

Highway Maintenance Specification



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<u>1.0 INTRODUCTION</u>	3
<u>2.0 CONVENTIONAL MAINTENANCE OPTIONS FOR CARRIAGEWAYS</u>	7
<u>3.0 SPECIALIST MAINTENANCE OPTIONS FOR CARRIAGEWAYS</u>	20
<u>4.0 MAINTENANCE OPTIONS FOR CATEGORY 4a AND 4b ESTATE ROADS</u>	28
<u>5.0 MAINTENANCE OPTIONS FOR FOOTWAYS</u>	32
<u>6.0 GENERAL</u>	38
<u>BIBLIOGRAPHY</u>	41

<u>1.1.0 INTRODUCTION</u>	4
<u>1.2.0 TABLE OF CARRIAGEWAY MATERIALS AND PROCESSES</u>	5
<u>1.3.0 TABLE OF FOOTPATH MATERIALS AND PROCESSES</u>	6
<u>1.4.0 TAR BOUND MACADAM</u>	6

1.1.0 INTRODUCTION

1.1.1 The Highway Maintenance Specification has been produced to give guidance to Maintenance Engineers in selecting appropriate materials and treatments for use. Advice is given in the use of both conventional and specialist products, and in their appropriateness to the various road hierarchy categories.

For ease of reference this document has been divided into the following sections:

- (1) Introduction
- (2) Conventional Maintenance Options for Carriageways.
- (3) Specialist Maintenance Options for Carriageways
- (4) Maintenance Options for Category 4 Estate Roads
- (5) Maintenance Options for Footways
- (6) General

Tables have also been produced which summarises the carriageway maintenance options and footpath maintenance options available and these are included within the introduction.

1.1.2 Financial limitations have reinforced the need to act prudently and hence it is imperative that best value is achieved. The selection of materials and treatments must therefore take full account of the whole life costs of the individual maintenance options and, although the guidance given has been written to take account of this. Maintenance Engineers should also be mindful of this when making their decisions.

1.1.3 Accordingly the emphasis will be on implementing a preventative maintenance strategy principally by the prudent use of patching, joint treatments, crack overband sealing and surface dressing (or other veneer treatments) in appropriate locations. These treatments are normally carried out before the need for resurfacing and their use will significantly extend the useful life of the pavement before it becomes necessary to undertake major works such as resurfacing.

1.1.4 Roads suitable for surface dressing or other veneer treatments must not be excluded from programmes on the grounds that urban roads require more stringent controls over application and aftercare for a for a greater period of time with extra emphasis on cleaning chippings from footpaths and junctions. With proper controls and after care this treatment can greatly extend the expected life of the Authorities highway network

1.1.5 In order to achieve the desired performance from highway maintenance works it is essential to:

- (i) Ensure that all works are pre-planned and that the design and the site supervision are to the appropriate level.
- (ii) Check that materials have been delivered and laid in accordance with the stated standards.

1.1.6 The mandatory requirement that all works must comply with the stated specification is an essential part of the policy in its aim of achieving best value. In order to achieve this, adequate and effective on site monitoring by the supervising staff is necessary, which must be supported by appropriate site investigation and sample testing by an accredited Highways Laboratory.

1.1.7 The Highway Maintenance Specification is seen as a 'live' document, which can be

updated as more information becomes available. Hence feedback from Maintenance Engineers is welcomed to ensure that future guidance is accurate and of maximum benefit.

1.2.0 TABLE OF CARRIAGEWAY MATERIALS AND PROCESSES

1.2.1 The following table summarizes materials/methods available for use on carriageways and indicates on which parts of the highway network they may be used. Types of location are shown in terms of the highway category (2, 3a/b, 4a/b) with the various treatments

Carriageway Category Material or Treatment		2.	3a	3b	4a	4b
Surface Dressing		A	A	A	A	A
maca 7.3	Resurfacing using (a) coated	N	A	A	A	A
7.4	0/10mm size close graded surface	N	N	C	A	A
7.5	0/6mm size dense surface course	N	N	N	N	A
	(b) rolled asphalt (BS 594)	A	A	A	A	N
	(ii) design mix	A	A	A	A	N
Slurry seal	Slurry Macadams / Micro Surfacing	A	A	A	C	N
Resin-based High Skid Resistant Surface Treatment		C	C	C	C	C
Retread		N	N	N	N	A
Repave		C	C	C	N	N
Recycling - (in situ)		N	N	C	C	C
Mechanical Retexturing		A	A	C	N	N
Retexturing by carbonisation		A	A	A	C	C
Retexturing by pressurised water		A	A	A	A	A
Concrete cracking		N	N	N	A	A
Specialist joint treatments		A	A	A	A	A
Stress absorbing and geotextiles		A	A	A	A	A
Block paving		N	N	N	A	A
Safepave		A	A	A	A	N
Screed Patching		C	A	A	A	A
Other specialist treatments		C	C	C	C	C
Stone Mastic Asphalt (SMA)		A	A	A	A	A
Thin surfacing		A	A	A	A	A
High Friction Surfacing		C	C	C	C	C

Key: A – Appropriate

N - Not suitable

C - Consultation is necessary

1.2.2 In many cases the material or treatment is clearly either APPROPRIATE or NOT. However, in those situations where this is not clear cut the notation 'C' is used to identify cases where it is necessary to discuss the matter with Laboratory Services before a firm proposal is made.

1.3.0 TABLE OF FOOTPATH MATERIALS AND PROCESSES

1.3.1 The following table summarizes materials/methods available for use on Footpaths and indicates on which parts of the network they may be used. Types of location are shown in terms of the footpath category (1, 1(a) 2, 3, 4, cycle) with the various treatments

Footpath Category or Material Treatment	1(a)	1	2	3	4	cycle
Precast concrete paving flags	A	A	A	A	A	A
Dense Bitumen Macadam	A	A	A	A	A	A
Footway surface dressing	N	C	C	C	C	N
Slurry sealing	N	C	C	C	C	C
Retread/Shallow recycling	N	N	N	N	A	A
Modular block paving	A	A	A	A	A	A
Concrete	N	A	A	A	A	A

Key:

A – Appropriate

N - Not suitable

C - Consultation is necessary

1.4.0 TAR BOUND MACADAM

1.4.1 New regulations have been introduced which require that sites that produce Hazardous Waste must be registered with the Environment Agency for the duration of the production of that waste (see Technical Guidance WM2 – Hazardous Waste). The regulations apply to hazardous waste that is removed from site to be placed in a hazardous waste cell.

This will affect Highway Maintenance sites in the following manner :

Bituminous mixtures containing coal tar as a binder must be classified as a Hazardous Waste if the concentrations of coal tar are above threshold limits.

Bituminous mixtures containing bitumen are not classified as hazardous.

It is inevitable in highway maintenance works that tar bound road construction layers will be encountered at some time.

The advice must be that if the works require full “blacktop” reconstruction, or require the removal of layers lower than 100mm then the site must be investigated. Investigation by cores is recommended which can then be tested to identify if any of the macadam layers contain tar as a binder and identify the concentration limits.

<u>2.1.0 CONVENTIONAL MAINTENANCE OPTIONS FOR CARRIAGEWAYS</u>	8
<u>2.2.0 SURFACE DRESSING</u>	8
<u>2.3.0 BITUMINOUS SURFACING</u>	10
<u>2.4.0 ORDERING OF BITUMINOUS MATERIALS</u>	14
<u>2.5.0 COATED MACADAMS</u>	13
<u>2.6.0 ROLLED ASPHALTS</u>	14
<u>2.7.0 THIN SURFACING STONE MASTIC ASPHALT (SMA)</u>	14
<u>2.8.0 DURABILITY OF BITUMINOUS MATERIALS</u>	15
<u>2.9.0 LOCAL PATCHING</u>	16
<u>2.10.0 RECONSTRUCTION</u>	18
<u>2.11.0 POLISHED STONE VALUE (PSV) / SKIDDING RESISTANCE</u>	19

2.1.1 The conventional materials options available have been categorised as follows:-

- (i) surface dressing
- (ii) bituminous surfacing
- (iii) local patching
- (iv) reconstruction

2.2.0 SURFACE DRESSING

2.2.1 There are two distinct methods of specifying surface dressing i) method specification ii) end product performance and the basis of both are explained briefly below.

Method Specification – with this type of specification it is essential for the Engineer (the Client) to specify precisely the roles and responsibilities of both the client and the contractor. The Engineer will be responsible for the surface dressing design which will include such items as type of dressing to be used e.g. single dressing / racked-in / double dressing, binder type and rate of spread, chipping size, PSV, rate of spread of chippings, period of work and unsuitable weather as well as many other items. The Engineer will also be responsible for ensuring the work is performed in accordance with the contract by site supervision and / or site testing. This information will be required if premature failure occurs to establish remedial works. It is the contractors responsibility to fulfil the specification requirements.

End Product Performance – with this type of specification the performance of the dressing at the end of an agreed maintenance period is measured. The Engineer determines the performance requirements. The Engineer must provide to the contractor all the necessary information which will allow for the design to be completed e.g.. site location, traffic flow, existing surface. The contractor is responsible for all aspects of the design and therefore its success. At the end of the agreed maintenance period usually 2 years the performance of the dressing is assessed at predefined sections of the dressing. Of the two specifying methods the end product performance is preferred.

2.2.2 Surface dressing is cost effective and is an important preventative maintenance treatment. It is used to restore skidding resistance, prevent the ingress of water and arrest further deterioration, hence extending the life of the surface.

