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Resurfacing of roads and other paved areas using asphalt

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Information
Service

Introduction

Resurfacing of a road pavement or other paved area is undertaken for one or more of the following reasons:

- to add strength to the construction to prolong its life;
- to correct the surface profile and thus improve riding quality and surface water drainage;
- to restore skid-resistance to an old surfacing polished by traffic;
- to restore the aesthetic appearance of a worn, aged surface.

As long as an existing pavement is of adequate strength and correct profile, the last two objectives can be achieved by the application of a surface treatment such as surface dressing (the technique described in Road Note 39[1] in which a bitumen spray is applied to the road surface followed by an overall application of chippings. However, in many situations there is a need to correct defective longitudinal/transverse profiles, and frequently the pavement needs to be strengthened so that it can continue to carry traffic satisfactorily. In such circumstances a new asphalt surfacing will be required. With judicious choice of a suitable surfacing, strength and riding quality can be restored, an adequate skid resistance provided and a surfacing of pleasing appearance obtained which will give many years of trouble-free service.

There is a large and sometimes bewildering choice of asphalt surfacing materials, each with its own properties and uses. To ensure maximum benefit and durability from them when used in resurfacing, it is essential that the work is given detailed consideration both before and during its execution. Resurfacing is not simply a matter of "we'll put another couple of inches on".

This information sheet is intended to provide a brief aide-memoire of the main considerations to be made at the design stage and in carrying out the work. In all cases reference should be made to the current editions of the appropriate British Standard National Guidance Document PD 6691[2] and European Standards[3,4,5].

** The term 'asphalt' is used in this publication and unless accompanied by a descriptor for example "Asphalt Concrete" (AC), 'Hot Rolled Asphalt' (HRA) or 'Stone Mastic Asphalt' (SMA), is applied in its generic sense to refer to the range of mixtures used in the UK.*

Also, the terminology used in this guide for the structural elements of the pavement is that adopted for use in European Standards. Surface course was previously known as wearing course, binder course was known as basecourse and base was known as roadbase.

General principles

When preparing for resurfacing work the following main points need to be considered:

- The strength of the existing construction - is it adequate to carry future anticipated loadings and if not, what degree of strengthening is required?
- The shape (regularity) of the existing surface - is it adequate to ensure satisfactory riding quality, surface water drainage and uniform compaction of any overlay material or does it need regulating?
- Thickness - will existing fixed levels, such as kerbs, accesses and bridge headrooms, permit an overlay to be used or will a particular thickness of the existing construction need to be removed before a new surfacing is laid?
- Mechanical key/adhesion - will the existing surface with the application of a bond coat provide adequate key/adhesion to any overlay that is applied?
- The new material - what type of material should be laid?
- Skid resistance - in restoring the surface, what level of resistance to skidding is required?
- Any other special considerations - e.g. colour, porosity/waterproofing?

Detailed considerations

Strength

The strength of the existing construction is all-important when considering resurfacing. Laying of new material on an unsound substrate is simply wasting time and money. Cracks and crazing on an existing surfacing are an indication of inadequate strength in the road structure below and such areas should be taken out and reconstructed. Potholes may simply be localised failures of a surface course or they may be an indication of more deep-seated weakness. A very poor shape in a road, even without cracks, is often also an indication of insufficient strength and sooner or later more definite signs of weakness in the form of cracks are likely to appear. Such areas, therefore, may also need reconstruction.

In the case of major highways, it is possible from knowledge of the construction, traffic loadings and transient deflection measurements to assess the strength and probable life of a road and to estimate the amount of overlay strengthening required. Highway authorities use detailed procedures for this purpose, but in situations other than major highways, in-depth examination or knowledge of the existing construction, particularly in obviously weak areas, may be sufficient to give some indication of the future load-carrying ability and what upgrading or remedial action is required. Alternatively, mechanical testing to assess the existing strength of the construction may be desirable.

Shape

Frequently, particularly in urban areas, resurfacing is required to restore the surface profile of a pavement which is reasonably structurally sound. This happens for instance on roads which have been excavated during the repair or installation of services beneath. Weak places, potholes for instance, may well require reinstatement of the pavement to some depth. Thereafter decisions are needed on the types and thicknesses of surfacing to be used, and whether it is necessary or advantageous to plane off the old surface before laying the new.

Excessive variations in the thickness of asphalt surfacing layers due to the materials being laid on a poorly shaped substrate are to be avoided as they can cause variations in initial compaction with subsequent variations in durability of the surfacing and reduction in the riding quality.

British Standard BS 594987[6] recommends the minimum surface regularity tolerances, in terms of maximum depression under a 3-metre straight edge, that are required under both single-layer and two-layer surfacings to ensure a satisfactory uniformity of thickness of these layers.

