

# **ADEPT SOILS & MATERIALS DESIGN & SPECIFICATION GROUP**

## **ADVICE NOTE ON BOND COATS BETWEEN ASPHALT LAYERS**

**JULY 2021**

### **Introduction**

ADEPT SMDS Group has produced this Advice Note on Bond Coats between asphalt layers as guidance for ADEPT members.

Tack coat and bond coat application 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. The purpose of a bond coat, which contains a polymer modified binder, is to enhance the durability of the pavement by:

- sealing the layer to prevent the ingress of water
- producing a fully bonded composite pavement structure
- minimising the risk of surface dust causing an adhesion issue

### **Standards**

The terms and definitions in BS594987 clause 3.1 states that bond coat is a “proprietary polymer modified bituminous binder used to promote adhesion between and/or sealing of layers in the construction and maintenance of roads and paved areas. It also includes the following notes: NOTE 1 Bond coats are polymer modified binders classified in accordance with BS EN 13808, BS EN 15322 or BS EN 14023. Bond coats are generally cationic polymer modified bituminous emulsions such as C50BP3 or C65BP3, although other types are sometimes needed for particular purposes and the supplier should be consulted and NOTE 2 Bonding and sealing between and around asphalt layers is essential to keep water out and enhance the durability of the road pavement.

BS 594987 (5.5.1 General) also states that a bond coat shall be applied prior to the laying of a new asphalt layer on any bound substrate. The enhanced adhesive and cohesive properties of bond coats are designed to provide greater confidence in the adhesion between layers, or to allow heavier rates of application to improve the impermeability of the surface of the lower layer, when compared with conventional bitumen emulsion tack coats.

British Standards, Specification for Highway Works Guidance and evidence from analytical pavement design are all supportive of bond coats.

### **Practicalities**

Historically, overlay materials have included hot rolled asphalt and macadam surface courses together with slurry surfacing however more modern surface courses introduced some 20 years ago such as SMA, Thin Surface Course Systems and Porous Asphalt tend to be laid much thinner than traditional surface courses. This places 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. BBA HAPAS approved Thin Surface Course Systems are systems because they include a bond coat as well as the asphalt itself.

Pavements constructed with bitumen rich mixtures were more likely to bond at the interface than modern materials with less binder, such as design mix asphalt concrete binder course

and base mixtures, and when comparing cores from old pavements with new ones shows the old pavement more blackish (rich in binder) than new ones which are lighter in colour. Cores cut now in both LA work and developer works are generally more likely to need sawing to test rather than splitting, which is a positive demonstration of bond. SMA it is nearly always overlaid on new binder course; however, a good bond coat is still required to provide a waterproofing seal.

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 underlying structural layers. The importance of bond coats has been covered in various publications as exemplified in the Bibliography.

Bond coats can be considered a “helping” agent to assist the bonding. A clean, relatively warm interface may develop bond between bitumen rich layers without a “helping” agent.

Tack coats have been applied in pavement construction in the UK since the early eighties and there are several factors to consider such as emulsion type, rate of spread, environmental/seasonal weather conditions, workmanship, foundation layers etc. BS594987 clause 3.2 tack coat refers to unmodified bitumen emulsion used to facilitate adhesion between layers in the construction and maintenance of roads and paved areas and notes that although tack coats have traditionally been used, they are no longer regarded as best practice and should only be used in footway surfacing.

BS594987 introduced bond coats in order to achieve superior performance and enhance pavement longevity. Milled surfaces provide a good mechanical key to assist friction bonding however the application of a bond coat, at the rate in BS594987 clause 5.1, provides confidence as a “dirty” layer encountered at shallow depth in pavement coring investigations has reflected failure due to de-bonding on a number of occasions.

Bond coats for bituminous mixtures, other than Thin Surface Course Systems to Clause 942, are covered in the SHW Volume 1, Clause 920 and reference compliance to BSEN 14023 and 13588. Requirements should be covered through Appendix 7/1 when required.

For Thin Surface Course Systems clause 942.17 states that “where required in the Installation Method Statement a bond coat or tack coat shall be applied. It shall be in accordance with the Installation Method Statement and is integral to the system. Unless otherwise stated in the Installation Method Statement it shall also comply with Clause 920 and BS 594987. A calibrated mechanised method of application shall be used unless otherwise agreed with the Overseeing Organisation”.

Ideally bond coats should be applied by a spray tanker for a safer way of working and control of application. It is recognised that for smaller areas it will be hand applied.

A full bond between bound layers is essential to obtain maximum performance from the pavement and to that end the use of a bond coat between layers will remain a requirement of the SHW and DMRB on the National network and used extensively by Local Authorities.

## **Conclusion**

There is no doubt that ADEPT SMDS Group consider bond coats to be important and that not applying a bond coat is not worth the risk of reduced life or premature failure. With the massive increase in traffic frequency and traffic loading in recent years together with changes in pavement materials and design the industry has recognised that bond coat application is an important and established technique. It is essential to reduce water ingress and produce a fully bonded construction with bond coats being covered by SHW, BS594987, HAPAS, Road Note 42 and REA Technical advice to name a few.

ADEPT SMDS Group advice would reiterate that the purpose of a bond coat is to enhance the durability of the pavement by:

- sealing the layer to prevent the ingress of water
- producing a fully bonded composite pavement structure
- minimising the risk of surface dust causing an adhesion issue

This is reiterated in the ADEPT research report from 2010, Climate Change and Evolved Pavements, Recommendation 15 which stated “Use bond coats to reduce voids at layer interfaces, promote adhesion and to waterproof asphalt pavements”.

ADEPT members are encouraged to ensure that such measures are taken through the appropriate use of specification clauses within their contracts, the application of British Standards and, where appropriate, a Product Approval Scheme such as BBA HAPAS.

## **Bibliography**

Shell Bitumen Handbook, 6<sup>th</sup> edition, 2014.

Climate Change and Evolved Pavements, CSS Research Project No 78, ADEPT November 2010.

Use of Bond Coats, HERG Report 12521, University of ulster March 2012.

Bond Coating, Technical Data Sheet no 5, Road Emulsion Association, March 2015

### **Historic papers (analytical design based)**

Hakim BA (2002) The importance of good bond between bituminous layers. Proceedings of the 9<sup>th</sup> International Conference on Asphalt Pavements. Copenhagen. August: paper No1: 5-3

Khweir K and D. Fordyce 2003 Influence of layer bonding on the prediction of pavement life Proceedings of the Institution of Civil Engineers, Transport 156, pp 73 to 83.

Roffe JC and Chaignon F (2002) Characterisation tests on bond coats, worldwide study, impact test recommendations. The 3rd International conference of Bituminous Mixtures and Pavements. Thessaloniki, Greece 21 – 22 November.