Hampshire County Council

Universal Services Directorate

Technical Guidance Note
TG6-2 - Flexible and Rigid Pavement Design

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Amendments are indicated by a bar in the left hand margin

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1. Policy / approach

1.1. Overview

1.1.1. The policies adopted by Hampshire County Council look to deliver road pavements that provide resilience and minimise the maintenance requirements of the entire road pavement during their design life.

1.1.2. Design Standards are used to ensure a consistent approach to pavement design and future maintenance. Within Hampshire these include:

- Design Manual for Roads and Bridges (DMRB)
- Manual of Contract Documents for Highway Works
- Specification for Highway Works
- Hampshire County Council's Highway Construction Standard Details
- Notes for Guidance on the use of the County Council's Series 11 Standard Detail Drawings
- Hampshire County Council's Technical Guidance Notes (TGs)

1.1.3. The TGs identify which elements of the DMRB are to be applied within Hampshire, as well as detail any other design standards / requirements that apply. They also include wider design guidance, detail any processes to be followed and link to the County Council's Material Use and Commuted Sum Policies. The relevant TGs associated with the design of pavements are detailed in section 3.

1.1.4. A design that does not comply with the Design Standards as required/detailed in this TG (this includes any cross reference to DMRB or other published standards), will require a departure from standard (DfS), in accordance with Technical Guidance Note TG 17 - Departures from Standard, for each element of the design that does not comply. There is no guarantee that a DfS will be granted and until the outcome is received, the design will be progressing at risk.

1.2. The design and construction of durable road pavements

1.2.1. The six essential elements required for the design and construction of a durable road pavement are:

- the nature and condition of the site through investigation
- an assessment of predicted commercial traffic volumes that the pavement has or will convey during its design life
- the foundation on which the pavement is to be constructed
- the design of the pavement itself
- the materials from which it is to be constructed
- the effective construction of foundation and pavement

1.2.2. These six elements all play a part in the design and long-term life of a road pavement. Further details on the technical requirements for each, as well as construction considerations, are provided in the following sections

1.2.3. When designing pavements, preference should be given to using recyclable materials with lower whole life carbon and warm mixes rather than hot mixes.

2. Definitions & abbreviations

AAV	Aggregate Abrasion Value
AC	Asphalt Concrete
CBGM	Cement Bound Granular Mixture
CRBM	Cold Recycled Bound Material
CRCB	Continuously Reinforced Concrete Base
CRCP	Continuously Reinforced Concrete Pavement
DCP	Dynamic Cone Penetrometer
Departure from standard (DfS)	A non-compliance with a mandatory requirement of a standard, as set out in Hampshire County Council's Technical Guidance Notes or other policy/standard document cross-referred to from the Technical Guidance Notes.
DMRB	Design Manual for Roads and Bridges
Design organisation	Any organisation, including in-house County Council resources, undertaking the design of works that affect any part of the highway network. Such works include private and public developments.
EME2	Enrobés á module elevé (2nd generation) material
HBGM	Hydraulically Bound Granular Mixture
HBM	Hydraulically Bound Mixture
HDM	Heavy Duty Macadam
HFS	High Friction Surfacing
HMB	High Modulus Base
HRA	Hot Rolled Asphalt
HSS	Hydraulically Stabilised Soils
JRC	Jointed Reinforced Concrete
Legal requirement	A statement in a standard that is associated with the words "must" or "must not". Legal requirements cannot be departed from or relaxed.
LWD	Light-Weight Deflectometer
Mandatory requirement	A statement in a standard with the words "shall" or "shall not"
MCHW	Manual of Contract Documents for Highway Works
MMA	Methyl Methacrylate
NH	National Highways

PSV	Polished Stone Value
QVE	Quick Visco-Elastic
RCC	Roller Compacted Concrete
SHW	Specification for Highway Works. The Specification for Highway Works is published as Volume 1 of the MCHW and, in addition to this introduction, contains numbered Series and Lettered Appendices. Reference is to be made to the relevant series and clauses as applicable to the Contract.
SMA	Stone Mastic Asphalt
GDCSO	Hampshire County Council's Guidance Document for Carriageway Surfacing Options
TG	Technical Guidance Note - A suite of notes detailing what the adoptable standards are for Hampshire County Council's local Highway network.
TRC	Temporary Running Course
TSCS	Thin Surface Course System
URC	Unreinforced Jointed Concrete
WMA	Warm Mix Asphalts

3. Additional guidance

The following documents and publications are to be reviewed when preparing to design a flexible or rigid road pavement:

Design Manual Roads and Bridges

- CD 127 - Cross-sections and Headrooms
- CD 224 - Traffic Assessment
- CD 225 - Design for New Pavement Foundations
- CD 226 - Design for New Pavement Construction
- CD 227 - Design for Pavement Maintenance
- CS 228 - Skidding Resistance
- CS 230 - Pavement Maintenance Assessment Procedure
- CD 236 - Surface Course Materials for Construction

Manual of Contract Documents for Highway Works

Guidance Document for Carriageway Surfacing Options

TRL Report - LR1132

BS 594987 - Asphalt for roads and other paved areas – Specification for transport, laying, compaction, and type testing protocols

PD 6691 - 2015 - Guidance on the use of BS EN 13108 - Bituminous mixtures – Material specification

'Managing Reclaimed Asphalt' - ADEPT

Technical Guidance Notes

- TG5 - Geotechnical Investigation, Testing and Design
- TG6-1 - Pavement Foundation Design
- TG6-3 - Modular Pavement Design
- TG6-4 - Permeable Paving
- TG8-1 - Drainage – General
- TG8-2 - Drainage – Infiltration
- TG17 - Departures from Standard

Highway Construction Standard Details

Notes for Guidance on the Highway Construction Standard Details

Hampshire County Council's Commuted Sums Policy

4. Technical requirements

4.1. General

4.1.1. This TG covers the design of new flexible and rigid pavements, as well as some aspects covering the maintenance of existing pavements. Guidance on the design of pavement foundations, modular pavements and permeable pavements are covered in TG6-1, TG6-3 and TG6-4, respectively.

4.2. Pavement

4.2.1. Pavement is the description given to the bound materials placed above the foundation. The vast majority of pavements within Hampshire's highway network are of a flexible construction, the bulk of which have evolved over time and have not been constructed to any design standards or using materials produced to a national specification.

4.2.2. Designed pavements generally consist of a surface and binder course (surfacing layers) over a structural base layer. Predominantly, flexible pavements are designed with an asphalt concrete (AC) base. However, lean mix concrete, wet lean concrete (now called lower strength concrete), wet mix macadam (unbound) and Hydraulic Bound Materials (HBM) may have been used for the construction of the base. Rigid and rigid composite (concrete with an asphalt overlay) and modular pavements are also on occasion constructed within Hampshire.

4.2.3. A surface course is expected to last between 10 and 20 years depending on the various factors including material used, quality of construction, weather, location etc. This can be extended by the application of surface treatments such as surface dressing or micro asphalt to seal the surface, but if left to deteriorate, the replacement of the surface course, or possibly the full pavement thickness, will be required. The period until a surface treatment is required will vary depending on the volume of commercial vehicles using the pavement, as well as the site's skid resistance requirements.

4.3. Investigation

4.3.1. Undertaking adequate investigation is vital to ensure that the subgrade strength is correctly assessed to enable a suitable foundation to be designed to support the proposed pavement. The foundation Class used for the foundation will also influence the choice of pavement to be designed.

4.3.2. It is incumbent upon the design organisation to consider the condition of the existing pavement into which any new construction or maintenance works are to be tied into or placed over. If the existing pavement is not

investigated, the design life of the pavement or performance at the interfaces could be compromised.