Potholes will need to be repaired by cutting back the affected layer(s) to sound material and to a regular perpendicular face, removing all loose material and, in the case of asphalt layers, coating the sides and bottom of the hole with an appropriate grade of bitumen before filling with fresh replacement material and compacting it.

Subject to levels dictated by kerbs and accesses with headroom permitting, and to any obviously weak areas being reconstructed, it is advisable to strengthen and reshape an existing road by superimposing a regulating course followed by a surface course.

Cases will arise where the thickness of a regulating course will vary from a maximum at the sides of the road reducing towards the crown. In such circumstances the nominal size or stone content of the material used will depend on the minimum thickness. As the material will be covered by a surface course and also in order to make the work more practical, the range of thicknesses for which a size of material may be used in regulating work is greater than in normal straightforward surfacing. Unless hot rolled asphalt or dense asphalt concretes are used, it is advisable to let traffic run on the regulated surface for some time so that any minor differential compaction arising from thickness variations can occur and be accommodated when laying the surface course.

When an existing road is structurally sound but limited improvement in its shape is required (e.g. where only the surface course is deformed or showing signs of wear) or where existing levels/headroom do not permit any appreciable thickness of overlay, an appropriate thickness of existing surfacing can be removed by cold

planing prior to application of a new surface course. If the original layer thickness is known, the thickness that will be planed out must be such that there is either at least 15mm of the original surfacing remaining after planing, or the whole thickness is removed to prevent the risk of mechanically generating a plane of weakness at the interface of the two old asphalt layers. This weakness may be evidenced by small thin slabs of the old surfacing, commonly called "biscuits", being broken out by the planer. Accumulations of surface treatments which might have given rise to an excessively soft or 'fatty' surfacing may similarly need to be removed. However, these materials will have provided an impervious seal to the road and care should be taken to ensure that this seal is not completely removed or is replaced by the new surfacing without delay. After cold planing all that is normally required before application of a new surfacing is for the planed area to be thoroughly cleaned and bond-coated.

Mechanical key/adhesion

A smooth or highly polished surface will not give any significant mechanical key to an overlay and roughening of the surface, e.g. by planing or scabbling, should be considered, particularly if on a gradient. Areas of major oil or other contamination should also be removed.

All bound pavement layers need to be bonded. This is particularly appropriate to the overlay of worn and planed surfaces. Special grades of bitumen emulsion are available for this purpose and in applying them the following points should be borne in mind:

a Appropriate guidance on the rates of spread of tack and bond coat are found in British Standard BS 594987[6].

b The application should be by the use of a pressure sprayer and the rate of spread should be uniform, with no puddles allowed to form.

c The emulsion must be allowed to break (that is, to change from brown to black) before the new material is laid, otherwise it will form a slip coat.

d The emulsion should not be spread so far in advance of the surfacing work that it is removed by traffic or otherwise rendered ineffective.

Selection of new material

The new surfacing material must be appropriate for the expected traffic conditions. For example, when resurfacing a main road, the surface course would normally be a proprietary 'Thin Surfacing System'. Hot Rolled Asphalt (HRA) or generic Stone Mastic Asphalt (SMA) are suitable alternatives.

Thin Surfacings, HRA and SMA are also suitable for use on more lightly trafficked roads. If the structural condition of the road is questionable HRA may be the most appropriate choice. Close graded Asphalt Concrete may also be used but is unlikely to be as durable as the other materials stated above.

For very lightly trafficked or pedestrian areas, Asphalt Concrete surface course (open, medium or fine-graded) would normally be adequate. For greater durability and for areas of intermittent high stress HRA and SMA would be the more appropriate choice although with higher initial cost.

The binder course is a very important layer in the road structure as it experiences high stress and is at risk of exposure to water. In most situations a dense Asphalt Concrete binder course will be the best choice. To achieve a combination of both high strength and durability, EME2 Asphalt Concrete will give a superior performance.

Where thinner layers are required to correct levels below the surface course, regulating courses may need to be used. These will generally be SMA or HRA. In the case of SMA surface course or Thin Surfacing, a more durable solution may be to increase the layer thickness, making use of its self regulating properties.

Skid resistance

Skid resistance of surface courses is a subject in itself and its detailed consideration is not within the scope of this information sheet. However it should be borne in mind that high speed situations require good macro-texture provided by the roughness (texture depth) of the surface together with good micro-texture provided by the polish-resistance of the aggregates used in the surfacing. For low speed situations a fine-textured finish may be perfectly adequate with an aggregate of average polish-resistance. In low speed/high stress situations good polish-resistance in the aggregate without the need for deep surface texture will be worth consideration. Various Transport Research Laboratory reports deal in detail with the relationship between skid resistance and surfacing characteristics. All asphalt surface courses give adequate skid resistance at lower speeds as long as they contain aggregate of reasonable polish-resistance, whilst heavily-chipped Hot Rolled Asphalt and proprietary Thin Surfacing Systems are able to provide the good macro-texture which is additionally required for high speed situations.

