



Road Emulsion Association Limited

## REAL Technical Data Sheet No. 8 - Patching and Grouting

### Introduction

Patching and Grouting are two important construction and maintenance techniques, applicable to roads and footways, which capitalise on the versatility of bitumen emulsion. The particular properties of emulsions that are exploited in these techniques are their ability to be used cold, to penetrate substrates and to coat dry or damp aggregate in depth. After curing, the coalesced bitumen provides excellent cohesive strength.

Patching refers to the repair of cracks, crazing, potholes and depressions, and is an effective treatment prior to surface dressing. Emulsion is used as a bond coat when conventional macadams are involved. Proprietary brushing grades can be used as a replacement for hot bitumen as an edge sealant.

Grouting is a process involving the construction or stabilisation of road surfacings and footways whereby emulsion is applied to compacted dry or damp aggregate. The low viscosity of the emulsion permits in- depth penetration through the interstices of the aggregate. This technique involves the construction of a combined base/wearing course surfacing from a thickness of 50mm to 75mm in one course or up to 100mm in two courses, as may be specified.

### Patching

#### 1. Preparation

The failed area should be cut cleanly to a regular shape with vertical or slightly undercut sides. A diamond shaped cut is preferred for heavily trafficked roads. It is important that the extent of the cut is such that the edges of the repair material will be in contact with good quality existing material. All loose and unstable material should be removed.

Bond coat emulsion Class C40B4 or C40BF4 (K1-40) is applied, either by spraying or by pouring and brushing around the sides and base of the prepared area. Where dry surfaces are experienced these may be moistened with water to permit deeper penetration of the emulsion.

#### 2. Application

For heavily trafficked roads the patching material is frequently a hot, dense bituminous mix, either bitumen macadam or asphalt. If the depth of the repair area is more than 100mm the opening should be filled with successive layers of these materials which are levelled and compacted. The final layer should be suitably profiled. The patching material should contain a nominal size of aggregate which is about, but no more than, half the depth of the layer. A vibratory plate compactor is suitable for the consolidation of the lower layers and small surfaces, whilst a roller is more practical for larger surface areas. If the repair has an open texture it can be sealed with emulsion class C60B3 or C60BF3 (K1-60) at a rate of spread of

0.8 to 1.0 l/m<sup>2</sup> and blinded with grit or with pre-prepared slurry surfacing. (See Technical Data Sheet No. 9.)

On less heavily trafficked roads alternative patching materials and procedures are available.

(a) **Deferred Set Macadams**

Particular attention needs to be paid to providing vertical edges to the patches so that edge support is obtained.

(b) **Emulsion/Aggregate Mixes**

Several permanent cold lay surfacing materials are available. . In the past HAUC certification gave assurance of the proven performance of permanent cold lay materials; however this certification was brought within the BBA/HAPAS scheme in 2001.

(c) **In-Situ Patching**

Clean aggregate which should be 20/31.5mm nominal size, or no larger than about two-thirds of the depth of the hole, is placed in the prepared site to a thickness slightly greater than its depth. At this stage the minimum amount of emulsion required to coat the stone is poured on, followed by good compaction. The emulsion should be class C60B3 or C60BF3 (K1-60) and it is important that only the minimum quantity be used in order to avoid 'fat' spots on the road. The open textured patch should then be sealed by covering with clean 6.3/10mm or 2.8/6.3mm chippings and again well rolled.

3. **Surface Dressing**

If it is considered that the patch needs to be surface dressed in order to provide a matching texture to the rest of the road, then the following procedure should be followed. Brush sharp grit (preferably bitumen coated) into the pores of the macadam and sweep off vigorously any excess. Brush or spray apply C69B3 or C69BF3 (K1-70) (or a proprietary brushing grade) emulsion over the surface so that sufficient is present to 50% cup the chippings to be used (approx. 1 - 2 l/m<sup>2</sup> depending on the macadam texture and chipping size). Immediately apply the chippings and protect the patch from fast moving traffic until the surface is cured and stable. (Technical Data Sheet No. 4 or Road Note 39 provide general guidance). The following day remove any loose chippings.

## **Grouting**

Both full and semi-grouted work are recognised methods. In the former the quantity of emulsion used should be sufficient to coat the aggregate the full depth of the construction; for a semi-grout, a lower water bound layer is formed during the aggregate compaction stage and then the emulsion is applied in sufficient quantity to completely coat the aggregate above this water bound layer. Semi-grouted work is particularly suitable for footway construction.

