the use of hot rolled asphalt and a considerable growth in the use of thin surfacings. The shear force exerted by traffic at the surfacing/binder course interface increases with decreasing surface course thickness and with increasing traffic. Hence a thin surfacing is more demanding. To accommodate these shearing forces the role of the bond coat particularly its adhesive and cohesive strength, is very important. In this respect product types have been extended from the basic cold applied 40% tack coat emulsions to the bond coats with higher binder contents, very often polymer modified or incorporating harder grades of bitumen, most of which are applied hot at higher rates of spread. Examples of typical bond coats are C50BP3 (K1-50) to C65BP3 (K1-65), but other alternatives are possible and users should consult their supplier for assistance in choosing an appropriate grade.

### Rates of Spread

Tack coats or bond coats should be selected according to the type of residual binder required and applied at appropriate rates of spread. The bitumen emulsion should be applied, preferably by a calibrated spraying machine wherever practicable, as evenly as is possible to achieve complete, uniform coverage of the existing surface. Rates of spread vary in ranges depending on the type of emulsion, the nature of the new surfacing material and the surface upon which it is being laid. Tack / bond coat emulsions are formulated to provide a rapid break once sprayed onto the road; some emulsions are designed for hot application which normally enhances the speed of break. In general, rates at the top end of a particular range may be required for open textured or "hungry" surfaces.

Higher rates of spread may be applied at the kerb face or edge of the carriageway, where normally less compaction occurs and water ingress may be a problem

For hot applied thin surfacings, the type of emulsion varies according to the thickness of the surfacing layer. As a basic guide thinner surfacing layers will require the use of bond coats that give more cohesive residual binders. Cohesion ranges from the basic C40B4 (K1-40)/C60B3 (K1-60) tack coats at the lower end to the more cohesive proprietary polymer modified bond coat grades at the higher end. For concrete surfaces a polymer modified bond coat is always recommended when overlaying with hot thin surfacings.

When slurry surfacings are applied over concrete the use of a bond coat is always recommended.\*

Recognising the need for the more demanding requirements of bond coats, REAL member companies can offer a range of emulsions to suit particular requirements

\*The age and surface condition of the concrete must be considered, as fresh non-primed concrete can often leave a powdery surface, which is difficult to remove.

The following table gives a guide to the rates of spread applicable in various circumstances. The suggested emulsion type is only a guide, and REAL member companies may offer other grades which may also be suitable. BS 594 and BS4987 provide more detailed guidance on the rates of spread for tack/bond coats. For BBA/HAPAS approved materials the certificate should be consulted for rates of spread.

New Road Material	Existing Surface	Emulsion Type	Rates of Spread in kg/m <sup>2</sup> of residual bitumen
Hot Rolled Asphalt and Macadam	Cold Planed surfaces Macadams Concrete	Tack Coat C40B4 (K1-40) /C60B3 (K1-60)  Bond Coat	0.15 – 0.25
Hot Rolled Asphalt	Hot Rolled Asphalt	Tack Coat C40B4 (K1-40) /C60B3 (K1-60)  Bond Coat	0.15 – 0.25
Conventional Porous Asphalt/Friction Course	Hot Rolled Asphalt Macadams Airfield Pavements	Bond Coat  As per HA/SHW clause	0.15 – 0.25
Proprietary Porous Asphalt / Friction Course	Hot Rolled Asphalt Macadams Airfield pavements	Bond Coat  Polymer modified	As specified by supplier
Slurry Surfacing	Airfield Pavements  Concrete*	C40B4 (K1-40)  Bond coat	0.10 – 0.15  0.20 – 0.40
Conventional Thin Surfacing	Bituminous Surfaces  Concrete*	Tack Coat  C40B4 (K1-40)  Bond Coat  Polymer modified	0.15 - 0.60  As specified by supplier
Proprietary Thin Surfacing **		Bond Coat	

\* The age and surface condition of the concrete must be considered, as fresh non-primed concrete can often leave a powdery surface, which is difficult to remove.

