

asphalt

applications

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Asphalt surfacings for high stress areas



Asphalt
Information
Service

Introduction



Information Sheet 2 in this series, Construction and surfacing of parking areas for medium and heavyweight vehicles¹ indicates, as its title suggests, the construction required and the types of surfacing materials that should provide adequate service under straight-forward vehicle parking conditions. However, as indicated in that information sheet, where excessive indenting loadings are envisaged, special types of surfacing may be necessary and strong foundations will need to be provided. Similar measures are likely to be necessary where channelised trafficking arises or where for any other reason unduly high stress is placed on the surfacing.

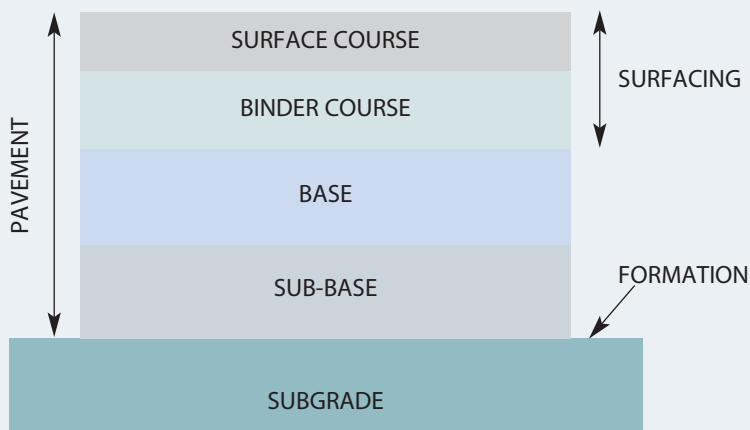
Examples of such situations are:

- i where solid metal support feet or dolly-wheels of heavy trailers are in contact with the surfacing;
- ii where goods are to be stored on the surfacing, particularly if there is heavy point contact with the surfacing, e.g. through rims of drums, corner feet of containers, etc;
- iii where tight manoeuvring by heavy vehicles gives rise to abnormally high stress wheel scuffing;
- iv where there is use of the surfacing by fork lift trucks;
- v where heavy objects are likely to be dropped on the surfacing;
- vi where heavy vehicles are travelling in tightly defined wheel-tracks, e.g. bus lanes.

This information sheet provides general guidance on the factors that may need to be taken into account when considering the use of asphalt* surfacings in such conditions.

The principle document for reference and guidance on the application and specification of asphalt when used in the UK is published Document PD 6691². This document interprets the requirements of the European Standards for Asphalt^{3,4,5} which cover the three main mixture types used in the UK.

The terminology used in this guide for the structural elements of the pavement, as illustrated here, is that adopted for use in the European Standards for asphalt mixtures^{3,4,5}. Surface course was previously known as wearing course, binder course was known as basecourse and base was known as roadbase.



** 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.*

General considerations

Fork lift trucks are of particular concern, for although the load carried by them may not be particularly heavy, they are slow moving, make sharp turns, often travel along fairly well-defined paths and produce high contact pressures, all of which can result in indentation or scuffing of the normal asphalt surfacing. The problem is greater for fork-lifts with solid metal or rubber wheels than for those with pneumatic tyres.

For heavy static loads the greatest problems are the risk of settlement of the construction and indentation of the surface. The greatest care must therefore be taken regarding not only the stability of the surfacing but also the strength of the formation, base etc.

Construction points

Paved areas where high stress usage most commonly arises are often sited on weak soils, for instance on poorly consolidated estuarine silts or on made-up ground in the vicinity of docks and harbours. In such circumstances it is particularly desirable to enlist the aid of a specialist in structural design to make sure that the pavement is adequate in strength and stiffness to carry the expected loads. It is also important to ensure that there is adequate provision for the drainage of the formation as well as good falls for the rapid removal of surface water.