2.2.3 ALL SURFACE DRESSING MUST BE OF A RECOGNISED DESIGN.

2.2.4 METHOD SPECIFICATION DESIGN

Where a method specification is used the selection of binder type, chipping size etc. is based upon the design process given in Road Note 39 (i.e. using volume of traffic and road hardness measurements), although literature relating to the use of proprietary materials must also be consulted where appropriate. As with all maintenance works, insufficient attention in design will inevitably lead to reduced treatment life and possible early failure.

2.2.5 Appropriate selection of materials and techniques allows this treatment to be used on all road categories in most rural and urban situations, including many highly stressed locations. The principal exceptions to this are main shopping areas and residential culs-de-sac, where

the conventional surface dressing process is not recommended for use. It is imperative, however,

2.2.6 that full attention is paid to pre-planning, control of the works during the operation and after care in order to ensure the treatment's successful use.

2.2.7 The success of surface dressing is enhanced by the use of the rack-ed in process. This offers the advantages of an interlocking matrix which is more resistant to early chipping loss and also significantly increased macro texture. The benefits of this are not only the improved quality of the dressing, but also a reduction in the number of loose chippings, which may lead to vehicle damage.

2.2.8 Before work is commenced early consultation is necessary between the engineer and contractor on the method of working and the materials to be used. The weather and nature of the surface to be surface dressed affect the best use of materials and as both are normally variable, daily consultations between the Engineer and Contractor are necessary on both programmes of works and use of materials.

2.2.9 Set out below is the information which must be used in the design: -

- (a) Road Surface Hardness (RN39)
- (b) Traffic Category
- (c) Dressing type e.g. racked –in, single dressing
- (d) Binder type
- (e) Chipping – Aggregate type, Size, Mechanical and Physical Properties
- (f) Chipping Size and Mechanical Properties
- (g) Required texture performance (SHTD)

2.2.10 Surface dressing shall normally cover the full carriageway width. The only exception to this is where "Beeny blocks" have been used, in which case a 150mm channel shall be left undressed, or where there are existing channel blocks, which shall not be normally dressed over

2.2.11 As an overall guide, the following options are likely to be the most appropriate for use, bearing in mind the advantages of using racked- in dressings and/or enhanced binders to improve the initial bonding and the long-term durability of the treatment: -

ROAD CATEGORY	BINDER	CHIPPINGS
2,3a, 3b	Polymer Modified	14/6 or 10/6 racked-in
3b, 4a	Unmodified	14/6 or 10/6 racked-in
4b (Urban)	Unmodified, Polymer Modified or Heavy Duty	10 or 6 single size
4b (Rural)	Unmodified	10 or 6 single size
High Stress Areas (irrespective of road category)	Individual Site Specification	

CONVENTIONAL MAINTENANCE OPTIONS FOR CARRIAGEWAYS

2

2.2.12 The minimum PSV of primary chippings to be used shall generally be specified in accordance with the following

Location	Min PSV
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Roundabouts, traffic signal junctions)	
Pelican crossings etc (inc. their approaches))	
Bends of radius less than 150m)	65
Gradients of 5% or steeper of length)	
Greater than 100m)	
Category 2, 3a, 3b (Urban) roads		60
Category 3b (Rural), 4a and 4b (Urban) roads		55
Category 4b (Rural) roads		50

2.3.0 BITUMINOUS SURFACING

2.3.1 Bituminous Materials

Quality Assurance Schemes for the Production and Laying of Bituminous Materials.

All contractors used in the supply and laying of bituminous materials for roads and footways shall be accredited under the following UKAS sector schemes

- Sector Scheme 14 - For the quality assurance of the production of asphalt mixes
- National Highways Sector Schemes for Quality Management in Highway Works 16 For the laying of asphalt mixes

Details of these schemes can be found on the UKAS web site

http://www.ukas.com/information_centre/publications.asp

The developer must, prior to the commencement of surfacing activities, submit for approval, the proposed contractor along with a copy of the Certificate of Accreditation under the UKAS Sector 16 scheme. The details of any supplier of materials must also be submitted at the same time, together with a copy of the suppliers Certificate of Accreditation under the UKAS Sector 14 scheme.

Contractors who are not accredited by either of the above schemes must gain the permission of the Engineer prior to commencement of any bituminous surfacing works. Any contractor who is not Accredited under the UKAS sector schemes, must submit as part of the request for a deviation, a quality plan which will assure the competence of the laying operation and the quality of the materials to be used.

- The term asphalt is the generic term now employed throughout the E.C. for all mixtures of mineral aggregate, including filler, and a bituminous binder. For simplicity however and to match our existing specification the term bituminous materials have been retained.

Only those bituminous materials manufactured by plants which hold accreditation from and comply with the requirements of THE NATIONAL THIRD – PARTY QUALITY ASSURANCE SCHEME FOR THE PRODUCTION OF BITUMINOUS MATERIALS (the SCHEME) shall be used in the permanent works.

(The SCHEME has been jointly developed by the County Surveyors Society, Highways Agency and BACMI)

Before the supply of any bituminous materials the Developer shall submit to the Engineer documented evidence that all primary and secondary support plant/s proposed by the Contractor from which supplies are to be delivered have a Quality Level of Q6 or better.

2.3.2 Thin surfacing, Stone Mastic Asphalt and High Friction mixes shall be specified having HAPAS / BBA certification.

2.3.3 Bituminous materials shall only be laid by laying contractors which have certification under Sector Scheme 16 – Quality Management of the Laying of Asphalt Mixes

2.3.4 Extensive documentation has been produced covering the use of bituminous materials. It is proposed to use them as reference literature and remind Maintenance Engineers that all staff involved in the design, specification, ordering or supervision of the use of bituminous materials must have a working knowledge of their contents.

2.3.5 All bituminous materials used in surface course, binder course or road (road base) layers shall be specified and ordered in accordance with the relevant specification requirements. In the case of conventional bituminous materials these specifications are:

- (i) BS594: Parts 1 & 2 Hot Rolled Asphalt for Roads and Other Paved Areas
2003
- (ii) BS4987: Parts 1 & 2 Coated Macadams for Roads and Other Paved Areas
2001

In the case of SMA's, thin surfacing and high friction surfacing, these will be specified in accordance with the relevant HAPAS Guidelines Document. (<http://www.bbacerts.co.uk/>)

2.3.6 Maintenance Engineers must ensure that all surfacing works ordered are undertaken in accordance with the Conditions of Contract and Specification contained therein. The Specification is derived from the DTp Specification for Highway Works.

2.3.7 The Design Guide and Specification for Residential and Industrial Estates. Section 10 of that document gives a specification which summaries the essential requirements for laying bituminous materials. This specification should also be viewed as applicable to highway maintenance surfacing works. It is not comprehensive however, and hence must not be included in highway maintenance contract documents without supplementary clauses being added.

2.3.8 Although the above specifications apply, the options available in these documents need to be summarised to give the following guidance for their use in Middlesbrough. Similarly specific guidance is given in areas which are critical in ensuring that surfacing works are carried out to the required standards.

2.3.9 It is anticipated that deterioration of a surface course will initially reduce the surface quality to traffic and eventually accelerate the structural failure of the pavement. Within the

CONVENTIONAL MAINTENANCE OPTIONS FOR CARRIAGEWAYS

2

total life of a pavement it can normally be anticipated that a surface course will provide an acceptable level of service of 6 to 10 years for macadam, SMA and thin surfacing and 10 to 14 years if hot rolled asphalt is used. It is difficult to predict the useful life of high friction surfacing as much depends upon the site location and types and amounts of traffic. As part of

the pre-planning process it will, of course, be necessary for the Maintenance Engineer to take account of the current condition of the pavement together with an assessment of the rate of deterioration and the anticipated future traffic flows. The pre-planning can only proceed after this information has been collected.

2.3.10 Where high grip surface treatments are used other than their designed use, e.g. colouring within hatching, there must be a commitment for the upkeep and future maintenance

2.3.11 The following table detailed the preferred surfacing options for the highway network:

<u>Carriageway Category</u>	<u>Material Specification</u>
2, 3a, 3b	(50mm thick 35%0/14 HRA (BS594: Pt 1: (2003 - Table 3, Column 3/3, Binder (No 3) (40mm thick 30%0/14 HRA (BS594: Pt 1: (2003 - Table 3, Column, 3/2 Binder (No 3) 0/14mm Stone Mastic Asphalt 0/10 Stone Mastic Asphalt
4a	(40mm thick 30%0/14 HRA (BS594: Pt 1: (2003 – Table 3, Column, 3/2 Binder (No 3) (40mm thick 0/14mm CGBM (BS4987: Pt 1: (2003 - Clause 7.3 tables 23, 24, & 25) (30mm thick 0/10mm CGBM (BS4987: Pt 1: (2003 - Clause 7.4 tables 26, 27, & 28) 0/14mm Stone Mastic Asphalt 0/10 Stone Mastic Asphalt
4b	(40mm thick 0/14mm CGBM (BS4987: Pt 1: (2003 – Clause 7.3 tables 23, 24, & 25) (30mm thick 0/10mm CGBM (BS4987: Pt 1: (2003 – Clause 7.4 tables 23, 24, & 25) 0/14mm Stone Mastic Asphalt 0/10 Stone Mastic Asphalt Thin surfacing

Note: Where CGBM is used the binder shall be 100/150 pen or 160/220 pen (not cut-back).

It should be noted that whilst the above options are preferred, in certain circumstances alternatives may be specified following consultation with the Group Engineer (Laboratories).

