Pavement
Contract preparation

CP 202 Instructions for specifiers for CC 202 Flexible pavement construction

(formerly)

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Contents

Latest release notes

Document Code	Version number	Date of publication of relevant change	Changes made to	Type of change
CP 202	NI/ LIVE_2025-02-19	Not available	Core document	Change to policy, major revision, new document development
This document supersedes Series 900, Series NG 900 and parts of Series 700, NG 700, Series 800, NG 800 and Series 1000, NG 1000, which are withdrawn. It has been rewritten to be compliant with the latest drafting rules, extensively restructured and includes technical revisions.				

Previous versions

Document Code	Version number	Date of publication of relevant change	Changes made to	Type of change

Foreword

This document provides specifier instructions for the production of the works specific requirements for CC 202 Flexible pavement construction.

This document does not form part of the works specification.

The works specification is made up of both the Specification for Highway Works and the works specific requirements completed by the Specifier.

This document is applicable for contracts throughout the UK, complemented by the additional specification requirements and contractual changes of each Overseeing Organisation.

Users are responsible for applying all appropriate documents applicable to their contract.

Users are responsible for archiving contract documentation in accordance with the user's quality management system.

1. General requirements for flexible pavement construction

1.1 Flexible pavement construction shall be as specified in CC 202/WSR/001.

Flexible pavement construction						
Drawing/ model number	**Design level document number**	**Location**	**Chainage from**	**Chainage to**	**Pavement foundation option**	**Flexible pavement option**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter text, to define the drawing or model number which contains the location where the permitted pavement option is to be constructed.

b) Enter text, to define the documentation which contains design level information.

c) Enter text, to define the location of the pavement option [e.g. road name, direction, lane].

d) Enter a number in units of m, to define the start chainage for the pavement option.

e) Enter a number in units of m, to define the end chainage for the pavement option.

f) Enter one or more values, from options as defined in Pavement foundation options of WSR 201/002 or WSR 201/003, to define the pavement foundation option for use with the pavement option.

g) Enter one or more values, from options as defined in Flexible pavement option of WSR 202/001, to define the corresponding reference for work specific pavement construction requirements.

Flexible pavement construction (continued)		
Drawing/model number	**Minimum PSV**	**Maximum AAV**
(a)	(h)	(i)

h) Enter text, to define the minimum Polished Stone Value (PSV) of the coarse aggregate or coated chippings in the surface course.

i) Enter text, to define the maximum Aggregate Abrasion Value (AAV) of the coarse aggregate or coated chippings in the surface course.

1.2 Flexible pavement options shall be as described in CC 202/WSR/001.

Flexible pavement options							
Flexible pavement option	**Pavement course 1 type**	**Pavement course 1 material reference**	**Pavement course 1 nominal thickness**	**Pavement course 2 type**	**Pavement course 2 material reference**	**Pavement course 2 nominal thickness**	**Pavement course 3 type**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference, to define the work specific pavement construction requirements for the pavement option.

b) Enter a value, from options Surface treatment, Surface course, to define the pavement course 1 type.

c) Enter one or more values, from options as defined in Pavement course materials of WSR 202/001, to define the corresponding material reference.

d) Enter a number in units of mm, to define the nominal thickness of pavement course 1.

e) Enter a value, from options Surface course, Binder course, Base course, to define the pavement course 2 type.

f) Enter one or more values, from options as defined in Pavement course materials of WSR 202/001, to define the corresponding material reference.

g) Enter a number in units of mm, to define the nominal thickness of pavement course 2.

h) Enter a value, from options Binder course, Base course, Not used, to define the pavement course 3 type.

Flexible pavement options (continued)					
Flexible pavement option	**Pavement course 3 material reference**	**Pavement course 3 nominal thickness**	**Pavement course 4 type**	**Pavement course 4 material reference**	**Pavement course 4 nominal thickness**
(a)	(i)	(j)	(k)	(l)	(m)

i) Enter one or more values, from options as defined in Pavement course materials of WSR 202/001, to define the corresponding material reference.

j) Enter a number in units of mm, to define the nominal thickness of pavement course 3.

k) Enter a value, from options Binder course, Base course, Not used, to define the pavement course 4 type.

l) Enter one or more values, from options as defined in Pavement course materials of WSR 202/001, to define the corresponding material reference.

m) Enter a number in units of mm, to define the nominal thickness of pavement course 4.