4.4. Traffic assessment

4.4.1. The estimation of 'design traffic' (commercial vehicles / lane / day – cv/l/d) for new roads, and of past and future predictions of cv/l/d for existing roads, is essential for determining the required thickness of a carriageway's pavement. This shall be undertaken in accordance with CD 224 – Traffic Assessment.

4.5. Pavement foundations

4.5.1. The main purpose of a pavement's foundation is to distribute the applied commercial vehicle loading at the base of the pavement through to the underlying subgrade. This is to be achieved without causing distress within the foundation or overlying layers, both during construction and the design life of the pavement.

4.5.2. Where an existing pavement is to be widened or reconstructed, access to the existing foundation is especially important to inform the new design. This is especially important for evolved roads, which are likely to be thinner than modern pavements, as it is essential not to create a 'sump' where pooled water would weaken the pavement foundation.

4.5.3. Whilst the subbase is not designated as a pavement layer, it is included within Appendix 7/1 of the projects specified along with the pavement construction details. Capping, which is an earthworks material, and part of the pavement's foundation, is, where required, also indicated within Appendix 7/1, with details of the acceptable options specified within Appendix 6/7.

4.5.4. The pavement's foundation shall be designed in accordance with TG6.1 - Pavement Foundation Design.

4.6. Design life

4.6.1. A 40-year design period without structural maintenance is generally considered the most economical solution for all new pavements and maintenance purposes. Any proposal for a lesser design period needs agreement in advance from the Highway Authority. The only exception to this is for maintenance schemes on evolved roads where the scheme brief/scope of works may only require resurfacing or haunching to a lesser value as directed by the Highway Authority.

5. Design factors

5.1. Investigation

5.1.1. Determining the condition of the existing pavement to be tied into or widened is essential. Visual surveys are key for the identification of construction changes and defects such as rutting and deformation, cracking and fretting, water pumping and drainage issues etc. From this further pavement investigation can be targeted at identifying:

- **Pavement construction**: materials (including the presence of coal tar), thicknesses and condition, details of bonding and defects.
- **Subbase and capping**: materials, thicknesses and condition, presence of water.
- **Subgrade**: material and condition, presence of ground water.

5.1.2. Coarse and detailed visual Inspections, as well as SCANNER (Surface Condition Assessment for the National Network of Roads) or other automated road carriageway condition surveys, can be used to determine the condition of an existing pavement, as well as informing the planning of maintenance proposals.

5.2. Pavement cores and in-situ testing

5.2.1. Cores, ideally of 150mm diameter, should be taken to determine the composition and layer thickness for all existing pavements to be widened or tied into. They will identify any variance in composition, as well as helping to determine the cause of any existing defects. This will assist in the determination of any underlying issues to be addressed whilst designing the new pavement or maintenance proposals, as well as for the purposes of producing tie-in details. Refer to Section 4 of ADEPT's 'Managing Reclaimed Asphalt – Highways and Pavements'

5.2.2. All core samples shall be tested for the presence of tar bound material immediately after extraction using a PAK Marker Spray. Where the presence of tar is identified, the core materials shall be bagged and immediately sent off to a laboratory for PAH (16) testing to determine the nature of the tar, with the materials prepared in accordance with appendix C of the ADEPT guidance. As it takes on average around 7-10 working days for laboratory testing, it is recommended that testing be provisionally programmed in case positive PAK tests occur. Further guidance can be found in documents, such as ADEPT's 'Managing Reclaimed Asphalt – Highways and Pavements'.

5.2.3. For detecting the presence of tar, a minimum of 1 No. core is recommended for sites with an area of less than 30m^2. However, for larger sites it is recommended that a minimum of 3 cores be taken, but in order to determine whether the potentially hazardous material covers the whole site or is more isolated, more cores should be taken, as the disposal of tar

bound materials is costly and there is also restriction on the storage of such materials on site. The maximum spacing shall be 50m.

5.2.4. If hazardous levels of tar are found to be present (indicated by a concentration of benzo(a)pyrene at or above 50 ppm (mg/kg) from the PAH testing), the material shall be identified within Appendix 2/5 – Hazardous Materials, and if it is to be removed, details shall be included within all appropriate appendices: Appendix 6/2 where removal is to be undertaken by excavation and Appendix 7/9 where it is to be removed by planing.

5.2.5. Where a section of existing carriageway is to be retained, assessments of the existing skid resistance shall be undertaken using a SCRIM (Sideway-force Coefficient Routine Investigation Machine) or Griptester survey. The assessment shall be undertaken in each direction covering, as a minimum, the extent of the proposed works. For smaller sites of less than 50m length, skid resistance can be assessed using a pendulum skid tester at a minimum of three locations within the nearside wheel track in each direction.

5.2.6. Where the skid resistance of the existing surface course is determined to be less than the required investigatory level for the appropriate Site Category for the new proposals, the existing surface shall be replaced as an inlay or overlay to match the requirements for the site. Where the existing carriageway is to be widened, the existing section of pavement shall be resurfaced as an inlay or overlay to match the proposed widening and laid homogeneously across the total width of the pavement.

5.3. Subgrade assessment

5.3.1. The subgrade strength shall be determined as detailed within TG6-1. Core holes only provide very limited opportunity to undertake sampling of the subgrade material for assessing plasticity and moisture content via laboratory testing, nor to easily establish the nature of the subbase and / or capping, nor their thickness. Therefore, trial pits shall be excavated for the purpose of sampling, to enable classification of the subgrade and facilitate in-situ testing of subgrade strength.

5.3.2. For further information on geotechnical testing requirements, including the assessment of subgrade strength for the design of payment foundations, are given in TG5 – Geotechnical Investigation, Testing and Design, with further advice provided within TG6-1 – Pavement Foundation Design.

5.4. Frost susceptibility

5.4.1. Where the subgrade is frost susceptible, the overall construction thickness should not generally be less than 450mm, irrespective of subgrade strength. Where a site-specific frost index evaluation has been carried out, it may be possible to justify reducing the minimum cover to 350mm. Further details are provided within TG6-1.

5.5. Traffic assessment

5.5.1. It is essential that existing traffic flows and / or predicted traffic volumes are established. This should include the number of commercial vehicles (CV) by class and category from classified traffic counts undertaken manually, ascertained from a video survey and / or predicted via modelling. Existing traffic data can also be obtained using automatic traffic counters (ATCs), or from permanent traffic counter locations, provided the results are fully classified. However, the classification of vehicles will always be more accurate from a manual or video survey. The option to derive commercial vehicles flows that was included in HD 24/06 does not exist within CD 224.

5.5.2. For new development junctions, any existing flows from traffic counts and proposed flows from transport assessments shall be modelled and converted to annual average daily flow of commercial vehicles (AADF), 1-way flow, for the predicted scheme opening year. For maintenance schemes, the existing AADF shall be used to determine the commercial vehicle flows and an assessment of past traffic undertaken to determine the residual life. The AADF is to be spilt by commercial vehicle classes and categories - OGV1 (2 and 3-axle rigid vehicles) and OGV2 (4-axle rigid vehicles and articulated vehicles with any number of axles).

5.5.3. CD 224 shall be used to determine the 'design traffic' in MSA, using the cv/l/d data, which in turn is used for the design of new and existing road pavements. Unless a DfS has been agreed, a 40-years Design Period shall be used. Growth (predictions of future increases for all categories of CV) and wear (associated to the passage of CVs over time) are to be applied for both new and existing pavements in line with the requirements within CD 224. Also, for dual 2 and 3 carriageways, the proportion of commercial vehicles in the heaviest loaded lane shall be determined.