2.3.12 It is also recommended that 50mm thick 40/20 mix should be used when HRA is specified in the following circumstances

(i) at risk locations i.e. roundabout, traffic signal junctions etc

CONVENTIONAL MAINTENANCE OPTIONS FOR CARRIAGEWAYS

2

(ii) when HRA is to be laid in the winter months (1st November – 31st March)

2.2.13 The binder grade should be specified as follows

(i) all HRA material – 50 pen

(ii) CGBM/DBM surface courses – 100/150 pen

(iii) DBM basecourse – 100/150 pen

Note: 160/220 pen binder shall be specified for CGBM/DBM surface courses when there is either a proportion of hand lay in the works or a material thickness of 30mm or less laid during the winter months. These occurrences should, however, be kept to a practicable minimum.

2.3.14 The specified texture depth should be in accordance with the following:-

- (i) HRA on roads subject to 40 mph speed limit or less - 1.0mm min sand patch (0.82 mini texture meter)
- (ii) HRA on all other roads - 1.5mm ave/1.2mm min sand patch (1.03mm mini texture meter)

- (iii) CGBM on all roads - 0.6mm min sand patch (0.6mm mini texture meter)
The texture for SMA and thin surfacing is termed a negative texture but is specified in the same manner as for the more conventional materials
Note: Mini-texture meter is no longer in specification and is therefore for guidance only.

2.3.15 It shall be an additional specification requirement that the application of coated chippings in HRA surface courses must also achieve the following minimum rates of spread

- (i) for 1.0 min texture depth – 60% of shoulder to shoulder value
- (ii) for 1.5 ave texture depth – 70% of shoulder to shoulder value

The chippings shall be delivered to site not more than 3 days before or less than 1 day before application in order that the rate of spread for the particular site can be determined

2.3.16 The PSV of precoated chippings for HRA surface courses should be specified in accordance with the values given in paragraph 2.1.10 for surface dressing chippings, subject to a minimum value of 60

The PSV of coarse aggregate in CGBM or HSC, HRA surface course should be similarly specified in accordance with paragraph 2.1.10

2.3.17 High Stone Content HRA laid 40mm thick is as an alternative to: -

- i) Chipped HRA in urban areas where a high texture depth is not a requirement.

CONVENTIONAL MAINTENANCE OPTIONS FOR CARRIAGEWAYS

2

ii) 0/14mm CGBM where additional durability is provided by a treatment of equivalent texture depth and costing only fractionally more.

iii) 0/10mm CGBM on stress locations e.g. on bends where bus movements rapidly erode the wearing course material.

2.4.0 ORDERING OF BITUMINOUS MATERIALS

2.4.1 It is a mandatory requirement that certain information is provided by the purchaser of material and that the supplier must respond with specific information. The Maintenance Engineer is therefore required to give precise instructions to his contractor and receive a detailed statement of the contractor's proposals. Note – the use of Limestone aggregate is not permitted in any surfacing course material or base material which is to be subjected to traffic.

2.4.2 The ordering of material can be a weak link in the chain. It is essential that the purchaser controls the choice of materials. The Maintenance Engineer is not allowed to leave the choice of options up to the supplier. All orders for bound, flexible material require that the following information is supplied by the Maintenance Engineer to his contractor.

2.5.0 COATED MACADAMS

2.5.1

- (a) Description of Course
- (b) Type and nominal size of aggregate
- (c) Layer thickness
- (d) Type and grade of binder

In addition to this basic information the following is required.

- (e) Traffic Category
- (f) Method of laying Note: The use of 'cut back' is not permitted and it is stressed that hand laying refers ONLY to the laying process and not the binder grade. THIS MUST BE STRESSED TO THE SUPPLIER AT THE TIME OF ORDERING.
- (g) The past and present practice of using cut-back materials in permanent works is not to be continued and any such materials together with all associated overlays will not be paid for by the Council.
- (h) Compaction requirements - end result compaction to be extended to include surface course materials when it becomes possible.

2.6.0 ROLLED ASPHALTS

2.6.1 The Maintenance Engineer must identify the material as set out in BS 594 2003, Part 1. As an example, surface course is to be - Table 3, Column 3/2.

Note: The use of limestone aggregate in CGBM or HRA surface courses is not permitted.

2.7.0 THIN SURFACING STONE MASTIC ASPHALT (SMA)

2.7.1 Stone Mastic Asphalts are proprietary materials, that is to say they are not covered a by British or European Standard. They are designed, produced, delivered and installed to the manufactures specification. Only those SMA's systems having Highway Authority Product Approval (HAPAS) certification should be specified. (<http://www.bbacerts.co.uk/>)

CONVENTIONAL MAINTENANCE OPTIONS FOR CARRIAGEWAYS

2

The minimum information given to the producer should be: -

- i) layer thickness
- ii) PSV of the aggregate
- iii) surface texture – remember the smaller the aggregate size the lower will be the achievable texture.

Note – thin surfacing is identified by types as given below:

- a) Type A – less than 17mm layer thickness
- b) Type B – 17mm to 25mm layer thickness
- c) Type C – 25mm to 40mm layer thickness

Note – SMA and thin surfacing materials are not impervious. Where they are used to overlay “old” road base and basecourse materials it will be necessary to incorporate an impervious layer such as a bond coat or a regulating course.

2.8.0 DURABILITY OF BITUMINOUS MATERIALS

2.8.1 The durability of a surfacing layer is directly linked to the density of the material at the completion of the laying process. In order to achieve the necessary compaction of the bituminous material, it is essential that its temperature does not fall to the point where it is no longer workable before the required density is achieved. As a guidance limit the compaction time of at least 10 minutes is needed and this must be allowed for at both the design stage and during construction.

2.8.2 Three basic factors control the length of time available:

- (i) Thickness of the layer
- (ii) Initial temperature of the material
- (iii) Climate - wind speed and air temperature

2.8.3 For guidance purposes only:

- increasing a layer thickness from 40mm to 50mm extends the time available for compaction by 50%.
- decreasing a layer thickness from 40mm to 30mm reduces the time available for compaction by 40%.
- compaction must be completed before the minimum temperature of rolling is reached.
- laying during the winter reduces the compaction time by up to 50% for layers under 50mm thick.
- use of low penetration binders (less than 50 pen) is no longer acceptable (it should be noted that the required stability is to be achieved by mix design).

2.8.4 Bituminous Binders

The binder shall comply with those listed in Section 2, Clause 2.1 of B.S.594 : Part 1

Note The normal shall be penetration grade 50, binder number 3 of Table 1 of B.S. 594 : Part 1

- (ii) Dense and Heavy Duty Macadam Mixtures

The binder grades shall be as given below:-

Machine laid materials

- (a) Dense Macadam – 125 pen. Heavy Duty Macadam – 50 pen.

CONVENTIONAL MAINTENANCE OPTIONS FOR CARRIAGEWAYS

2

Penetration grade bitumen of 190 pen. may be used in machine laid with the approval of the Engineer

Note - The use of 190 pen materials will result in increased layer thickness and requires the Engineer’s approval.

No fluxing or volatile oils shall be permitted in the manufacture of machine laid materials

Where Dense or Close Graded Surface Course materials are to be laid between the 1st June and the 1st October, the binder shall be 50 pen with a 3% addition of Sasol Wax. This applies to both Footways and Highways. Alternatives will only be permitted with the prior approval of the Engineer.

(b) Hand laid materials

Between the 1st June and 1st October, the binder shall be 50 pen with an addition of 3% Sasol Wax. Dense and close graded macadam – 125 pen / 190 pen

NOTE - It is preferable to use penetration graded bitumen for all works, however substantial advantages can be gained from using cut-back bitumen in footpath locations which are hand laid and therefore binder viscosity of 200 secs may be permitted in these areas with the approval of the Engineer.

2.8.5 Of equal importance to the decisions made at the design stage is to verify that the site works have produced the required results. Testing of materials and laying performance in order to ensure compliance with the specification will also include the requirement for the laid material to have achieved an acceptable agreed density. This additional testing via the Nuclear Density Test, although to be carried out by an approved Highways Laboratory, will be primarily at the request of the Maintenance Engineer.

2.8.6 When considering the choice of materials and treatments it is stressed that past practice will not be accepted as justifying the use of any inappropriate material or its thickness. In any case, where either an unapproved process or material is used, or a material is laid outside the specified thickness without the written authorisation of the Client such items will not be paid for by the Client.

2.8.7 In order to ensure that site works are carried out correctly, the Council have produced a 'Blacktop' Guide; for the use of all staff involved in supervising surfacing works. The basic steps set down in that document together with the need for the Contractor's operatives to be adequately trained and supervised form the minimum requirements for acceptable site practice.

2.9.0 LOCAL PATCHING

2.9.1 All conventional bituminous materials used for patching of the carriageway shall be designed, specified and ordered in accordance with the requirements of:-

- (i) BS 594: Parts 1& 2: 2003 - Hot Rolled Asphalt for Roads and Other Paved Areas
- (ii) BS4987: Parts 1& 2: 2003 - Coated Macadams for Roads and Other Paved Areas

2.9.2 Conventional materials - Patching works must be undertaken in accordance with the

CONVENTIONAL MAINTENANCE OPTIONS FOR CARRIAGEWAYS

prescribed Conditions of Contract and Specification. The Specification shall be based on the DTp Specification for Highway Works and the works ordered in a way which will give the most economical contract rates.

2.9.3 Patching could involve replacement of the surface course layer alone or include the replacement of binder course/base (road base) layers or, in extreme cases, full depth local reconstruction. From the alternatives available, there are several preferred options which

experience has shown to be the most appropriate for use. However, care must be taken to ensure that any differences between highway authority patching works and the requirements of the HAUC Specification for the Reinstatement of Openings in the Highway are minimised.