\*\*Bond coat type and rate of spread as specified by supplier

## Application

It is essential that emulsions are applied uniformly over the surface. They should be allowed to break completely, i.e. turn from brown to black, before site traffic is allowed onto the surface. Excessive application should be avoided such as to cause ponding. This can lead to delayed emulsion break and “pick-up” by tyres of construction vehicles resulting in subsequent deposition on the finished surface and on exit roads. This is particularly the case for thin surfacings where excessive application can lead to “bleed-through” of binder. If the bond coat is to be subjected to temporary trafficking by site vehicles, a light application of coated grit at about 2.5 kg/m<sup>2</sup> will assist in preventing pick-up on tyres. Tack coats may be applied by hand lance (from drums), but preferably, to exercise maximum control over the uniformity and rate of coverage, they should be applied by conventional spray tankers or via integral paving machines. The use of integral pavers ensures no direct contact between the bond coat and site vehicles and is recommended wherever possible and particularly for very thin surfacings. Nozzle sizes of spray-bars should be appropriate to the type of emulsion being applied. Recipient surfaces should be clean and free from loose dust; they may be damp but standing water should not be present

### **(a) Working from Drums**

Working from drums is not recommended by the REAL for situations in which controlled spraybar application could be used. However, for situations in which there is no alternative, the following controls should be exercised. Before use and at prescribed intervals during storage it is important that drums of emulsion are well rolled. They should also be protected from frost during storage. (See REAL Technical Data Sheet No.2).(4)

The emulsion should be sprayed evenly from a hand lance with a circular action rather than with a side to side swing. To assist in the undertaking of work programmes it is convenient to calculate the number of drums required and to position these at intervals along the edge of the carriageway. For example, for a lane width of 3.65 metres at a rate of spread of 0.5 l/m<sup>2</sup>, the 200 litre drums should be set out at intervals of approximately 110 meters. For small areas, 25 litre containers may be more suitable to use. (At 0.5 l/m<sup>2</sup> 25 litres should cover about 50m<sup>2</sup>).

### **(b) Machine Work**

When emulsion is stored in a mobile storage tank or applied from a bulk distributor, it should be circulated thoroughly before use and at intervals during storage. (See REAL Code of Good Practice) (5). Spray distributors should initially be calibrated according to BS 3136 (6) or BS 1707 (7), BS EN 12272-1(8) as appropriate. During application the "carpet tile" (8) test may be used to check the rate of spread of the emulsion from bulk distributors (not from integral pavers) and the overall rate may be checked by comparison of the quantity of emulsion used against the area covered.

### **Cleaning and Maintenance of Equipment**

After use, brushes and equipment should be cleaned with kerosene or gas oil or other suitable solvent. (See REAL Technical Data Sheet No.3) (9) as recommended by the emulsion supplier. This dirty solvent must not be disposed of in the tack / bond coat emulsion tank. It is important that emulsion is not allowed to remain in hand sprayer pipe work after the completion of daily work schedules.

## **Health and Safety**

During bond coating operations all relevant Health and Safety information and safe working practices should be followed. This information is provided by the REAL and can be found in Technical Data Sheet No.2 (4) and in member companies' individual Material Safety Data Sheets covering Bitumen Road Emulsions

## **References**

1 BS 434: Part1. - Specification for bitumen road emulsions (standard to be replaced by EN13808)

2 BS 4987:- Coated macadam for roads and other paved areas

3 BS 594:- Hot rolled asphalt for roads and other paved areas

4 Recommendations for the Safe Handling & Storage of Bitumen Road Emulsions

5 Code of Good Practice for the use and Safety of Mobile Storage Tanks

6 BS 3136:- Specification for cold emulsion spraying machines for roads

7 BS 1707:- Specification for hot binder distributors for road surface dressing

8 BS EN 12272-1 - Rate of spread and accuracy of spread of binder and chippings

9 Recommendations for the Cleaning and Maintenance of Spraying Machines for use with Bitumen Emulsions

10. EN 13808 – Framework for specifying cationic bitumen emulsions

Note: Descriptions of emulsion grades in accordance with BS EN 13808 may change when UK Guidance document PD6690 is finalised. During the transition period in changing from BS434 Pt1 to BS EN 13808, typical BS EN 13808 grade descriptions are used in the text of this data sheet, followed by the BS434 Pt1 description in brackets. Technical Data Sheet No1 gives a basic

interpretation of grade descriptions from BS EN 13808, but for a full understanding of the specification and variations in grade descriptions, reference should be made to PD6690 when it is available.

*Revised by the Technical Committee, July 2006.*