1.3 Flexible pavement options (continued) shall be as described in CC 202/WSR/001.

Flexible pavement options (continued)			
Flexible pavement option	**Pavement course 5 type**	**Pavement course 5 material reference**	**Pavement course 5 nominal thickness**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to define the work specific pavement construction requirements for the pavement option.

b) Enter a value, from options Binder course, Base course, Not used, to define the pavement course 5 type.

c) Enter one or more values, from options as defined in Pavement course materials of WSR 202/001, to define the corresponding material reference.

d) Enter a number in units of mm, to define the nominal thickness of pavement course 5.

1.4 Pavement course materials shall be as described in CC 202/WSR/001.

Pavement course materials		
Pavement course material reference	**Material designation**	**Document and section reference**
(a)	(b)	(c)

a) Enter a unique reference, to define the material reference that assigns work specific material requirements.

b) Enter text, to define the material designation corresponding to the pavement course material reference [e.g. AC 20 dense bin 40/60 des W, CBGM 1 C12/16].

c) Enter text, to define the SHW document number and section for the associated material [e.g. CC 202.10].

Use of regulating course within flexible pavement construction

1.5 Use of regulating course shall be as specified in CC 202/WSR/001.

Use of regulating course			
Drawing/model number	**Flexible pavement option**	**Regulating thickness range (mm)**	**Pavement course material reference**
(a)	(b)	(c)	(d)

a) Enter text, to define the drawing or model number which contains the location where the regulating course is to be constructed.

b) Enter a unique reference, from options as defined in Flexible pavement options of WSR 202/001, to define the associated pavement option where regulating course is to be used.

c) Enter text, to define the thickness range for the regulating course.

d) Enter one or more values, from options as defined in Flexible pavement options of WSR 202/001, to define material references for the permitted materials to be used as a regulating course.

Surface levels requirements and verification of flexible pavement courses

1.6 Prior to overlay or opening to traffic, the surface level of each flexible pavement course shall be at the design level subject to the relevant

tolerances stated in table 1.6, unless otherwise stated in CC 202/WSR/001.

Table 1.6 Permitted deviation from design level for flexible pavement courses	
Flexible pavement course	Permitted deviation from design level
Surface course	± 6 mm
Binder course	± 6 mm
Base course	± 15 mm

SI.1.6 Prior to overlay or opening to traffic, the surface level of each flexible pavement course shall be at the design level subject to the following tolerances: [enter free text].

1.7 Verification shall be undertaken for the surface level of each flexible pavement course by measurement against the datum level on a grid of points not more than 2 m spacing transversely and not more than 10 m spacing longitudinally.

1.8 The frequency of measurement of surface levels shall be once prior to overlay or opening to traffic.

1.9 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the surface level of each flexible pavement course.

1.10 Following the completion of the surface course, surface water shall flow into the surface drainage system without ponding.

Surface regularity requirements and verification of surface courses

1.11 Prior to opening to traffic, the longitudinal regularity of the surface course along any line parallel to the edge of the pavement shall be within the limits as detailed in table 1.11.

Table 1.11 Longitudinal irregularity limits for surface courses			
Longitudinal irregularity	4 mm	7 mm	>10 mm
Number of permitted longitudinal irregularities per 300 m length	20	2	0

1.12 Where the length of the surface course to be assessed against table 1.11 is shorter than 300 m, the number of permitted longitudinal irregularities shall be that for a 300 m length, pro rata then rounded up to the nearest whole number.

1.13 Verification shall be undertaken for the longitudinal regularity of surface courses by testing continuously along the entire length using a rolling straightedge or equivalent apparatus capable of measuring irregularities over a 3 m length.

1.14 The frequency of longitudinal regularity testing shall be once prior to opening to traffic.

1.15 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the longitudinal regularity of surface courses.

1.16 Verification for the longitudinal regularity of surface courses by testing shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 23.N].