2.9.4 Although the above specifications apply, the options available in these documents need to be summarised to give the following guidance for their use. Similarly specific guidance is given in areas which are critical in ensuring that patching works are carried out to the required standards. It should be remembered that the good practice guide states that any temporary pothole repairs should be permanently repaired within a period of 6 months.

2.9.5

(i) All roads, where the existing surface course is HRA, shall be similarly reinstated. This shall also apply to those overlaid by surface dressing or other veneer treatments.

(ii) The preferred surfacing material for patching in the various road categories shall be the same as the whole carriageway surfacing treatments given in Section 2.2.10.

(iii) Texture depths shall comply with the requirements of Sections 2.2.13, 2.2.14 and these shall similarly apply to surfaces where the wearing course has been overlaid by surface dressing or other veneer treatments.

(iv) The use of 'cut-back' is not permitted in carriageway works, including patching, and it is stressed that hand laying refers ONLY to the laying process and not the binder grade. **IT MUST BE STRESSED TO THE SUPPLIER AT THE TIME OF ORDERING THAT 'FRESH' MATERIALS ARE REQUIRED.**

The past and present practice of using cut-back materials in permanent works is not to be continued and any such materials together with associated overlays will not be paid for by the Authority.

(v) Areas for patching shall be cut out so that the excavated edges are vertical. Any saw-cutting beyond the area of the patch shall be sealed using an approved sealing system.

(vi) All bound vertical edges and exposed ironwork shall be painted with a bitumen-based edge sealant or prepared with an equivalent edge sealing system or material. Tack coat solution shall not be used as an edge sealant.

(vii) A bitumen emulsion tack coat shall be applied to the surface of the binder course (or base (road base)) immediately prior to laying the wearing course (or binder course), unless the binder course (or base (road base)) is untrafficked and less than 24 hours old.

(viii) Where overband joint sealing is considered then it must comply with the requirements given by the HAPAS Guidelines Document – Crack Sealant Systems for Highways. All such overband sealing must give a skidding resistance that matches the surrounding surfacing course and in no case less than 55. **OVERBANDING IF USED SHALL NOT UNDER ANY CIRCUMSTANCES BE APPLIED WIDER THAN 40mm.**

(ix) Patching within areas surfaced by special friction coatings must include reinstatement of the special friction coating as soon as reasonable practicable.

CONVENTIONAL MAINTENANCE OPTIONS FOR CARRIAGEWAYS

2

2.9.6. Ideally patching in advance of surface dressing should be carried out at least six months prior to the surface dressing, in which case the material shall comply with the specification requirements of sections 2.3.1 to 2.3.5 above. If this is not possible the patching must be completed a minimum of one month in advance and the following materials should be used:

(i) 50% 0/10 or 60% 0/20 HRA to BS594: Part 1: 2003 (ref. table 2, columns 2/1 and 2/4) or

(ii) provided that existing surfacing is not HRA (or HRA overlaid by surface dressing etc),

0/20mm size DBM binder course to BS4987: Part 1: 2003 (Clause 6.5).
In both cases the minimum PSV of the coarse aggregate shall be not less than 55.

2.9.7 The grade of the binder to be used for all carriageway patching works shall be as follows
(i) Hot rolled asphalt -50 pen
(ii) Bitumen Macadams – 160/220 pen

2.9.8 Thin surfacing Stone Mastic Asphalt - In the case of SMA's, thin surfacing these will be specified in accordance with the relevant HAPAS Guidelines Document.
Hand laid areas are to be avoided as SMA materials are difficult to hand lay and achieve a satisfactory performance. Where it is necessary to hand lay then consider the use of a reduced nominal size of aggregate e.g. replace a 0/14mm with a 0/10mm

2.10.0 RECONSTRUCTION

2.10.1 Where the structural condition of a road has deteriorated to the extent that reconstruction is required, this has historically involved excavation and replacement with new material. It should be noted that treatments/techniques now exist which can cause less traffic disruption and may be economically viable in particular situation (see later). However, where reconstruction is specified it should be correctly designed taking full account of the ground conditions, traffic loading and any problems caused by the location of existing services.

2.10.2 A carriageway reconstruction must be properly designed. Adequate site investigation must be undertaken including, where necessary, level surveys, road cores, trial pits and drainage surveys. Considerations must also be given to obtaining condition survey data e.g. DVI's, deflectograph etc.

2.10.3 Reconstruction will incorporate a flexible surface course, binder course and base (road base). For category 2, 3a and 3b roads the structural design shall be in accordance with HD14/87 and HA 35/87 - Structural Design of New Road Pavements, as traffic data is generally available for roads in these categories. Hence designs will be produced particular to individual sites.

2.10.4 Reconstruction of Category 4a roads should similarly follow the design principals of HD 14/87 and HA 35/87, although a degree of flexibility is introduced by permitting the use of CGBM wearing course, provided there is no reduction in the overall thickness of the bituminous layers. Reconstruction of Category 4b roads is dealt with later in section 4.0.

2.10.5 In some urban situations, for example where existing services in the carriageway are known to be at a high level, there may be advantages in using full-depth asphalt construction. In such circumstances, the advice of the laboratory should be sought.

CONVENTIONAL MAINTENANCE OPTIONS FOR CARRIAGEWAYS

2

2.10.6 Reconstruction of concrete roads or overlaid concrete roads shall be in accordance with the above paragraphs. However, where local reconstruction of individual concrete bays is proposed in situations where the adjacent bays are sound, the defective bay should be renewed in structural concrete to accord with the adjacent bays.

2.9.7 Flexible replacement of failed concrete bays may be permitted while longer term investigations are carried out. However the construction of the flexible bay must be to the relevant specification and depth.

2.10.8 The overall specification for carriageway reconstruction works is the DTp Specification for Highway Works (Current Edition). The specification for the reconstruction of the bituminous layers shall be those documents given in Section 2.2.0 - Bituminous Surfacing. Hence paragraphs 2.2.1 to 2.2.21 are deemed to equally apply to this section.

2.11.0 POLISHED STONE VALUE (PSV) / SKIDDING RESISTANCE

2.11.1 Both BS 594 – Hot Rolled Asphalt and BS 4987 – Macadam specifications for surfacing course mixtures state that the choice of aggregate depends primarily on the aggregates suitability to cope with the traffic and site conditions.

In highway application where a minimum skidding resistance is required then an aggregate with a suitable Polished Stone Value must be used to ensure that the minimum resistance to skidding is achieved.

The minimum PSV for the **coarse aggregate** in both hot rolled asphalt and macadam surfacing shall be 50.

Rock of the Limestone group shall not be used in any surfacing course application as its PSV is not adequate to achieve the minimum skidding resistance requirements.

Coated chippings for application in hot rolled asphalt shall have a PSV of not less than 60 and an aggregate abrasion value (AAV) of not greater than 12.

Note – Skidding resistance is a product of both the PSV of the aggregate used and the surface roughness i.e. texture depth of the asphalt surface. The texture depth can be achieved by an application of coated chippings at a rate of 70% of shoulder to shoulder coverage.

Where Stone Mastic Asphalt (SMA) is specified then the Engineer will need to state in the specification the minimum aggregate PSV and which must be checked on the HAPAS / BBA certificate to ensure compliance.

Aggregates for surface dressing will have a PSV of not less than 50.

SPECIALIST MAINTENANCE OPTIONS FOR CARRIAGEWAYS

3

3.1.0 SLURRY PRODUCTS

21

3.2.0 HIGH FRICTION SURFACING

22

3.3.0 RETREAD

22

3.4.0 REPAVE

23

<u>3.5.0 RECYCLING</u>	23
<u>3.6.0 MECHANICAL RE-TEXTURING</u>	24
<u>3.7.0 RE-TEXTURING BY CARBONISATION</u>	24
<u>3.8.0 RE-TEXTURING BY PRESSURISED WATER</u>	24
<u>3.9.0 CONCRETE CRACKING AND SEATING</u>	24
<u>3.10.0 SPECIALIST JOINT TREATMENT</u>	25
<u>3.11.0 STRESS ABSORBING MEMBRANES/GEOTEXTILES</u>	25
<u>3.12.0 MODULAR BLOCK PAVIOURS</u>	25
<u>3.13.0 SAFEPAVE</u>	26
<u>3.14.0 SCREED PATCHING</u>	26
<u>3.15.0 VACUUM INJECTION / PRESSURE GROUTING</u>	27
<u>3.16.0 HEAT AND RESTORE</u>	27
<u>3.17.0 COLD RECYCLED BITUMEN BOUND MATERIAL (FOAMIX)</u>	27

SPECIALIST MAINTENANCE OPTIONS FOR CARRIAGEWAYS

3

3.1.0 SLURRY PRODUCTS

These can be banded into two categories:-

3.1.1 Thin film slurry seals

Those products with aggregate size 1.5mm to 5mm. These tend to be applied as single-coats and, although manufacturers say they can be used on lightly trafficked estate roads, they are only really suitable for use on footways, cycleways or parking areas, as surface texture is reduced to very low levels.

3.1.2 Conventional slurry seals will prolong the life of a surface course by sealing small cracks and other minor defects and/or by sealing porous surfaces. However, due to the small aggregate size, using the material to regulate cannot be successfully achieved. Surface irregularities must therefore be removed by preparatory patching.