5.6. Flexible and rigid pavement design standard

5.6.1. CD 226 is the design standard that shall be used for all flexible and rigid pavements. Figure 2.20 shall be used for the design of flexible pavements, both with asphalt and a Hydraulically Bound Granular Mixture (HBGM) base layers, utilising the 'design traffic' (MSA) derived from CD 224. As mentioned previously, the vast majority of pavements within Hampshire are of flexible construction with an asphalt base. However, where a flexible pavement with an HBGM base is being designed, it shall be Cl. 822 CBGM 1, C8/10 (or T3).

5.6.2. Figure 2.26 is to be used for the design of rigid pavements, both continuously reinforced concrete pavement (CRCP) and continuously reinforced concrete base (CRCB). Design Thicknesses for Rigid (Jointed) Pavements shall be calculated in accordance with Equations 2.46a and 2.46b. Roller compacted concrete (RCC) shall be designed using Figure 2.40. Guidance for designing Alternative Pavements is provided in Section 4 of CD 226.

5.6.3. When producing designs for extending the life of an existing pavement, consideration shall be given to the traffic loading it has carried since its construction, as well as its residual life. CD 224 provides guidance on how to derive commercial vehicle growth of past traffic in order to establish a 'design traffic' (MSA) for designing maintenance proposals.

5.6.4. Unlike HD 26/06, CD 226 does not include separate lines within the nomograph for Design Thickness for Flexible Pavements for DBM50/HDM50, HRA50 or DMB125, but a single AC40/60 option, along with EME2 (see section 7.2 for further information on the use of EME2). However, DBM 125 may be considered in specific circumstances in cold weather on lightly trafficked lower classification (C and U) roads due to its greater workability. Where DMB 125 materials are required to be used, further guidance is provided within section 7.5.

5.6.5. It should be noted that, CD 226 requires that the total thicknesses of materials be rounded up to the nearest 5mm, and not 10mm as was the requirement within HD 26/06.

5.7. Widening and tie-ins

5.7.1. When tying into or widening an existing carriageway, which may not conform to current design standards, details are to be produced to ensure a contiguous and durable surface finish and to prevent the formation of 'sumps' which may trap groundwater and cause softening of the subgrade. Further guidance on maintaining drainage paths within pavement foundations can be found within CD 225.

5.7.2. The preference would always be to widen the excavation to a minimum of 1.3m to enable conventional construction techniques to be used, with Type 1F unbound mixture subbase materials to Cl. 803 used to improve compaction. In order to place the joint between the wheel track zone, the existing surface and binder course shall be removed, with stepped joints formed in accordance with requirements of Cl. 903.29 to Cl. 903.41. Refer to the M-series of the County Council's Highway Construction Standard Details

5.7.3. Where constraints dictate that a side road tie-in or haunch widening of less than 1.3m wide is all that can be provided, internally vibrated C8/10 lower strength concrete 2 (LSC2) (formerly wet lean concrete 2), may be used in lieu of the granular subbase and base layers to overcome difficulties in compacting granular materials in narrow strips. Crack inducers shall always be installed transversely at the formation throughout the section of widening at 3.0m centres.

5.7.4. If the existing drainage paths would be interrupted, then 100mm diameter perforated pipes shall be installed beneath the concrete from the existing construction to at least 100mm beyond the edge of the proposed widening. The pipes shall be filled with 4/10 mm clean aggregate and the ends closed with a permeable geotextile. These pipes shall coincide with low spots and be placed at a maximum of 10.0m intervals.

5.7.5. The binder and surface course joints shall be positioned as required by Cl. 903.29, with the binder and surface course layers removed from the existing carriageway to enable new layers to be installed homogeneously across the haunch and existing carriageway.

5.7.6. As with all tie-ins, a stepped joint shall be constructed between the existing pavement and the haunch. A glass fibre composite Type 1 pavement reinforcement shall be installed to help prevent reflective cracking through the overlying asphalt layers above the joint between the existing and proposed base layers. This should extend a minimum of 0.5m each side of the joint below the proposed binder course.

5.7.7. Care shall also be taken to ensure that the skidding resistance is even across the existing and widened carriageway. Where there would be a difference in skidding resistance between an existing and proposed surface course, the existing surface course shall be removed, and a new surface course applied homogeneously across the existing and widened pavement.

5.8. High friction surfacing

5.8.1. High friction surfacings (HFS) are products which contain 100% calcined bauxite aggregate with a PSV in excess of 70. They can be applied on the approaches to junctions and crossing locations and around bends where the level of wet grip required cannot be provided by naturally occurring aggregates and / or where the risk of skidding cannot be reduced by other measures.

5.8.2. Whilst HFS's provide excellent skid resistance, they are not particularly durable and are expensive to maintain / replace. Therefore, their use shall be restricted to specific locations where there is a clear and demonstrable safety need for a higher PSV than can be achieved through conventional surfacing products.

5.8.3. The site shall be risk assessed and the nature of the site (Site Category), measured traffic speeds and the known or predicted volumes of cv/l/d used for determining where HFS should be applied. Further guidance can be found within the County Council's Guidance Document for Carriageway Surfacing Options (GDCSO), specifically Tables 1e and 1f.

5.8.4. There is a preference within Hampshire to not use HFS, but a surface course with a 68 PSV aggregate where the Highway Authority considers it appropriate to do so following a site-specific assessment, with HFS applied where the proposed traffic or site conditions dictate it is required. Further guidance on these HFS systems are provided in section 7.7.

5.8.5. The minimum length of HFS required under any given circumstances should be equivalent to the distance travelled over a three second period at the posted speed limit. The recommended minimum lengths, as well as further guidance on the laying requirements and other criteria are provided within the GDCSO.

5.9. Overrun areas

5.9.1. Overrun areas are used to 'extend' the carriageway for use by larger vehicles, which require a greater width to manoeuvre or negotiate a junction. They are commonly used on smaller or compact roundabouts, as well as for deflection buildouts. They enable larger vehicles to be accommodated but create the deflection required to achieve a compliant design by dissuading lighter traffic from taking a straight ahead and faster path through the introduction of an inclined surface, with or without a rumble effect.

5.9.2. In all situations, it shall be incumbent on the Design Organisation to produce a compliant design that avoids the need for any overrun areas, as they present significant maintenance implications. Their use shall only be permitted in extreme circumstances, and the Design Organisation shall clearly demonstrate that a solution cannot be delivered without overrun areas, **irrespective of the land required to achieve a compliant design** for the Highway Authority to consider approving its use, and works shall not commence without prior approval.

5.9.3. As all overrun areas are to be designed specifically for the site in question, no standard detail has been produced. However, further guidance is provided within the Notes for Guidance on the Highway Construction Standard Details to assist with their design for locations where they are to be permitted.

5.10. Pavement design report

5.10.1. In accordance with the England National Application, E1, within CD 226, a pavement design report shall be produced for the design of all new, widened or upgraded pavements. The report shall be submitted along with the design drawings, specification and any proposed DfSs in relation to the pavement design as part of the approval process by the Highway Authority.

6. Design process

6.1. General

6.1.1. The designs of new pavements and widening schemes shall be undertaken in accordance with the requirements of CD 226. An alternative design may be produced, but in accordance with CD 226, 4.8, justification for the choice and an indication of any additional specification requirements or testing regime necessary for their validation shall be included within the pavement design report. Maintenance schemes shall be designed in accordance with GDCSO.

6.1.2. The issues of future maintenance requirements must be considered when the width of the carriageway is determined, with the ability to use lane closures preferred to the need for a full road closure. Where traffic is to be channelised, such as at priority give way features, the pavement shall be designed to cater for the total two-way volume of commercial vehicles on the immediate approach and alongside the buildout.