Even after taking all appropriate steps with regard to the strength of the lower layers of the construction, it is still necessary to reduce to a minimum the risk of indentation within the surfacing. This involves taking into account not only the maximum loads likely to be involved, but also the bearing areas. Something frequently overlooked with respect to indentation is that the important factor is the load per unit area rather than the total load; with small bearing areas the deformation or indentation risk is likely to be disproportionately greater. Metal wheels will be more damaging than rubber tyres as the area of contact is likely to be less.

It is not often appreciated that indentation of asphalt surfacings is related not only to load but also to loading time and temperature, with the same load causing greater damage the longer it is applied and the higher the surfacing temperature. Thus, the disposition of the site in relation to prevailing sun and weather can be significant.

Except in the case of very weak formations such as soft or made-up ground, the construction of the lower layers of paved areas for these high stress situations can generally follow that suggested for heavy vehicle parking in Information Sheet 2 but particular attention should be paid to the strength and compaction of the sub-base and base. The binder course should be one of the stiffer and more dense mixes - either Asphalt Concrete dense binder course to BS EN 13108-1³ utilising 70/100 or 40/60 pen paving grade bitumen, or Hot Rolled Asphalt to BS EN 13108-4⁴ utilising 30/45 pen grade bitumen or a Polymer Modified Bitumen (PMB) depending on severity of site usage and the needs of the particular construction. Due to the higher bitumen content and fatigue resistance of Hot Rolled Asphalt, its use as a binder course tends to be associated with two particular applications. Areas that are at risk from either reflective cracking and/or the potential for movement within the pavement structure arising from subgrade instability, or the requirement to utilise a near impermeable mixture to prevent water ingress to the receiving layer or construction unit e.g. a concrete bridge or culvert.

Where the probability of indentation/deformation is general to the whole paved area, but is of a relatively low risk nature, some improvement in the resistance of asphalts to deformation can be obtained by adopting the principles of increasing coarse aggregate content and binder hardness and reducing binder content (consistent with achieving satisfactory durability). These stiffer mixes will inevitably be more difficult to lay and achievement of full compaction in all layers of the construction is essential to satisfactory performance. Therefore, only experienced specialist surfacing contractors should be employed for this type of work.

Such materials are:

- a Hot Rolled Asphalt surface course to PD 6691² with a 55% coarse aggregate content utilising a PMB.
- b Hot Rolled Asphalt design-mix surface course to PD 6691² with 30 or 35% coarse aggregate content and incorporating crushed rock fine aggregate (Type C mix).
- c Stone Mastic Asphalt to PD 6691² utilising a 40/60 pen paving grade bitumen or a PMB.

(Further notes on the use of these material types are given in Information Sheet 2 in this series).

Where heavy indenting loads are likely to be concentrated in a relatively limited section of a paved area e.g. the support legs of heavy lorry trailers, one compromise is to provide a normal bituminous surfacing, as indicated above, for the majority of the area but to provide some means of load spreading over the delineated critical areas, (e.g. steel plates), or an indentation-resistant inset, (e.g. concrete or concrete block construction).



Where very high risk of indentation and stress are anticipated, alternative types of construction will be necessary. These may involve the use of proprietary surfacings of the cement/polymer grouted asphalt, epoxy asphalt types, or alternative types of construction, such as concrete or concrete block paving. Such alternative surfacings or types of construction or the use of special oil-resistant binders in the asphalt will also need to be considered where there is a risk of undue spillage of hydraulic or petroleum oils, in view of the possible adverse effects of these oils on the normal bitumen-bound asphalt surfacings. Where concrete block paving is adopted, the use of a dense Asphalt Concrete or Hot Rolled Asphalt base may well provide a suitable high-strength, stable foundation.

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 **Construction and surfacing of parking areas for medium and heavyweight vehicles**, Information Sheet 2, Mineral Products Association, London.
- 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 **Interpave, the Precast Concrete Paving and Kerb Association**, 60 Charles Street, Leicester LE1 1FB. www.paving.org.uk
- 7 **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.



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

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