NI/1.17 Prior to opening to traffic, the transverse regularity of surface courses, measured as the difference between the surface and the underside of a 3 m straightedge and wedge placed at right angles to the centre line of the road in accordance with BS 8420 [Ref 31.N], shall be not more than 3 mm.

Horizontal alignment of flexible pavements

1.18 The horizontal alignment of the edge of the flexible pavement surface shall be at the design alignment within the following tolerances: ± 25 mm.

Rectification of flexible pavement layers

1.19 Where a bituminous layer is to be removed and replaced for the purposes of rectification, the rectification shall be to the full depth of the bituminous layer, full lane width and not less than 15 m in length for surface course and not less than 5 m in length for binder course and base course.

1.20 Where the hydraulically bound granular mixture (HBGM) base is to be removed and replaced for the purposes of rectification, the rectification shall be to the full depth of the HBGM base, not less that 2 m in width and not less than 20 m in length.

1.21 Where the lower strength concrete is to be removed and replaced for the purposes of rectification, the rectification shall be to the full depth of the lower strength concrete layer, full lane width and not less than 5 m in length.

2. Use of bituminous base and binder course layers by traffic

General requirements for use of bituminous base and binder course layers by traffic

2.1 Where bituminous base and binder course layers are opened to traffic as a temporary running surface, the coarse aggregate in the mixture shall be not less than PSV_{50}, unless otherwise stated in CC 202/WSR/002.

SI.2.1 The requirements for the treatment of the bituminous base and binder course layers that are opened to traffic as a temporary running surface shall be as follows: [enter free text].

2.2 Where the bituminous base and binder course layers are opened to traffic as a temporary running surface, following trafficking, the surface shall be free from potholing, fretting, rutting and open joints.

3. Hydraulically bound granular mixture base

General requirements for hydraulically bound granular mixture bases

3.1 Hydraulically bound granular mixture (HBGM) shall be as specified in CC 202/WSR/003.

Hydraulically bound granular mixture (HBGM)						
Pavement course material reference	**Compressive strength**	**Category for percentage of crushed or broken particles in coarse aggregate**	**Resistance to fragmentation of coarse aggregate**	**Coefficient of thermal expansion**	**Transverse cracks spacing**	**Longitudinal cracks spacing**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference, from options as defined in Pavement course materials of WSR 202/001, to define the corresponding reference for the material.

b) Enter a value, from options C8/10, C12/16, C15/20, to define the compressive strength of the material.

c) Enter a value, from options $C_{90/3}$, $C_{50/30}$, to define the category for crushed or broken particles and totally rounded particles in the mixture.

d) Enter a value, from options LA_{50}, LA_{60}, to define the category for the maximum value of the Los Angeles coefficient.

e) Enter a value, from options $<10x10^{-6}$ per °C, No requirement, to define the coarse aggregate coefficient of thermal expansion.

f) Enter a number in units of m, to define the transverse crack spacing formed by induced cracks and transverse construction joints.

g) Enter a number in units of m, to define the longitudinal crack spacing formed by induced cracks and longitudinal joints.

Constituent requirements for HBGM base

3.2 Aggregates used in CBGM 1, SBGM 1, FABGM 1 and HRBBGM 1 shall comply with the aggregate requirements for HBGM in "Hydraulically bound mixtures for pavement subbase" in Section 9 of CC 201 [Ref 32.N].

3.3 Binders and water used in CBGM 1, SBGM 1, FABGM 1 and HRBBGM 1, shall comply with the binder and water requirements and documentation in "Hydraulically bound mixtures for pavement subbase" in Section 9 of CC 201 [Ref 32.N].

Product requirements, verification and documentation for HBGM base

3.4 CBGM 1, SBGM 1, FABGM 1 and HRBBGM 1 shall comply with the product requirements, verification and documentation, including the laboratory mixture design procedure and documentation in "Hydraulically bound mixtures for pavement subbase" in Section 9 of CC 201 [Ref 32.N].

Production and installation requirements and verification for HBGM base

3.5 Preparatory works at the site, production, transport, delivery, installation and trafficking of HBGM base shall be in accordance with BS 9227 [Ref 27.N] using the ex situ method.