6.1.3. Where such features are to be retrofitted into an existing carriageway, consideration shall be given to reconstructing the section of pavement on the immediate approach to and alongside the buildout to pre-empt the need for early structural maintenance. Cores shall be taken, and the existing pavement construction assessed to determine whether the existing pavement will adequately cope with the predicted CV flow for a further 40-years, with reconstruction proposed if determined otherwise.

6.2. Flexible pavement design

6.2.1. The design total thickness for flexible pavements with either a flexible asphalt or HBGM base shall be determined using the nomograph in Figure 2.20 of CD 226. As mentioned within section 4.2, the total thickness is divided into surface and binder course (surfacing layers) over a structural base layer. Generally, the surfacing layers constitute the top 100mm; commonly 45mm for the surface course and 55mm for the binder course, with the remaining thickness formed of base material. However, 50mm thick surface course over a 60mm binder course may be used, but it should be noted that surface and binder course materials are normally more expensive than base materials.

6.2.2. Flexible AC binder course and base with 40/60 penetration binder are most commonly used for pavements within Hampshire. However, on occasion 100/150 binders are used for specific locations for lightly trafficked roads constructed during colder weather, subject to Highway Authority approval.

6.2.3. There is an option to use ex-situ cold recycled bound material (CRBM) for both base and binder within a pavement. See section 7.2 for further information.

6.2.4. The base and binder course should be of the same material type (both layers contain AC 40/60 or both layers containing EME2). However, where

a design for a flexible pavement with an asphalt base combines an EME2 layer with an AC 40/60 layer, the design thickness shall be based on the AC 40/60 line in Figure 2.20 and not that for EME2.

6.2.5. Where a flexible pavement with an asphalt base using EME2 is being proposed for a new carriageway, a Class 3 or Class 4 foundation shall be used, unless a Class 2 foundation can be demonstrated to achieve a minimum stiffness of 120 MPa. This is because of the increased effort required to fully compact EME2 materials where very low penetration binders are used. However, for flexible pavements with an asphalt base, the Class 2 foundation line in Figure 2.20 can be used with EME2 when widening or reconstructing an existing pavement which has been assessed to have a Class 2 foundation.

6.3. Rigid pavement design

6.3.1. The nomograph, Figure 2.26 - Rigid (Continuous) Pavements, shall be used for the design of CRCB and CRCP Pavements, with URC, JRC Pavements calculated in accordance with Equations 2.46a and 2.46b.

6.3.2. Roller compacted concrete (RCC) is another alternative form of rigid construction that has recently been added to the SHW 1000 Series. It may be permitted for specific applications other than for use within pavements for main carriageways, such as for the construction of agricultural accesses. Where considered, the design thickness shall be determined using Figure 2.40.

6.4. Hard shoulder

6.4.1. To ensure full compaction of the trafficked carriageway, rural all-purpose single carriageways without footways or kerbs should have a 1.0m hard shoulder, measured to the trafficked side of edge line, in accordance with the requirements within CD 127 - Cross-sections and Headrooms. This is also to ensure that any over-the-edge drainage discharges the surface runoff further from the trafficked pavement to reduce the possibility of softening a susceptible subgrade under the pavements' shoulder. However, where 1.0m is considered impracticable due to land constraints, the shoulder width may be reduced to 0.3m, where permitted by the Highway Authority.

6.5. Bridge decks

6.5.1. For bridge decks, commonly a 100mm depth of surfacing (binder and surface course) is applied, subject to the Approval in Principle (AIP) process. This will normally consist of hot rolled asphalt materials for the surface course layer as it provides a more 'waterproof' layer than AC materials. Depending on the cover to the deck, a base and / or foundation may also be required. Warm mix asphalts may be used for the base and binder layers. If an AC surface course is proposed for the adjacent pavement, this shall be changed to an HRA surface course with equivalent characteristics over the bridge deck to provide a more impervious surface.

7. Materials

7.1. General

7.1.1. Hampshire's GDCSO provides guidance on the materials to be used for new pavements and maintenance proposals. It concentrates mainly on surfacing materials, providing guidance on which materials to specify for a specific use or location based on commercial vehicle volumes and stress condition for differing speed limits, road hierarchy and Site Category. It also provides recommendations for layer thicknesses and laying temperatures, plus details on the use of bond coats, Polished Stone Values (PSV) and Aggregate Abrasion Value (AAV) etc. as well as the requirements and thicknesses for regulating materials and permitted binder course and base materials.

7.1.2. Explanations of pavement defects and details of maintenance options and techniques, not covered within this TG, are also provided.

7.1.3. Relaxations on the use of specific surfacing materials, such as proprietary materials to address specific conditions, may be considered for schemes within conservation or special designation areas. However, these will necessitate submitting a DfS for approval to their use and a commuted sum may be required to cover the cost of the future maintenance.

7.1.4. Below is guidance on the flexible and rigid pavement materials permitted for use within Hampshire.

7.2. Flexible pavements

7.2.1. The majority of Hampshire's network is surfaced with bitumen bound products, the preferred materials for use on Hampshire's highway network. Details of the materials options for the various structural elements and surfacings for flexible pavements, from small residential roads to dual carriageways and junctions are set out within the GDCSO.

7.2.2. Hampshire requires that, with the exception of Cl. 942, the contractor guarantees all installed surface courses for a period of **3-years** from the date of opening to traffic. All installed Proprietary Thin Surface Course Systems (TSCS) conforming to Cl. 942 and HFSs conforming to Cl. 924 shall be guaranteed for a period of **5-years** and **3-years**, respectively. For developer-led schemes, refer to the S278/S38 Guidance for Developers.

Material selection

7.2.3. The selection of appropriate materials is vital to producing a pavement that meets the needs and safety of its users, whilst providing value for money. As mentioned above, the total thickness of flexible pavements is based on a predicted MSA using Figure 2.20 of CD 226, with stiffer materials producing a thinner total pavement thickness.

7.2.4. The assessed total thickness is made up of three pavement layers. As mentioned in 6.1, the surfacing typically makes up the upper 100mm, with

the remaining thickness being the structural base layer below. The nominal target layer thickness and minimum compacted layer thicknesses for all asphalt concrete (AC) mixtures are stated in BS 594987. Where required, thicker bases may need to be laid in two layers to satisfy the nominal layer thickness requirements.

Surface course options

7.2.5. For the majority of carriageways within Hampshire, HRA is the preferred surface course option. Where macro texture is required HRA with pre coated chippings is specified. HRA surface course will be either a design mix clause 911 or a performance mix clause 943. Stone Mastic Asphalts (SMA) or Asphaltic concretes (AC) should only be used where there is a valid reason not to use an HRA material and they are certified compliant with clause 942.

7.2.6. The choice of surface course material should be made based on the suitability for the site in question, considering the traffic use, cv/l/d and the site category. Guidance on selection of appropriate surface course materials is provided within the GDCSO.

Bituminous base and binder options

7.2.7. The first-choice binder and base material is CRBM. However, this may not be acceptable for higher levels of trafficking (see section 2 of the GDCSO for further details).

7.2.8. When using AC base and binder, there is no discernible benefit in specifying hot over warm materials, as they are equal in terms of performance, so the warm mix option should be used whenever possible/available due to environmental benefits. For AC base and binder materials (whether warm or hot) increased stiffness from materials with bitumen (40/60 pen) are preferable, especially as all asphalt laid in carriageways should be machine laid. Where AC base/binder is used, it should be a Design mix (Des) in in accordance with the GDCSO and clause 929 of the SHW. This is because they achieve a consistent mixture whereas Recipe (Rec) mixes in accordance with clause 906 of the SHW can be problematic due to variable aggregate characteristics. Base layers are produced using a 32mm size coarse aggregate, whilst binder courses use a 20mm size coarse aggregate.