1. **Preparation of Base**

After ensuring that the foundations and drainage are satisfactory, the base may be scarified or, alternatively, clean sand or quarry fines should be applied to a total thickness not exceeding 13mm.

## 2. Application of Aggregate

### (a) Selection

Any clean, angular aggregate can be used, provided that its crushing strength is sufficiently high to withstand the traffic to be carried. The grading should be selected with reference to the character of the aggregate and the depth of each compacted layer. Typical gradings would be:

#### **For 50mm compacted thickness**

60% 20/40mm nominal single sized material

30% 20/31.5mm nominal single sized material

10% 14/20mm nominal single sized material

#### **For 65 - 75mm compacted thickness**

60% 50mm nominal single sized material

30% 20/40mm nominal single sized material

10% 14/20mm nominal single sized material

The various sizes should be thoroughly mixed or alternatively the 14/20mm material should be spread over the larger aggregate, after the latter has been placed in position, and vibrated into the interstices.

### (b) Spreading and Compacting

For finished thickness up to 75mm the aggregate should be spread to the required contour such that, after rolling, the minimum thickness is not less than specified. The aggregate should be stockpiled outside the area upon which it is to be spread and protected from contamination. Spreading may be carried out manually using shovels, and not forks, care being taken to avoid segregation during the operation.

It may also be spread by mechanical means, such as a spreader box, when it is advisable firstly to spread the coarse aggregate and then to superimpose 14/20mm material as a separate operation.

Compaction should be carried out with a vibrating roller. Rolling should be longitudinal and progress from the sides towards the centre of the road or footway until there is no appreciable movement of the aggregate under the roller. If required, 14/20mm chippings can be added at this stage in order to correct any deficiencies there may be in the quality of the surface. For semi-grouted work, a quantity of water should be applied during rolling to form a uniform water bound layer. This lower layer should not exceed two-thirds of the total thickness of the compacted aggregate.

## 3. Application of Emulsion for thicknesses up to 75mm

For a full grout the quantity of the emulsion should be sufficient to penetrate the full depth of the course; it is advantageous to apply the emulsion in two stages. For semi-grouted work the quantity of emulsion used should be sufficient to coat the aggregate to the full depth of the layer above the non-bituminous layer. Typical rates of application for grouting are given in the following table:

<b>Thickness of Course</b>	<b>Nominal size of Aggregate</b>	<b>Full Grout</b>	<b>Semi-grout</b>
mm		l/m <sup>2</sup>	l/m <sup>2</sup>
50	40mm down	5.5 - 7.0	3.0 - 5.5
65	50mm down	7.0 - 9.5	4.0 - 7.0
75	50mm down	9.5 - 11.0	5.5 - 8.0

The emulsion used should be class C60B3 or C60BF3 (K1-60). Class C69B3 or C69BF3 (K1-70) emulsion may be used by agreement between purchaser and supplier (a lower viscosity is often used). Immediately after application of emulsion, clean 2.8/6.3mm or 6.3/10mm chippings should be spread uniformly over the surface to fill the interstices.

#### 4. **Application of Emulsion for thicknesses above 75mm**

Should a finished thickness of over 75mm be specified the aggregate should be spread, compacted and grouted with emulsion in two separate layers. The bottom layer should not have a thickness less than that of the top layer and the size of the aggregate should be appropriate to the thickness of each course. After the bottom course has been grouted the second layer of aggregate should be spread immediately, followed by compaction and grouting. The surface interstices of the second layer only are filled with chippings as in the case of a single course grout.

Work which is subsequently jointed should be finished off by layering and rolling a feathered edge not less than 300mm in width. Later this is cut back to a clean vertical face immediately before laying new material.

#### 5. **Surface Dressing**

After a stabilisation period of several days, the surface should be swept and sealed with a surface dressing of bitumen emulsion selected from classes C60B3 or C60BF3 (K1-60), or C69B3 or C69BF3 (K1-70) at an application rate of 0.9 to 1.4 l/m<sup>2</sup> with 6.3/10mm or 8/14mm chippings. For heavily trafficked roads, a second surface dressing of emulsion, of the same class and rate of application, and 8/14mm chippings should be applied about two or three months after the first application, to provide a non-skid surface.

*Revised by the Technical Committee, July 2006.*