3.1.3 Slurry seals do have the advantage of being available in a variety of colours e.g. red, green, buff etc. and hence can be effectively used to highlight cycle lanes, for example, or areas of hard landscaping, mixer courts etc, and should be considered before choosing high surface grip options.

3.1.4 Thick film slurry seals/slurry macadams/Micro Asphalts. Those products with aggregate size 6mm or more. These can be applied as single-coats, although double-coat application is preferred as this permits a degree of regulating. The best known example of this is Ralumac (Note: for the purposes of this document, (Nimpactacote is also included in this category)

3.1.5 Slurry macadams are appropriate as an alternative to surface dressing or as an alternative to resurfacing in situations where a limited amount of regulating is required (i.e. the surface has a regular profile). In certain circumstances they can make it unnecessary for ironwork, gullies etc. to be raised, provided that the surrounding area is not already at a depressed level to the rest of the carriageway surface. For most situations a slurry macadam using 8mm aggregate applied in two coats should be appropriate; although 10mm aggregate, which offers better surface texture, is recommended for higher speed roads. The treatment thickness will be in the range 15mm to 20mm and hence a slurry macadam overlay will not normally require kerb levels to be adjusted.

3.1.6 Slurry macadams can be used successfully on high stress sites and in sensitive locations such as town centres where surface dressing is inadvisable.

3.1.7 Slurry macadams should not be used in the following situations:-
i) in residential cul-de-sac or other areas where a significant amount of hand working is required. It should be noted that some restricted sites may be treatable using the smaller mechanical plant supplied by some Contractors.
ii) on concrete roads unless the joints are treated with stress-absorbing material either before or after overlay.

3.1.8 The use of slurry macadams is ultimately determined by their cost effectiveness. At present the prices for cold planing and resurfacing to provide a CGBM wearing course are very competitive and there is no cost benefit in selecting a slurry macadam alternative. Hence slurry macadams should only be considered on roads incorporating HRA surfacing

3.2.0 HIGH FRICTION SURFACING

3.2.1 This type of treatment can be sub-divided into three main categories: -

- i) epoxy-resin high skid resistant surface dressing (e.g. Shellgrip)
- ii) epoxy-resin high skid resistant slurry treatment (e.g. Zebragrip)
- iii) epoxy-resin high skid resistant hand applied treatment (e.g. Bimagrip)

The difference between these is in the method of laying although all should be regarded as veneer treatments.

3.2.2 This product incorporates a high strength binder and very high PSV calcined bauxite chippings. It is therefore designed for use in high stress locations where a surface offering maximum resistance to skidding is required. It should be borne in mind, however, that this treatment is expensive and hence its use is restricted to sites where adequate skidding resistance cannot be achieved by conventional materials.

3.2.3 It is imperative that the existing surface is in a structurally sound condition, as the life of the treatment is likely to exceed that of the materials below. In addition roads with reflective cracking must receive joint treatment prior to application.

3.2.4 It should be noted that all sites nominated to receive this treatment must be agreed with Laboratory Services and the Sustain and Maintain group in advance.

3.3.0 RETREAD

3.3.1 This process is used to reconstitute and restore profile to macadam surfaces which have become deformed, cracked, heavily crazed etc. but where the road foundation is still structurally sound. Excavation and replacement of the surfacing layers is avoided by reconstituting the existing material.

3.3.2 Typically the process will involve scarifying the existing surface down to a depth of approximately 75mm. Additional material may be added if required, followed by various phases of harrowing, grading, rolling and application of bitumen emulsion. The treatment is completed by a final application of bitumen emulsion and single size chippings.

3.3.3 It is normally necessary to follow up this treatment with a bituminous overlay, although fibre reinforced surface dressing could be considered in appropriate lightly trafficked locations.

3.3.4 It should be noted that the structural strength of the resulting road construction is likely to only be suitable in lightly trafficked locations. Hence this treatment is recommended for use on category 4b roads alone and in particular estate roads.

3.3.5 One drawback with retread is that material segregation can occur, with the result that the fine aggregate falls to the bottom of the reconstituted layer. However, a recent development has been the introduction of the shallow in situ surface recycling process being marketed by Road Recycling Limited. This process reconstitutes the material to a depth of 100mm and claims to overcome the problems of segregation. It is also two or three times quicker than retread although is marginally more expensive.

SPECIALIST MAINTENANCE OPTIONS FOR CARRIAGEWAYS

3

3.4.0 REPAVE

3.4.1 Repave is an in-situ process for restoring asphalt surfaces. The whole process is carried out by a single pass of a plant train, which heats the road surface, scarifies it and then grades it to the correct profile. At the end of the plant train 25mm HRA overlay is applied by a conventional paver followed by chipping application and rolling.

3.4.2 The process is used on asphalt surfaces but the size of the plant train will prohibit its use on restricted sites. In addition the heating plant will cause flaming and fuming, raising questions of safety in urban areas. It is therefore recommended that this treatment only be

considered in unrestricted rural locations.

3.4.3 It is expected that this process will not be commonly used, if at all, in Middlesbrough.

3.5.0 RECYCLING

3.5.1 Any recycled product must be placed in the base (road) layers.

3.5.2 This falls into two categories, these being in-situ recycling and off-site recycling.

3.5.3 In-situ recycling:- this process involves pulverising the existing construction using specialist recycling plant. Quantities of cement and/or bitumen emulsion are added to the material which is mixed and compacted. Typically material to a depth of approximately 300mm can be recycled and currently marketed plant can treat minimum widths of 1m. The process is completed by the application of a new bituminous overlay.

3.5.4 This treatment is applicable to sites with structural defects which extend beyond the scope of retread. Account must be taken of Statutory Undertakers apparatus and the need to rebuild inspection chambers when assessing the suitability of particular sites.

3.5.5 The process is likely to be most commonly utilised for category 3b, 4a and 4b roads in rural areas where utility services and carriageway ironwork are only occasionally present. It can be effectively used to repair either haunch or whole carriageway failure.

3.5.6 Off-site recycling:- this process involves mixing cold planings with an additive to produce a material which can be either reused immediately or stockpiled. This will depend on the processes being offered by different Contractors.

3.5.7 Trials of one process which added a cold additive to cold planings to produce a material for stockpile indicated that this particular product would only be suitable as a footway binder course material. Hence such products are not recommended for use in carriageway construction.

SPECIALIST MAINTENANCE OPTIONS FOR CARRIAGEWAYS

3

3.6.0 MECHANICAL RE-TEXTURING

3.6.1 Mechanical retexturing is appropriate for use on sites where the skidding resistance of a surface has fallen below intervention levels but the structural condition of the road is still

sound. It is best suited to HRA or concrete road surfaces, with alternative treatments likely to be more beneficial on CGBM or surface dressed roads. Typically the section of carriageway treated should not be large and it should have good surface regularity.

3.6.2 The life of the treatment, before action is again required, will be between one and three

years, depending on the PSV and AAV of the aggregate and the volume of traffic.

3.7.0 RE-TEXTURING BY CARBONISATION

3.7.1 This process is used to treat fatted up surfaces by carbonizing the excess bitumen. Hand held apparatus is used to direct hot compressed air onto the affected area causing it to burn away. The process is low cost and effective. However, the associated flaming does make it unsuitable for use in built-up areas and hence its use should be restricted to rural locations or open locations in urban areas.

3.8.0 RE-TEXTURING BY PRESSURISED WATER

3.8.1 This process is used both in the treatment of fatted-up surfaces and smooth surfaces requiring the restoration of surface texture. Hand held apparatus is used to direct pressurised water onto the area requiring treatment and by this restoring the macrotexture of the surface. Again this process is low cost and effective and does not have the safety disadvantages of carbonisation.

3.9.0 CONCRETE CRACKING AND SEATING

3.9.1 This process uses repeated blows from a pneumatic hammer to crack the rigid surface and effectively transform it into a non-rigid material layer. The resulting surface is then compacted and overlaid with a new flexible wearing course. The whole process is entirely in-situ and will generally be quicker and cheaper than conventional reconstruction.

3.9.2 Concrete cracking and seating does, however, reduce the structural strength of the original concrete and hence an increased depth of bituminous overlay must be provided to compensate for this. Typically this should be in excess of 75mm and hence note should be taken of adjacent footway levels before this treatment is selected.

3.9.3 In addition the process must only be used on sites with a sound sub-grade and hence comprehensive site investigation must be carried out to determine the suitability of the road construction and formation.

3.9.4 With the above in mind, it is anticipated that concrete cracking and seating will only be an appropriate treatment for category 4b and possibly some category 4a roads. Sites which have been treated in this way in the past have had varying degrees of success, hence its future use needs careful consideration

SPECIALIST MAINTENANCE OPTIONS FOR CARRIAGEWAYS

3

3.9.5 Any site using this process must be recorded on the Street Works register as a site of Special Engineering Difficulty due to the special precautions such as full depth saw cutting which will be necessary for any future openings in this carriageway

3.10.0 SPECIALIST JOINT TREATMENT

3.10.1 A variety of products are available with stress absorbing properties, which are used to treat concrete bay joints, reflective cracking and other isolated cracks.

3.10.2 Examples include the overlay treatment marketed by Trustseal, the shallow recessed

treatment marketed by Fibrescreed and the deep joint treatment marketed by Johnson and various other companies.

3.10.3 Projects involving overlay, resurfacing or other surface treatments where stress cracks are present must include suitable treatments to prevent these cracks recurring.

3.11.0 STRESS ABSORBING MEMBRANES/GEOTEXTILES

3.11.1 Various systems are available to deal with both isolated stress cracking or whole surface cracking/crazing which incorporate membranes which, laid prior to wearing course application, are designed to prevent such cracking recurring.