7.2.9. When designing new pavements, the nomograph (Figure 2.20) in CD 226 is only applicable to Cl. 929 design mixes – Cl. 906 material should not be specified.

Warm mix asphalts

7.2.10. In July 2021, Cl. 908 was added to the SHW introducing a number of permitted Warm Mix Asphalts (WMA). There are substantial environmental benefits to be gained from using such materials whose production requires less energy, and potential reductions in carbon dioxide emissions of up to

15%. Hampshire declared a climate emergency in June 2019 and as part of the authorities aim to reduce its impact on the environment, WMAs shall be used in preference to traditional hot mix materials unless prior agreement has been given by the Highway Authority. There are added health and safety benefits, as these materials are typically laid around 40°C cooler than conventional hot mix asphalts.

7.2.11. Within the list, the following materials are permitted:

- Clause 911 for High Stone Content Asphalt (not Cl 911 chipped HRA)
- Clause 942 for Thin Surface Course Systems

7.2.12. In addition, High Stone Content Asphalt to Clause 911 is to be permitted, as this does not need to be at the higher temperature required of a chipped HRA to enable pre-coated chippings to be rolled in.

7.2.13. There are also WMA binder materials available, and within Hampshire the following materials are permitted:

- Clause 929 for Dense Binder Course Asphalt Concrete (Design Mixtures)
- Clause 937 for Stone Mastic Asphalt (SMA) Binder

plus, the following base material:

- Clause 929 for Dense base (Design Mixtures)

In all situations, WMAs shall be installed in accordance with the producer's (manufacturer's) instructions.

Recycled base and binder options

7.2.14. Cold-lay base and binder courses materials are produced from the arisings of excavating redundant pavement materials and similar sources, blended, if necessary, with other aggregate and bound with cementitious, hydraulic, or bituminous binders, separately or in combination.

7.2.15. Ex-situ CRBM to Cl. 948, and in compliance with BS 9228, can be produced using bitumen, foamed or as an emulsion, with or without cement. It can also contain additional fillers for added strength, or lime for 'breaking' and adhesion purposes. Four options are described and categorised in the SHW. When added to the pulverised and graded redundant pavement materials, CRBMs are produced which can be used as a base or binder material.

7.2.16. Within Hampshire, CRBM is being produced from tar bound road planings, predominantly removed from Hampshire's highway network. At Hampshire County Council's Micheldever depot, Quick Visco-Elastic (QVE) Class B4 materials are being produced. This material is available to purchase for use on all County Council schemes.

7.2.17. The nominal aggregate size is 20mm, and the Class B4 Indirect Tensile Stiffness Modulus, equivalent to 4700 MPa. To the graded aggregate is

added foamed bitumen, OPC and additional fillers. It is comparable to an AC 40/60 hot mix asphalt material, and as such, can be used as a binder course within footways and potentially as a base and / or binder course within C or U category carriageways, and possibly higher categories with Highway Authority approval, as part of a designed pavement. However, as the aggregate is nominally 20mm, the nominal target layer thickness of between 50mm and 100mm shall apply.

7.2.18. Once compacted, the material shall be sealed using a sprayed membrane of Class C40 B4 bitumen emulsion in accordance with the requirements of Cl. 948.29.

7.2.19. A period of 24 hours may be required to allow for curing of a CRBM layer before either trafficking or placing further layers upon it.

Hydraulic Bound Mixtures

7.2.20. Hydraulic Bound Mixtures (HBM) is the generic term which covers a wide range of mixtures of aggregates or soil plus hydraulic binders and water which can be used in UK construction and road maintenance. These include HBGM, CBGM, HSS, RCC etc. BS 9227 specifies the requirements for the production, installation, testing, and conformity of HBMs conforming to BS EN 14227 for pavement applications, whether constructed by the ex-situ or in-situ method of production. Further details of these materials are contained within this TG below and within TG 6.1 - Pavement Foundation Design.

7.2.21. HBMs complying to SHW Cls 821, 822, and with BS 9227, are Cement Bound Granular Mixtures (CBGM), which principally use cement as the hydraulic binder. Both are examples of HBGMs that comply with BS EN 14227-1, with Cl. 821 covering CBGM 5 and Cl. 822, CBGM 1. Although these are chiefly foundation materials, CD 226 permits the design of flexible pavements with a HBGM base. If proposed for use within Hampshire, only Category B, C8/10 CBGMs listed above shall be permitted.

Bond coats

7.2.22. Bond coats shall be applied between each new bituminous layer. It shall also be used on existing pavement layers that are receiving new bituminous overlays. The application of bond coats between each bound pavement layer are essential to maintaining the integrity of the pavement. It both seals the layer to prevent the ingress of water and enhances the durability and resilience of the bound pavement layers by improving the inter-surface bond to reduce the risk of ‘slippage’ between layers. They also reduce pushing and sliding of the new materials during laying, thereby improving compaction and increased the life expectancy of the

surfacing. The use of tack coats is no longer accepted within carriageways in Hampshire.

7.2.23. Bond coats have higher binder contents than the traditional K1-40 tack coat which they have replaced. The bitumen is either polymer modified or a harder grade of bitumen and is usually applied hot.

7.2.24. All bond coats used within Hampshire should be cationic, as opposed to anionic, as these are more effective given that the positively charged emulsifiers react with the negatively charged aggregate surface to 'break' more effectively.

7.2.25. Bond coats were only available for tanker application. However, as they are also available in smaller quantities, their use for patching and small areas of hand lay materials, as well as on larger machine lay application, a bond coat shall always be applied. The SHW requires bond coats to be applied by a metered spray tanker whenever practical. Only in genuinely inaccessible areas should hand sprayers be used as an alternative.

7.2.26. Pavers with integrated spray tanks offer the benefit of applying bond coat directly in front of paving preventing bond coat being removed by delivery vehicles which is beneficial and should be encouraged. However, checks are to be made to ensure the bond coat has been allowed to 'break' completely (turning from brown to black) prior to the surfacing material being laid, and also to ensure that there are no blockages of any spray jets to ensure an even coverage.

7.2.27. Further detail on the rate of spread for bond coats can be found within the GDCSO.

EME2

7.2.28. Whilst EME2 is an option for both base and binder, as a thinner pavement can be produced due to its increased strength, it can only be used on a Class 3 or 4 Foundation for new designs, unless a Class 2 foundation can be demonstrated to achieve a minimum stiffness of 120 MPa.

7.2.29. It is not a suitable material for use in small scale works, due to its cost, the foundation requirements and the onerous testing regime that go with them. In addition, a curing period is required, and it can produce issues (noise and vibrations), the later because of joints and cracks. It is also difficult to remove for remedial works or by utilities, with any excavations having an impact on the integrity of the slab.

7.2.30. Whilst this material is permitted as a base within the GDCSO, it is not included as a binder option. Therefore, as indicated in section 6.2, the design thickness for a flexible pavement including an EME2 base with an AC 40/60 binder course, shall be based on the AC 40/60 line within the Figure 2.20 nomograph. This makes the total bound materials as thick as for an AC 40/60 design which would be far more expensive to construct as a result.

7.2.31. Due to the limited use of this product in the UK, there is a lack of experienced resources who are competent to lay the material. This is a relatively stiff material and the combination of layer thickness, temperature, roller used and number of passes, may lead to the required compaction not being fully achieved.

Grouted macadam

7.2.32. Grouted macadam surface courses materials offer solutions to highly stressed sites such as bus lanes, bus stops, HGV laybys and turning areas and have been developed to withstand ‘exceptional’ forces.