Special considerations

When overlaying an existing concrete road or paved area with an asphalt surfacing, there is a specific problem which arises from the joints or cracks in the concrete. Concrete slabs expand and contract with changes in temperature creating movement in the joints. This movement will propagate cracks in the asphalt overlay. Experience has shown that even with relatively thick overlays this 'reflective cracking' will appear in time, although the thicker the surfacing the slower will be the rate of appearance. Pavement design research has indicated that an asphalt surfacing thickness of 180mm or more will be needed to significantly delay the onset of reflective cracking. In view of this, it is recommended that a two-layer surfacing (binder course plus surface course) is adopted when surfacing over concrete, wherever existing levels permit. If only a single surface course layer can be accommodated, reflective cracking must be anticipated in the early life of the surfacing. When it occurs, appropriate maintenance to prevent ingress of water will need to be taken, e.g. sealing the crack with a flexible bituminous compound. It may be worth considering the use of polymer modified asphalts which have been developed to be more resistant to reflective cracking than standard surfacing mixtures.

When laying asphalt surfacings over a concrete substrate a bitumen emulsion bond coat must always be used. Recent research into the special considerations for overlaying concrete has been published by TRL as Road Note 41[7].

Laying

Recommendations for the laying of the various asphalt materials mentioned above are given in British Standard BS 594987[6], as are the recommended surface regularity tolerances of the final surface.

It is strongly advised that all surfacing work is entrusted to well-established specialist surfacing contractors and not to itinerant or casual callers. A list of specialist surfacing contractors in any area, who are members of the Mineral Products Association, is available from the address given on this information sheet.

References

Important: When referring to any of the documents listed it is essential to check that it is the latest/current edition of that document. This can be readily confirmed by checking the currency of the document on the appropriate website.

1 **Road Note 39 (Sixth Edition) Design Guide for Road Surface Dressing,** 2008 TRL, Crowthorne, Berkshire. www.trl.co.uk/library/reports/publications

2 PD 6691 - Asphalt. **Guidance on the use of BS EN 13108 Bituminous Mixtures - Material specifications.** BSI, London.

3 British (European) Standard BS EN 13108-1 **Bituminous mixtures - Material specifications - Part 1: Asphalt Concrete,** BSI, London

4 British (European) Standard BS EN 13108-4 **Bituminous mixtures - Material specifications - Part 4: Hot Rolled Asphalt,** BSI, London.

5 British (European) Standard BS EN 13108-5 **Bituminous mixtures - Material specifications - Part 5: Stone Mastic Asphalt,** BSI, London

6 British Standard BS 594987 Asphalt for roads and other paved areas - **Specification for transport, laying and compaction and type testing protocols,** BSI, London

7 **Road Note 41 Best Practice Guide for overlaying concrete,** 2008 TRL, Crowthorne, Berkshire.

8 **BSI website for the purchase of European and British Standards and Public Documents**. www.bsiglobal.com/upload/Standards%20&%20Publications/shop.html

Information sheets in this series

1 The construction and surfacing of car parking areas including private drives and permeable hardstandings
2 The construction and surfacing of parking areas for medium and heavyweight vehicles
3 Resurfacing of roads and other paved areas using asphalt
4 Decorative and coloured finishes for asphalt surfacings
5 Choosing a surfacing contractor
6 Asphalt surfacings for high stress areas
7 Use of asphalt in the construction of games and sports areas
8 Farming applications of asphalt
9 Miscellaneous uses of asphalt
10 Airfield uses of asphalt
11 Construction and surfacing of footways and cycleways using asphalt
12 European Asphalt Standards and their application in the UK.

Booklet

'What's in a Road?'
A general review of pavement construction and the different materials that are used for the construction and maintenance of asphalt roads.

Enquiries for orders for 'What's in a Road?' should be addressed to the Mineral Products Association, details on next page.

Topics in Asphalt

- Asphalt - Road materials with quality
- Roads are 'green' with asphalt

Publications

Apart from this and the other information sheets and booklet dealing with uses of asphalt and pavement construction, a range of other publications is available from the Mineral Products Association covering aggregate production and processing, lime, ready-mixed concrete, sand and gravel and slag. A full list of these publications may be obtained from the address shown on the next page.

Further advice

General advice on the use of asphalts may be obtained from the Mineral Products Association at the address given on this information sheet. For detailed guidance on any site-specific matter, advice should be sought from local specialist surfacing contractor members of the Mineral Products Association.

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The Mineral Products Association is the trade association for the aggregates, asphalt, cement, concrete, lime, mortar and silica sand industries.

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