3.11.2 These products are particularly suitable for schemes involving overlay to concrete roads where it is necessary to prevent reflective cracking, caused by thermal movement in the concrete bay joints, from occurring.

3.11.3 A Stress Absorbing Membrane (SAM) is designed to dilute localized stresses within the overlay. There are two main types available, preformed and hot applied. The hot applied product is generally cheaper but less effective than the preformed SAM,

3.11.4 A more effective method of preventing reflective cracking is to use a geotextile to reinforce the overlay. An example of such a product is Netlon AR1,

3.12.0 MODULAR BLOCK PAVIOURS

3.12.1 Modular Block Paviours are occasionally used to aesthetically enhance areas or to highlight entrances to residential roads. Such projects are normally funded from budgets other than that for highway maintenance. As the riding quality is likely to be poor their use should be restricted to very low speed locations.

3.12.2 Concrete paving blocks shall comply with the requirements of BS EN 1338 and shall have the following performance requirements:

- a) Weathering requirements – all blocks shall be of class 3
- b) Abrasion resistance - all blocks shall be of class 3
- c) Slip resistance – blocks for predominately pedestrian use shall have, at the time of installation a wet slip resistance when measured in accordance with BS 7976 of not less than 50.
- d) Skidding resistance - blocks for vehicular areas shall have, at the time of installation a wet skidding resistance when measured in accordance with BS 7976 of not less than 55

SPECIALIST MAINTENANCE OPTIONS FOR CARRIAGEWAYS

3

3.12.3 Clay pavers shall comply with the requirements given in BS EN 1344 and shall have the following performance requirements :

- a) Freeze / thaw resistance – all blocks shall be of classification FP100
- b) Transverse breaking load – all blocks shall be of classification T4
- c) Abrasion resistance - all blocks shall be of classification A3
- d) Slip / Skid resistance – blocks for predominately pedestrian use shall be of class U1. Blocks for vehicular areas shall be of class U3.

3.12.4 The construction of the pavement shall be in accordance with the **BS 7533 : Part 3 : Code of Practice for the laying of precast concrete paving blocks and clay pavers for**

flexible pavements and laid in accordance with Section 10.8 of the Design and Specification for Residential and Industrial Estates. All locations must be fully discussed in advance with the Maintenance Section.

3.12.5 Reinstatement

Where the reinstatement of modular surfacing is necessary then it shall be carried out in accordance with the requirements of BS 7533 : Part 11.

(i) General

It is permitted to reuse modular units that have been removed, cleaned and stored during reinstatement operations. Those modular units which in the opinion of the Engineer are unfit to be reused shall be discarded and replaced by units which match the original works in all respects.

(ii) Extent of reinstatement

Removal of an additional 1m of units around the reinstatement area including units which have been disturbed during the excavation, backfilling and reinstatement shall be required.

3.13.0 SAFEPAVE

3.13.1 This is a proprietary wearing course system comprising an emulsion tack-coat sprayed onto an existing surface before placing a hot bituminous-bound mixture which, after compaction, forms a textured surfacing course. The nominal thickness of the layer is 15-25mm.

3.13.2 The size of the plant involved and the high unit cost make it suitable only for relatively straight sections of over 10,000 sqm, where the location demands this particular type of treatment in preference to surface dressing or other veneer surfacings.

3.14.0 SCREED PATCHING

3.14.1 Various products on the market offer a type of local patching which is carried out using screed applied materials. The materials used combine polymer modified resins and high PSV chippings which can be laid in thicknesses down to 3mm, hence obviating the need for excavation to repair

3.14.2 The products are particularly appropriate for repairing surface defects in HRA (e.g. chip loss, serious fretting, etc.) or for any surface course patching where the depth of repair is less than 25mm.

3.15.0 VACUUM INJECTION / PRESSURE GROUTING

3.15.1 The processes are used to stabilize carriageways of concrete slab construction by the filling the voids and sealing the joints by injection of grout beneath the slabs. The sites which have been treated this way in the past have had varying degrees of success and hence its use in future needs careful assessment.

3.16.0 HEAT AND RESTORE

3.16.1 Heat and restore procedures are acceptable if they are HAPAS / BBA approved and carried out by an approved installer e.g. Rhinopatch.

3.17.0 COLD RECYCLED BITUMEN BOUND MATERIAL (FOAMIX)

3.17.1 Foamix macadam is a specialist material which is produced from recycled, pulverised and graded aggregates mixed with a foamed bitumen to give a macadam type mix for use as a base (road base) and / or a binder course. The material uses cold technology for production, storage, delivery, laying and compaction. The aggregates used are essentially recycled “blacktop” materials but are not restricted to this source and therefore may include blast furnace slag, crushed concrete, demolition products which have been removed from various sites which are then prepared and mixed at a specialist plant. The bitumen (normally of 125 pen.) is foamed prior to mixing with the aggregate.

3.17.2 Foamix shall only be used as a base (road) or binder course and requires the approval of the Engineer prior to installation. Approval will require a Quality Assurance Document from the supplier incorporating the requirements given in BS EN 9001

MAINTENANCE OPTIONS FOR CATEGORY 4a AND 4b ESTATE ROADS

4

4.1.0 MAINTENANCE OPTIONS FOR CATEGORY 4a AND 4b ESTATE ROADS 29

4.2.0 SERVICEABLE CONDITION 29

4.3.0 STRUCTURAL CONDITION 30

4.1.0 MAINTENANCE OPTIONS FOR CATEGORY 4a AND 4b ESTATE ROADS

4.1.1 Category 4a and 4b estate roads account for a high percentage of the road network in Middlesbrough and it is for these roads that the greatest diversity of carriageway maintenance options exist.

4.1.2 Whilst maintenance of the higher category roads is generally confined to conventional treatments and methods of construction which are designed and specified in accordance with national standards, maintenance of category 4a and 4b estate roads presents the engineer with the need to consider modified conventional construction designs or the use of specialist maintenance techniques.

4.1.3 In general, a category 4a and 4b estate road will have one of the following types of existing construction:

Surfacing	Surfacing	Surfacing	
Concrete Base (road)	Bituminous Base (road)	Unbound Base (road)	Structural Concrete
Sub-Base/ Sub-Grade (A)	Sub-Base/ Sub-Grade (B)	Sub-Base/ Sub-Grade (C)	Sub-Base/ Sub-Grade (C)

4.1.4 These roads are defined as having a traffic loading of less than 60 cvpd per lane (0.5 msa), although many carry under 10 cvpd (07 msa). Accordingly, the maintenance options for use on category 4a and 4b estate roads are as follows:

- | | |
|---|--|
| (i) surface dressing | (ix) concrete cracking and seating |
| (ii) patching | (x) retread/shallow recycling |
| (iii) crack overhand sealing | (xi) retexturing |
| (iv) joint treatment | (xii) slurry macadam |
| (v) cold plane and resurface | (xiii) reconstruction of reinforced concrete bays. |
| (vi) bituminous overlay | (xiv) Infra red permanent repair systems |
| (vii) shallow flexible reconstruction | |
| (viii) full-depth flexible reconstruction | |

4.2.0 SERVICEABLE CONDITION

4.2.1 The maintenance of the serviceable condition of these roads shall be carried out in accordance with the policies given in the Highway Network Management Plan. Hence, if the road is structurally sound, maintenance shall follow a preventative maintenance strategy and be by the use of patching, crack overband sealing, joint treatment and surface dressing. The only exceptions to this are roads within main shopping centers or residential cul-de-sac where local deterioration is still to be arrested by patching, crack overband sealing and joint treatment but the option of surface dressing the whole surface area is precluded. Instead whole surface deterioration shall be allowed to continue until either a slurry macadam overlay is appropriate (HRA surfaces only) or the optimum time for resurfacing is reached.

MAINTENANCE OPTIONS FOR CATEGORY 4a AND 4b ESTATE ROADS

4

4.2.2 In cases where the surface has deteriorated to such an extent that intervention by preventative maintenance treatments is no longer possible, then either a flexible overlay should be applied or the existing surfacing should be removed and replaced with a new surface course. The choice of action is determined by kerb and ironwork levels, and by the condition of the existing surface. The depth of any planing should be restricted to the minimum required to accommodate the new surface course whilst removing any material which would be unacceptable in the pavement construction.

4.3.0 STRUCTURAL CONDITION

4.3.1 The maintenance of the structural condition of category 2, 3a, 3b and 4a roads incorporates the construction recommendations of HD14/87 and HA 35/87. However, these documents become inappropriate for category 4b roads where traffic volumes are much smaller. A much older document, LR1132: The Structural Design of Bituminous Roads,

includes recommendations for lightly trafficked roads, although these must be tempered with practical and economic considerations. This means that conventional reconstruction may not be the most appropriate treatment when balanced against the specialist processes available which provide adequate structural strength for lightly trafficked roads.

4.3.2 For Category 4b estate roads, structural failure does not in itself mean that action is necessary. The carriageway is likely to have an adequate serviceable condition beyond the "critical point" and hence a structural treatment will only be necessary when the carriageway presents a safety problem or the cost of remedial patching has become excessive.

4.3.3 When action is necessary the use of retread/shallow recycling or concrete cracking and seating must be considered. Providing the site is suitable, these options will restore the carriageway to an acceptable structural condition at a fraction of the cost of conventional reconstruction. Comprehensive site investigation must be carried out to determine this. The principal restrictions on the use of these treatments are as follows:

- (i) Sites suitable for retread/shallow recycling should be structurally sound below 100mm depth (i.e. below the treatment depth)
- (ii) Sites suitable for concrete cracking should have sound formation/sub-base and kerb levels shall permit a bituminous overlay to the slab of 50mm minimum depth.