7.2.33. They consist of a purposefully designed, open-graded bituminous 'receiving course', into which a cementitious or asphaltic grout is vibrated. The grout can be coloured to distinguish it from an adjacent area such as to demark a bus lane. The material, which shall have BBA/HAPAS BBA HAPAS or equivalent product acceptance scheme certificate, produces an extremely strong surface course that is highly resistant to deformation, fuel spillages and fretting.

7.2.34. They do not produce a suitable surface for sites that require higher skid resistance. Shot blasting or an equivalent process could be used to remove the surface grout and expose the coarse aggregate beneath to improve skidding resistance. However, if a coloured grout has been used to ‘highlight’ the area, much of the colour will be removed. A naturally coloured aggregate with the desired PSV, such as Harden red or Cloburn red Granite with a red grout, or Criggion Green Granite with a green grout will help in such situations.

7.3. Rigid pavements

7.3.1. There are various types of rigid pavement, such as Continuously Reinforced Concrete Pavement (CRCP), Continuously Reinforced Concrete Base (CRCB), both of which are normally constructed with an asphalt overlay, plus Unreinforced Jointed Concrete (URC) and Jointed Reinforced Concrete (JRC).

7.3.2. Composite / rigid pavements have been constructed at locations within Hampshire where clay or other poor formations were encountered. Some of these have subsequently been overlaid with varying thicknesses of asphalt. However, they are rarely used, with bus stops lay-bys being their major use. Due to their rigid, durable rut resistant surface, they are often the best option for such scenarios.

7.3.3. Concrete pavements present significantly different maintenance issues than bituminous pavements. The principal issue being that the opportunities to plane and relay a surface course does not exist. The GDCSO provides advice on maintenance options for rigid pavements. Composite / rigid pavements that have been overlaid with varying thicknesses of asphalt are, for reasons of future maintenance, not generally recommended for carriageway construction.

7.4. Over-run areas

7.4.1. Over-run areas are to be avoided through good design as detailed in section 5.9.

7.4.2. Where considered necessary **and** approved for use by the Highway Authority as detailed in 5.9, the proposed construction and that of the kerbed restraint, shall be detailed and submitted to the Highway Authority for consideration. It should be noted that the use of imprinted thermoplastic material is no longer permitted for use within Hampshire.

7.5. Alternative materials

7.5.1. Whilst the option to design a pavement using DBM 125 does not exist within CD 226, asphalt concretes using 100/150 penetration binder may be used for base and binder course layers in specific circumstances such as cold winter weather conditions. However, its use is to be restricted to lower classification (C and U) that are lightly trafficked (less than 100 vehicles each way per day) which will not be susceptible to deformation due to traffic movements in warmer temperatures, and only with the prior approval of the Highway Authority. Where this is to be considered, the total design thickness of bound layers shall be increased by a minimum of 12%.

7.6. Polished stone and aggregate abrasion values

7.6.1. The GDCSO covers details of Polished Stone Values (PSV) (microtexture) and Aggregate Abrasion Value (AAV) requirements, plus bitumen specification and traffic noise consideration. This is based on the most appropriate site categories and investigatory levels for the type of surface course being proposed and the estimated cv/l/d.

7.7. High friction surfacing

7.7.1. All HFSs shall comply with the Cl. 924, Type 1. There are three types of HFS all of which use calcined bauxite aggregate. These are:

- Hot applied – A pre-mixed material with a thermoplastic base.
- Cold applied – A two-part thermosetting epoxy or polyurethane resin binder applied by tanker applied to the pavement's surface, onto which the aggregate is broadcast and rolled in.
- Methyl Methacrylate (MMA) – similar to the above but with a polyurethane modified MMA binder onto which the aggregate is spread and rolled in.

7.7.2. The differences in the types of products, when they can be applied and their long-term durability are as detailed below:

- Hot applied systems can be applied throughout the year by spreading transversely using a shoe. It can be applied as soon as a

new surface course has cooled. However, it is not suitable for heavily trafficked sites – typical service life 3 to 4 years.

- The cold applied systems have been proven to be the more durable and should always be used in preference to hot applied systems. They shall not be applied to newly laid surfaces, with a two-week period allowed for the volatile elements within the bitumen to have evaporated and/or wear. It relies on evaporation to cure the binder, which make it unsuitable in colder conditions – typical service life 4 to 6 years.
- MMA systems can be applied potentially as soon as 12 hours after the surfacing has been completed, thereby reducing the risk of a site being left without an HFS for a period. Written confirmation must be obtained that the installer's guarantees are applicable in these instances. MMA can also be laid in cooler temperatures than cold applied materials - typical service life 5 to 10 years.

7.7.3. Hot applied systems are only suitable for areas that are not heavily trafficked and will only be approved for use in specific circumstances. During cooler weather or where the risk of skidding is considered high, MMA systems only should be proposed. The designer shall submit the proposals to the Highway Authority for approval. However, the Highway Authority may require a different HFS system than proposed to be used.

7.7.4. Only products holding appropriate BBA/HAPAS certification shall be used. There is also a 3-year 'end-performance' requirement for all HFS treatments used within Hampshire, which may be higher than the product certification indicates. In which case, the manufacturer and applicator will be required to confirm acceptance of the 3-year guarantee requirement before the product is applied. The applicator shall be required to inspect the site and raise any concerns regarding the condition of the substate with the Highway Authority prior to application.

7.7.5. **Due to the ongoing maintenance costs, there is a preference to not use HFS, with the use of a high PSV surface course preferred where the Highway Authority considers it appropriate.** This will be considered on a site-specific basis, with HFS applied where the proposed traffic or site conditions dictate it is required. Further guidance on HFS systems, including their suitability for specific locations, the length to be applied, colour, and condition of the substrate onto which the HFS is to be applied can be found in the GDCSO.

7.7.6. Where HFS is to be applied onto a negative textured material a scratch coat may be required as a pre-treatment to reduce system binder drainage and to even the substrate surface. The need for a scratch coat shall be identified at the design stage to enable allowance within the contract and ensure that it is costed. Either way, the need for a scratch coat shall be discussed with the Contractor and the quantity agreed prior to application.

7.7.7. Where it is proposed to apply HFS to a substrate that has been surfaced dressed, consideration should be given to removing the dressing by micro

planing before applying the HFS. This requirement shall also be included within the design and clearly indicated on the construction drawings.

7.7.8. It should be noted that commuted sums will apply in relation to its use within development related works to cover the cost of future maintenance.

7.8. Gateway surfacing

7.8.1. Not commonly used these days due to ongoing maintenance costs, Gateway surfacings are used as a patch incorporating a speed limit roundel to highlight a speed limit change, or a change of environment such as at the gateway into an area of different character by the use of a contrasting colour.

7.8.2. They often consist of materials similar to HFS but with lower PSV as a skid resistant requirement is not required. However, if used within Hampshire they are to be constructed using as HFS using Cl. 924, Type 1 materials.

7.9. Regulating materials

7.9.1. The GDCSO provides details on the requirements for a range of regulating materials that are acceptable for use within Hampshire, covering a range of thickness up to 120mm.

7.9.2. Regulating materials are normally applied to reprofile an existing pavement to enable full thickness layers to be provided above, and helping to improve ride quality. Some degree of regulation is likely to be required under the lowest new pavement layer.

7.9.3. In accordance with Cl. 702 of the SHW, surface and binder courses should be laid within a tolerance of ± 6mm. However, it is important to understand that these tolerances are based upon the underlying surface being laid to a similar standard.

8. Construction

8.1. Supply of asphalt mixes

8.1.1. In accordance with Cl. 901.2, all bituminous mixtures supplied in accordance with BS EN 13108 - 'Bituminous mixtures - material specifications. Factory production control' and guidance document PD 6691:2015+A1:2016, shall be CE marked and the Contractor shall submit the declaration of performance which shall demonstrate that the mixture provides the performance required by the specification.

8.1.2. The contractor shall supply to the Highway Authority a Declaration of Performance (CE Marking) information for all asphalt materials proposed for incorporation into the carriageway and/or footway, such information to be supplied a minimum of three weeks before supply is to commence.

8.1.3. Details of Operating Compliance Levels (OCLs) for all asphalt plants supplying materials shall be provided for the entirety of the period of supply. Details of any non-conformity of materials supplied shall be provided as soon as is practical.

8.1.4. Each material specified shall comply in all respects with the appropriate clause of the SHW and any associated BS or BS EN in terms of its specification, handling and laying. Each source / mix shall be approved by the Highway Authority prior to the material being laid, with mix certificates submitted for approval being no older than 12 months.

8.1.5. Both in-situ and laboratory testing of surfacing materials shall be undertaken by an independent UKAS or equivalent accredited body, approved by the Highway Authority.

8.2. Laying of asphalt mixes

8.2.1. In accordance with Cl. 901.2, all asphaltic or bituminous mixtures shall be laid by organisations registered to and operating in compliance with the 'National Highways Sector Scheme 16 for the Laying of Asphalt Mixes', and those of BS EN ISO 9001: 2008, which consistently conform to the relevant technical specifications, in particular British Standard BS 594987.

8.2.2. In preparation for the surfacing works, the contractor shall submit to the Highway Authority a laying pattern for approval / comment. Where a hot rolled asphalt course is proposed, a 150mm wide chip-free channel shall be provided to assist with drainage runoff.

8.3. Rigid pavements

8.3.1. The strength classes of concrete, constituent materials and all other aspects for pavement layers used in all forms of concrete pavements are covered in Series 1000 of the SHW. CRCPs are normally constructed with an asphalt overlay of minimum thickness 30mm), and CRCBs with an asphalt overlay of 100mm. RCC pavements shall be designed with a total minimum asphalt thickness of 90 mm, with the binder course selected

from one of the materials within CD 226, Table 2.41. URCs and JRCs are normally left as a concrete surface, with either a tamped or brushed finish.

8.3.2. Details to be used with concrete pavement construction can be found in the C Series of MCHW, Volume 3 - Highway Construction Details, Section 1 - Carriageway and Other Details.

Manual of Contract Documents for Highway Works - Volume 3 - Highway Construction Details

8.3.3. All pavements shall be constructed in accordance with the relevant series of the SHW, ensuring adequate drainage, foundation strength and integrity of the pavement. These considerations are to be reflected both in the design and during construction, as failure to do so in one or both will have implications on the life expectancy of the pavement.

8.3.4. Prior to placing any pavement materials, the foundation shall be assessed to ensure it is adequate. Refer to section 7 of TG 6-1.

8.4. Flexible pavements

8.4.1. All flexible pavements shall be constructed in accordance with the requirements of the 700 Series of the SHW and BS 594987.

8.5. Regulating materials

8.5.1. Regulating courses shall have their finished surfaces laid to achieve the appropriate tolerances for horizontal alignments, surface levels and surface regularity for pavement layers, in accordance with Clause 702.

8.5.2. Where a material can be laid within the nominal and minimum thickness requirements stated in BS 594987, it shall be laid as a full layer rather than a regulating layer, with regulating materials used only where the minimum thickness cannot be achieved.

8.5.3. Where a regulating thickness of less than 10mm to 15mm is required, provided that the maximum permitted laying thickness of the subsequent binder or surface course layer meets the requirements within BS 594987, and subject to agreement with the Highway Authority, the total thickness may be achieved by increasing the thickness of the subsequent layer.

8.6. Joint treatments

8.6.1. In accordance with Cl. 903, all longitudinal joints in all layers shall be situated outside wheel-track zones. Sub-clause 903.30 clarifies the wheel-track zones as between 0.5 m and 1.1 m and between 2.55 m and 3.15 m from the centre of the nearside lane markings for each traffic lane (or, in the absence of lane markings, lane edges).

8.6.2. Where haunch widening has been constructed, the binder and surface course shall be removed from the existing section of pavement to enable a

new binder and surface course to be laid continuously up to the proposed longitudinal joint.

8.6.3. As required by BS 594987, all joints within surface course, binder course and base layers shall be offset by at least 300 mm from parallel joints in the layer beneath. Joints should always be located in low stress areas of the pavement wherever practicable. However, where an existing road surface is being replaced, it is permitted to locate the surface course longitudinal joints within the middle of a traffic lane. This position should only be selected if positioning the joint under the lane edge or lane marking would result in significant areas of sound surface course material being unnecessarily replaced. Joints should never be placed in the wheel-track zones.

8.6.4. A stepped joint shall be constructed at all interfaces between an existing and new pavement, whether it is for a longitudinal tie-in for a new side road, haunch widening or a haunch repair, or for a transverse tie-in.

8.6.5. A stress absorbing membrane (an approved Type 1 glass fibre composite pavement reinforcement) shall be installed across the joint at the base / binder interface. The membrane shall extend a minimum of 500mm each side of the joint where the existing and new base layers meet (that is at the base / binder interface) and be installed in accordance with the manufacturer's instructions.

8.6.6. Where an existing road pavement is to be resurfaced, joints in the surface course shall coincide with either the lane edge or the lane marking whichever is appropriate. If positioning the joint under the lane edge or lane marking would result in significant areas of sound surface course material being unnecessarily replaced, the joint could be located in the middle of a traffic lane. All surface course joints at tie-ins to existing pavements shall be saw cut.

8.6.7. Square transverse joints shall not be permitted at a tie-in to an existing surface course but shall be constructed either as diagonal or 'V' joints. This improves the ride quality at the joint and reduces the compression effect of vehicle impact ensuring the joint remains stable for an extended duration, even with the ingress of water.

8.6.8. Longitudinal and transverse joints in surface courses shall be made flush. All transverse joints, where the asphalt abuts an existing surface, and all longitudinal joints, shall be made by cutting back the existing pavement to a vertical face that exposes the full thickness of the layer. All loose materials shall be discarded, and the vertical face painted completely with a thin uniform coating of hot applied 40/60 or 70/100 paving grade bitumen. If approved by the Highway Authority, cold applied thixotropic bitumen emulsion of similar grade or polymer modified bitumen emulsion bond coat before the adjacent width is laid. The following joints shall be treated:

- all transverse joints
- joints where the asphalt abuts an existing surface

- all longitudinal joints

8.6.9. Further details are provided within the GDCSO.

8.7. Delivery and rolling temperatures

8.7.1. Guidance on delivery and rolling temperatures and compaction requirements of asphalt materials are summarised in the GDCSO, with more comprehensive details from BS EN 13108 provided in BS 594987.

8.7.2. The testing of surface texture (macrotexture) shall be undertaken where specified, to ensure compliance with GDCSO guidance (based on Cl. 921 for AC and HRA surface courses and Cl. 942 for proprietary TSCSs), for the appropriate site category, as well as longitudinal and transverse surface regularity requirements to assess ride quality shall be undertaken in accordance with SHW Cl. 702.5 to 702.9, based on the specified category for the road.

8.8. Temporary surface courses and running on binder course

Trafficking of a planed binder course

8.8.1. Trafficking of a planed binder course may be permitted subject to the approval of the Highway Authority following a safety risk assessment of the existing pavement. The risk assessment shall be jointly undertaken by the Contractor and the Highway Authority with any identified risks mitigated before the section of planed road is opened to traffic.

8.8.2. A full safety risk assessment in accordance with GG 104 is not necessary, but the risk assessment shall be suitable for the site in question. The assessment shall consider among other aspects the adequacy of the surface water drainage system while temporary running of a planed surface is in operation. It should be noted that the Highway Authority may not permit running of a planed surface if severe weather conditions (for example, prolonged heavy rainfall, sub-zero temperatures) are predicted for safety reasons.