4.3.4 If the specialist treatments detailed above are not appropriate to the particular location, the only alternative remaining is conventional reconstruction. This shall be determined bearing in mind the recommendations of LR1132.

4.3.5 (i) Sub-base: For most sites in Middlesbrough the CBR of the road formation is likely to be either between 2% and 5% in which case 150mm type 1 sub-base +350mm capping layer will normally be specified, or greater than 5%, in which case 225mm type 1 sub-base would be specified.

(ii) Bituminous layers: For very lightly trafficked roads carrying under 10 cvpd per lane (0.07 msa) a minimum thickness of bituminous layers of 110mm is recommended. This thickness is sufficient to avoid excessive sub-grade stress under the occasional very heavy wheel load on

MAINTENANCE OPTIONS FOR CATEGORY 4a AND 4b ESTATE ROADS 4

hot days. For roads carrying between 10 and 60 cvpd per lane (i.e. all other category 4b estate roads) a standard construction design shall be assumed giving a thickness of bituminous layers of 170mm.

4.3.6 However, from analysis of the performance of construction materials, it has been determined that 10mm of dense bituminous base (road) /binder course is equivalent to between 30mm and 35mm of type 1 sub-base material. This has been applied to the above to make the bituminous layer thickness 150mm in both cases whilst varying the sub-base thickness to maintain an equivalent structural strength. This gives the following reconstruction alternatives for category 4b estate roads:-

<10 cvpd		>10 cvpd		
30mm	Surface course	0/10mm CGBM to Cl 7.4 of BS4987 Pt	Surface Course	30mm

		1		
50mm	Binder Course	0/20mm DBM to Cl 6.5 of BS4987 Pt 1	Binder Course	50mm
70mm	Base (roadbase)	0/28mm DBM to Cl 5.2 of BS4987 Pt 1	Base (roadbase)	70mm
150mm	Type 1 Sub base		Type 1 Sub base	300mm

Notes:

- (i) the minimum construction depth of 450mm for frost susceptibility is assumed for roads >10cvpd as only a marginal increase in sub-base depth is required to meet this criterion. It is considered uneconomical for roads carrying <10cvpd to meet this criterion, many of which function at present with construction depths significantly less the 450mm.
- (ii) for residential cul-de-sac or back streets the surface course may be replaced by 25mm thick DBM to cl 7.5 of BS4987 Pt1 provided there is no overall reduction in the thickness of the bituminous layers.
- (iii) for all category 4b roads the binder course and base (road) layers may be replaced by either two layers of 0/20mm normal size DBM base course to cl 6.5 or a single 120mm layer of 0/28mm DBM base course to cl 6.4 of BS4987 Pt 1 if cost effective.

MAINTENANCE OPTIONS FOR FOOTWAYS

5

<u>5.1.0 MAINTENANCE OPTIONS FOR FOOTWAYS</u>	33
<u>5.2.0 PRECAST CONCRETE PAVING FLAGS</u>	33
<u>5.3.0 DENSE BITUMEN MACADAM (DBM)</u>	34
<u>5.4.0 FOOTWAY SURFACE DRESSING</u>	34
<u>5.5.0 SLURRY SEALING</u>	35
<u>5.6.0 RETREAD /SHALLOW RECYCLING</u>	35
<u>5.7.0 MODULAR BLOCK PAVING</u>	36

<u>5.8.0 CONCRETE</u>	36
<u>5.9.0 ALTERNATIVE BITUMINOUS MATERIALS</u>	36
<u>5.10.0 SLIP RESISTANCE IN PEDESTRIAN AREAS.</u>	36

MAINTENANCE OPTIONS FOR FOOTWAYS

5

5.1.0 MAINTENANCE OPTIONS FOR FOOTWAYS

5.1.1 There are two principal types of footway in Middlesbrough, these being:-

- (i) footways incorporating precast concrete paving flags
- (ii) footways incorporating bituminous surfacing.

In order to maintain these footways, the following maintenance options are available:-

Precast concrete paving flags.

Dense Bitumen Macadam (DBM).

Footway surface dressing.

Slurry sealing.

Retread/Shallow recycling.

Modular block paving.

Concrete.

5.2.0 PRECAST CONCRETE PAVING FLAGS

5.2.1 When it is the policy of the Council that renewal of footways should replace paving flags with blacktop construction, there will be exception to this is in certain designated locations, for example main shopping areas, where the continuing use of special pavings has been agreed.

5.2.2 When maintenance of footways is proposed, the Maintenance Engineer must decide between the merits of strengthening the over run areas or lifting and relaying the existing flags, including replacement of those which are damaged, compared with the renewal of the whole footway in blacktop construction. This should primarily be based on an assessment of the comparative costs involved. However, the construction and condition of adjacent footways must also be considered, such that the proposed works would not compromise the Maintenance Engineer in decisions on future maintenance in that area. This particularly relates to situations where reconstruction in blacktop might inhibit the option to lift and relay flags on a nearby footway.

5.2.3 If repetitive maintenance is required to footways due to vehicular overrun or areas most vulnerable to damage, then replacing existing paving on a strengthened sub-base may be cost effective solution, or alternatively concrete strips or bollards may be considered. Traffic paving is most suitable for pedestrian / vehicular shopping areas where accesses by light delivery and service vehicles is required. Paving particularly in heavy pedestrianised areas are regularly washed and swept by mechanical means see Clause 5.1.6. Under these circumstances Traffic paving can be advantageous to maintain a reasonable level in the interest of public safety.

5.2.4 The construction of flagged footways shall be in accordance with the requirements of section 10.9 of the Design Guide and Specification for Residential and Industrial Estates. It should be noted that paving flags shall be a minimum of 63mm thick and laid in an interlocking bond.

5.2.5 In cases where the existing sub-base is sound, replacement of paving flags with blacktop construction shall apply to the surfacing layers alone, with the existing sub-base remaining in place. The additional depth of bituminous surfacing shall be made up with binder course

MAINTENANCE OPTIONS FOR FOOTWAYS

5

material.

5.2.6 It should be noted that areas of paving can be seriously damaged by mechanical sweepers, which suck out the material between, and under, the flags and hence suitable precautions should be taken whenever practicable, particularly with newly laid surfaces. This clause equally applies to modular block paving.

5.3.0 DENSE BITUMEN MACADAM (DBM)

5.3.1 When it is proposed to resurface or reconstruct a footway using DBM in the surfacing layers, this shall be carried out in accordance with the requirements of Section 10.8 of the Design Guide and Specification for Residential and Industrial Estates.

5.3.2 However, full depth reconstruction of footways in flexible construction shall incorporate the following materials:-

- (i) 20mm depth of 0/6mm size surface course to BS4987 - Clause 7.5

- (ii) 40mm depth of 0/20mm nominal size binder course to BS4987 - Clause 6.5
- (iii) 150mm depth of type 1 sub-base.

Note: where footways are regularly subject to over-riding, increase the binder course thickness to 60mm and sub base to 225mm.

5.3.3 All materials used must be hot applied and freshly made. The use of "cut-back" is permitted but for surface course material only, and should be avoided altogether on footways likely to have immediate use during the summer months. Reference must be made to BS4987: Part 1: 1988 to ensure that all bituminous materials are correctly specified and ordered.

5.3.4 As a general rule, the following grades of binder should be specified.

- (i) DBM surface course laid during the summer months -160/220 pen
- (ii) DBM surface course laid at other times – no less viscous than 200 sec
- (iii) DBM binder course – 160/220 pen

5.4.0 FOOTWAY SURFACE DRESSING

5.4.1 As the far more socially acceptable alternative of slurry sealing is available at a similar cost, the use of surface dressing is not recommended for the treatment of footways in Middlesbrough as a general policy. There may, however, be individual locations, particularly in rural areas, where footway surface dressing is adjudged to be the most appropriate treatment. In such circumstances the merits of using polymer modified or fibre reinforced binders should be considered in improving the long-term durability of the treatment.

5.4.2 The Highway Network Management Plan describes the preventative maintenance strategy adopted by the Council. This philosophy extends to the maintenance of footways where the aim is to keep the need for resurfacing/reconstruction to minimum by prudent intervention at the appropriate time with preventative maintenance treatments

5.4.3 For carriageways this is achieved by patching, joint sealing and surface dressing, and for bituminous footways these options are also available. Patching and joint sealing can very

MAINTENANCE OPTIONS FOR FOOTWAYS

5

often be used as economic and effective ways of arresting footway deterioration on their own and Maintenance Engineers should give careful consideration to their use in avoiding the need for whole footway treatment

5.4.4 The use of surface dressing to treat footways, however, must be considered more carefully. As with carriageways, there are substantial cost savings when compared with the conventional alternative treatment of replacing the surfacing layer. However, unlike carriageway treatment, footway slurry seals present a maintenance option which is at a comparative price

5.4.5. Footway surface dressing is machine applied and is required to comply with a strict specification, which includes the need for proper control of pedestrian movements and aftercare. Nevertheless there are still loose chippings present and there is also a potential for bitumen becoming exposed, problems which have more unacceptable consequences on footways than when they occur on carriageways. These problems do not occur to a significant extent with slurry seals.