8.8.3. If approved, ‘Temporary Road Surface’ signs shall be posted on each approach. If the works are due to extend beyond five days, then the use of a suitable surface treatment with an appropriate PSV shall be applied directly to the planed binder course.

Temporary running on a new binder course

8.8.4. Where permitted by the Highway Authority, and in accordance with Clause 903.43 (ii), as amended by Appendix 0/2 within Hampshire County Council’s specification, a newly laid AC 20 dense binder material may be used as a temporary surface for not longer than 3 weeks on low-speed roads (30mph or less), provided that a suitable risk assessment has been jointly undertaken, as detailed above (in 8.8.2). ‘Temporary Road Surface’ signs shall be posted on each approach. Prior to laying of the surface course bond coat, any defects shall be repaired, the binder course shall be

high pressure cleaned to the satisfaction of the Highway Authority, to remove all detritus and oil spillages from the binder surface. The Highway Authority will advise if a higher rate of application of bond coat is required should the condition of the binder course surface require it.

8.8.5. For lightly trafficked roads within developments (which will be adopted as Highway upon issue of the Section 38 Agreement Part 2 Adoption Certificate), longer running on binder is permitted where, **in addition to the requirements in 8.8.4**:

- the developer has addressed how surface water runoff will be catered for to ensure ponding does not occur on the binder course
- the pavement thickness excluding the surface course has been designed to accommodate the msa (including construction traffic) with the associated design calculation included within the Section 38 Design Check submission (refer to Appendix A for typical pavement construction designs)
- the aggregate in the binder course shall be crushed rock (other than limestone) with a PSV of not less than 55.

Temporary running course

8.8.6. Should it be necessary to permit temporary running for more than 3 weeks (but not longer than 2 months) on a lightly trafficked 'C' or Unclassified Road, a temporary running course (TRC) shall be applied. The coarse aggregate shall have a minimum of PSV 55, or as agreed with the Highway Authority, and shall be crushed rock (other than limestone), with 'Temporary Surface' signs posted on each approach.

8.8.7. The base layer of the TRC, proposed by the contractor, shall be increased in thickness from the designed base layer to compensate for the lack of a surface course. The proposal shall be submitted to the Highway Authority for approval two weeks prior to laying.

8.8.8. Prior to laying the permanent surface course, the TRC shall be planed off and swept to the approval of the Highway Authority, and the designed binder and surface courses applied in accordance with the requirements of BS 594984 and Cl. 903 with a bond coat applied beneath the new layer.

Higher speed / classification highways

8.8.9. Temporary running for any period on higher speed highways (>30mph), more heavily trafficked 'C' class roads, 'B' or 'A' classification roads may be permitted, subject to the approval of the Highway Authority. A TRC shall be applied with a coarse aggregate having a minimum of PSV 55, or as agreed with the Highway Authority, and shall be crushed rock (other than limestone), and 'Temporary Road Surface' signs shall be posted on each approach.

8.8.10. Prior to laying the permanent surface course, the TRC shall be planed off and swept to the approval of the Highway Authority, and the proposed binder and designed surface course applied in accordance with the

requirements of BS 594984 and Cl. 903 with bond coats beneath each layer.

8.9. Grouted macadams

8.9.1. To be effective, a grouted macadam surface course needs to be part of a designed pavement, applied to a sound substrate and be allowed to 'cure' fully before trafficking. It is important to ensure the grout penetrates well into the voids, and coring should be undertaken to establish this.

8.9.2. Installing a grouted macadam alongside a system of kerb drainage should be considered carefully, as once the grout enters the drainage inlets, it is almost impossible to remove.

8.10. Rigid pavements

8.10.1. Construction of rigid pavements shall be in accordance with Series 1000 of the SHW. The NH's Highway Construction Details (HCDs) provide details on types and jointing details etc. for concrete carriageways.

8.10.2. Guidance on skid resistance, surface finish and regularity, detailing, materials and construction, including joints etc. are provided in CD 236.

8.11. High friction surfacing

8.11.1. It is essential that the condition of the substrate onto which the HFS is to be applied is deemed suitable by the HFS Contractor prior to application, in order that they are able to provide the 3-year guarantee.

8.11.2. Whilst it should be identified within the contract documents where HFS is to be applied onto a negative texture substrate, or where a surface dressing has been removed by micro planing, the need for a scratch coat shall be discussed with the HFS Contractor and the quantity agreed prior to application.

8.11.3. Any existing road markings within the area of proposed HFS shall be masked beforehand, and then reapplied upon completion of the HFS in order to prevent surface water holding in the depression which could freeze in low temperatures.

8.11.4. As for HRA surfaces, HFS shall be laid with a 150mm clear channel to the kerbs to facilitate drainage.

9. Further support

9.1. Should you have a specific query or feedback about any of the content of this Technical Guidance Note, please send an e-mail to: - Technical.Guidance@hants.gov.uk.

9.2. Should you have a query about applying this to your particular project, please contact:

- the HDA officer dealing with your S278 or S38 application (if you are a developer or developer's consultant); or
- the Technical Guidance Note Specialist(s) (if you are a working within Hampshire County Council).

9.3. Associated Technical Guidance Notes

TG5 - Geotechnical Investigation, Testing and Design

TG6-1 - Pavement Foundation Design

TG6-3 - Modular Pavement Design

TG6-4 - Permeable Paving

Appendix A – Typical pavement construction options for development sites (based on Class 2 foundation)

Pavement option	MSA	Running on binder for more than 3 weeks	Base	Binder course	Surface course*	Total thickness (mm)
1	≤ 2 msa	✗	100mm thick CRBM QVE class B4 Base (Cl 948)	55mm thick CRBM QVE class B4 (Cl 948)	45mm thick HRA 30/14 Surf	200mm
2			100mm thick CRBM QVE class B4 Base (Cl 948)	55mm thick AC20 Dense Bin (warm mix)	45mm thick HRA 30/14 Surf	200mm
3			100mm thick AC32 Dense Base (warm mix)	55mm thick AC20 Dense Bin (warm mix)	45mm thick HRA 30/14 Surf	200mm
4		✓	145mm thick CRBM QVE class B4 Base (Cl 948)	55mm thick AC20 Dense Bin (warm mix)**	45mm thick HRA 30/14 Surf	245mm
5			145mm thick AC32 Dense Base (warm mix)	55mm thick AC20 Dense Bin (warm mix)**	45mm thick HRA 30/14 Surf	245mm
6	2 to 5 msa	✗	130mm thick CRBM QVE class B4 Base (Cl 948)	65mm thick CRBM QVE class B4 Base (Cl 948)	45mm thick HRA 30/14 Surf	240mm
7			130mm thick CRBM QVE class B4 Base (Cl 948)	65mm thick AC20 Dense Bin (warm mix)	45mm thick HRA 30/14 Surf	240mm
8			130mm thick AC32 Dense Base (warm mix)	65mm thick AC20 Dense Bin (warm mix)	45mm thick HRA 30/14 Surf	240mm
9		✓	175mm thick CRBM QVE class B4 Base (Cl 948)	65mm thick AC20 Dense Bin (warm mix)**	45mm thick HRA 30/14 Surf	285mm
10			175mm thick AC32 Dense Base (warm mix)	65mm thick AC20 Dense Bin (warm mix)**	45mm thick HRA 30/14 Surf	285mm

* Refer to Hampshire County Council's Guidance Document for Carriageway Surfacing Options with regard to types and suitability of surfacing materials for different locations

** Binder course shall not contain limestone aggregate