5.5.0 SLURRY SEALING

5.5.1 Slurry sealing is the principal treatment in the preventative maintenance strategy for bituminous footways. It is used to treat those bituminous footways exhibiting minor defects, such as crazing and-fretting, at a time which will enable the deterioration of the footway to be arrested. By this the life of the footway will be extended by a treatment which is a fraction of the cost of resurfacing or reconstruction.

5.5.2 Slurry seals can also remove minor surface irregularities either within the single coat application or by pretreatment with a regulating course of the material. The extent to which this can be done will depend on the product chosen and the aggregate size. Nevertheless, any significant depressions will need to be removed by preparatory patching.

5.5.3 The aggregate size for footway slurry seals varies from 1.5mm, which is a binder/sand mix with no regulating properties, to 5/6mm, where the material is capable of regulating minor depressions. The choice of material inevitably depends on the individual site for treatment, and the advice of the Laboratory Services and the Manufacturer should be sought before a final decision is made.

5.5.4 Slurry seals have the additional advantage of being available in a variety of colours, e.g. red, green, buff etc., and hence can be effectively used to highlight cycleways, for example, or areas of hard landscaping.

5.6.0 RETREAD /SHALLOW RECYCLING

5.6.1 For bituminous footway surfaces where cracking and/or surface deformation has occurred it is normal practice to reconstruct the bituminous layers using DBM binder course and surface course. Depending on the structural defect it may also be necessary to replace the sub-base material.

5.6.2 Reconstruction of the bituminous layers are relatively high, however, an acceptable result can be achieved by use of the retread process. Consideration should therefore be given

MAINTENANCE OPTIONS FOR FOOTWAYS

5

to using retread on all bituminous footways requiring replacement of the bituminous layers except in main shopping and busy urban areas. It should be noted, however, that retread will not deal with a defective sub-grade and hence its use is restricted to sites where the formation is structurally sound

5.6.3 The retread process involves the reconstitution of the existing footway material. Typically the process will involve scarifying the existing surface down to a maximum depth of 75mm. Additional material may be added if required, followed by various phases of harrowing, grading, rolling and application of bitumen emulsion. A temporary surface of bitumen emulsion and single size chippings can be applied; the treatment is, however, completed by the application of a new DBM surface course.

5.7.0 MODULAR BLOCK PAVING

5.7.1 For maintenance of existing areas of block paving, the materials shall be laid in accordance with the requirements of section 10.8 of the Design Guide and Specification for Residential and Industrial Estates. This shall also apply to new areas proposed for block paving

but each new site must be specifically approved by the Group Engineer (Maintenance) in advance.

5.7.2 Replacement of local or complete areas of block paving must involve "like for like" materials and thickness. The only exception to this is in areas of precast concrete flagging where the replacement flags must be 63mm minimum thickness.

5.8.0 CONCRETE

5.8.1 Full width concrete footpaths are normally only for use in industrial estates. Where their use is specified the materials shall be laid in accordance with the requirements of sections of 10.6 of the Design Guide and Specification for Residential and Industrial Estates.

5.8.2 Concrete may also be used on flagged footways where vehicle over-riding occurs, for example at entrance/exit radii or on the first course behind kerbs. In such locations the design shall be the same as for footpaths in industrial estates, although the reinforcing mesh may be omitted.

5.9.0 ALTERNATIVE BITUMINOUS MATERIALS

5.9.1 Permanent Cold-lay Materials: - the use of permanent cold lay materials is advocated in the HAUC Specification for the Excavation and Reinstatement of Openings in the Highway and it can therefore be considered for use.

5.10.0 SLIP RESISTANCE IN PEDESTRIAN AREAS.

5.10.1 It must be noted that there are requirements for a minimum wet slip resistance in pedestrian areas and therefore it is essential to choose the materials used in these areas with this in mind. The introduction of new specifications for block paving and flags gives a minimum wet slip resistance value at the time of installation of not less 35.

Normal pre-cast concrete flags and block paving have been tested over a number of years and are acceptable. Clay paviors are also acceptable. However some imported materials are

suspect therefore it will be necessary to check those materials where there is little or no data. Slip resistance is measured using a Pendulum Tester which simulates pedestrian use

GENERAL

6

6.1.0 SIGNING AND GUARDING OF ROADWORKS

39

6.2.0 TEMPORARY TRAFFIC SIGNAL CONTROL

39

6.3.0 NOTIFICATION OF WORKS

39

6.4.0 PROTECTION OF CARRAIGEWAY, IRONWORK

40

6.5.0 EXCAVATIONS

41

6.1.0 SIGNING AND GUARDING OF ROADWORKS

6.1.1 For any works carried out within the adopted highway the Contractor shall ensure that all roadworks signing is provided to the satisfaction of the Highway Authority and shall comply with Chapter 8 of the Department for Transport's 'Traffic Signs Manual'. The Contractor shall note that he has a civil law liability to warn road users of any obstructions on the highway caused in connection with his road works.

6.1.2 Any Traffic diversions which may become necessary must have prior authorization from the Highway Authority. At traffic sensitive locations, adequate time must be allowed for consultation processes to take place and for the full requirement of the New Roads and Streetworks Act 1991 to be met.

6.1.3 All sites to have contractors identification signing and contact telephone number.

6.2.0 TEMPORARY TRAFFIC SIGNAL CONTROL

6.2.1 The Traffic Signs Regulations and General Directions 2002 Part II Direction 53 provides the requirement that permission is required from a traffic authority for the placement of portable light signals on the highway. It is an offence under Section 65 of the New Roads and Street Works Act 1991 to place and operate portable light signals on the highway without approval from the traffic authority.

The following minimum notice periods are required for the approval process.

Category of Work	Period
Emergency, Special Urgent and Remedial (Dangerous)	Telephone before set-up Fast track/retrospective process
Urgent	Fast track process
Minor Works Traffic Sensitive	10 days
Minor Works Non-Traffic Sensitive	7 days
Remedial Works (Dangerous)	Fast Track Process
Remedial Works (Non-Dangerous)	10 days
Standard Works Traffic Sensitive	10 days
Standard Works Non-Traffic Sensitive	7 days
Major Works / Projects	20 days

Guidance Note GN 2/93 is available at the NEHAUC website <http://www.nehauc.org.uk/> along with the Temporary Traffic Signal Control Application checklist form NRSA 10/97/TS.

6.3.0 NOTIFICATION OF WORKS

6.3.1 In accordance with the Traffic Management Act 2004 and its associated Regulations all street and highway works will be registerable, except:

Works not breaking up the street, and either:

(a) not opening or incursing on carriageway of a Traffic Sensitive street during a Traffic Sensitive period

GENERAL

6

(b) not involving vehicle halting on carriageway (in non-legitimate parking place) for >10 minutes in 1 hour & 60 minutes in 1 day on a Traffic Sensitive street during a Traffic Sensitive period

Notices Periods

Activity Designation (Duration and Carriageway Incursion if applicable)	STREET CHARACTERISTICS			
	TRAFFIC FLOW PROXY			
	Category 0,1 and 2 as well as TS		Category 3 and 4	
	S54	Ss 55/57	S54	Ss 55/57

Programmed	6 months	20 days	6 months	20 days
Major (>10 days & Incursion or when a temporary traffic order is required)	3 months	20 days	3 months	20 days
Standard (4 to 10 days & Incursions)	2 months	20 days	n/a	20 days
Standard (< 4 days & Incursions)	n/a	20 days	n/a	10 days
Minor (No Incursions)	n/a	3 days	n/a	3 days
Immediate	n/a	2 hours after	n/a	2 hours after

6.4.0 PROTECTION OF CARRAIGEWAY, IRONWORK

6.4.1 The contractor shall employ mechanical equipment and/or labour to keep all roads, footpaths and footways clean and free from dust, mud, slurry and any obstructions to the satisfaction of the Highway Authority.

6.4.2 The contractor shall be responsible for the protection of and the adjustment of all manhole covers, hydrants, service boxes and road gullies to suit the finished road level prior to the laying of the surface course. Any part of these covers against which surfacing material is to be laid shall be cleaned and treated with hot bitumen or emulsion to the satisfaction of the Engineer. If required gullies must be emptied upon completion and filled with fresh water.

GENERAL

6

6.5.0 EXCAVATIONS

6.5.1 All excavations in the footway or carriageway shall be carried out in strict accordance with Clause 6.1 and in a manner which avoids undue damage to the road, or any other adjacent structures.

6.5.2 When excavations are to be carried out in the vicinity of street trees, whether on the highway or adjacent to, guidance should be taken from Advice Note for Local Authorities 1996 also from the National Joint Utilities Group (NJUG) 1995

Bibliography: -

- i. Road Note 39 – 3rd Edition
- ii. RDSA Guidance Note
- iii. BS434 – Bitumen Road Emulsions
- iv. BS594:2003 - Hot Rolled Asphalt for Roads and Other Paved Areas
- v. BS4487: 2003 – Coated Macadams for Roads and Other Paved Area
- vi. [Middlesbrough Council Design Guide and Specification for Residential and Industrial Estates](#)

- vii. Specification for Highway Works (Current Edition)
- viii. Middlesbrough Borough Council Blacktop Guide
- ix. Bituminous Mixes and Flexible Pavements – An Introduction (BACMI)
 - x. HAUC Specification for the Reinstatement of Openings in the Highway.
 - xi. CSS: A Practical Guide to Patching
- xii. HD 14/87 & HA 35/87 - Structural Design of New Road Pavements.
- xiii. LR1132 - The Structural Design of Bituminous Roads.
- xiv. New Roads and Streetworks Act 1991
- xv. Code of Practice for the laying of precast concrete paving blocks and clay pavers for flexible pavements