3.6 Transverse cracks shall be induced in the HBGM base at 3 m centres during installation, unless otherwise stated in CC 202/WSR/003.

3.7 Transverse construction joints shall be formed at such spacing that they substitute a transverse crack.

3.8 Induced transverse cracks and transverse construction joints in HBGM base shall be aligned with any induced transverse cracks and transverse construction joints in the HBM subbase, with a tolerance of ± 100 mm.

3.9 Where individual construction widths exceed 4.75 m, additional longitudinal cracks shall be induced in the HBGM base outside wheel track zones in accordance with BS 9227 [Ref 27.N].

3.10 Longitudinal cracks in the HBGM base shall not be induced within 2.0 m of longitudinal joints.

3.11 Quality control of the HBGM base shall be in accordance with BS 9227 [Ref 27.N].

3.12 Quality control for HBGM base shall include in-situ wet density and compressive strength in accordance with "Hydraulically bound mixtures for pavement subbase" in Section 9 of CC 201 [Ref 32.N].

3.13 Production and installation documentation for HBGM base shall comply with "Hydraulically bound mixtures for pavement subbase" in Section 9 of CC 201 [Ref 32.N].

4. Lower strength concrete for flexible pavement construction

General requirements for lower strength concrete for flexible pavement construction

4.1 Lower strength concrete for flexible pavement construction shall comply with "Lower strength concrete for pavements" in Section 3 of CC 206 [Ref 30.N].

4.2 Installed lower strength concrete for flexible pavement construction shall comply with the Surface levels requirements and verification of flexible pavement courses in "General requirements for flexible pavement construction" in Section 1 of this document.

5. Formation of joints in bituminous layers

General requirements for formation of joints in bituminous layers

5.1 Formation of joints in bituminous layers shall be as detailed in CC 202/WSR/005.

Formation of joints in bituminous layers				
Drawing/model number	**Location**	**Chainage from**	**Chainage to**	**Minimum longitudinal joint offset (mm)**
(a)	(b)	(c)	(d)	(e)

a) Enter text, to define the drawing or model number which contains the location where the minimum longitudinal joint offset from parallel joints in the preceding layer applies.

b) Enter text, to define the location of the formation of joints in the bituminous layers.

c) Enter a number in units of m, to define the start chainage for the formation of joints in bituminous layers.

d) Enter a number in units of m, to define the end chainage for the formation of joints in bituminous layers.

e) Enter text, to define the minimum offset from parallel joints in the preceding layer.

5.2 Longitudinal joints in the bituminous layers shall be offset by a minimum of 300 mm from parallel joints in the preceding layer, unless otherwise stated in CC 202/WSR/005.

5.3 Longitudinal joints in bituminous layers shall be situated outside of wheel tracks, where wheel tracks are 600 mm wide with the inside edges offset from the centre of the lane by 720 mm.

5.4 Unless longitudinal joints in bituminous layers are formed using echelon paving, they shall be cut back to a vertical face that exposes the full thickness of the layer, or formed with an edge compactor.

5.5 Prior to the placement of bituminous layers, a uniform layer of bitumen shall be applied to the entire face of all vertical faces against which the layers are to be laid, including previously laid asphalt.

5.6 Within 24 hours of forming abutting longitudinal joints in all bituminous base and binder course layers, a uniform layer of bitumen

shall be applied over the top surface of the joint, spanning to 75 mm on either side of the joint at a residual rate of not less than 0.50 kg/m^2.

5.7 Longitudinal joints in surface course layers shall coincide with lane edges, lane marking or middle of a traffic lane.

5.8 A uniform layer of bitumen shall be applied to the entire face of any freestanding edge of bituminous layer at the high side of a camber.

5.9 Bitumen for application to joints and edges of pavement layers shall be compliant with BS EN 12591 [Ref 7.N] or BS EN 13808 [Ref 4.N].

5.10 The bitumen for application to joints and edges of pavement layers shall meet the performance characteristics as stated in table 5.10.

Table 5.10 Permitted penetration grades for bitumen for application to joints and edges of pavement layers

Bitumen type	Permitted penetration grades
Paving grade bitumen to BS EN 12591 [Ref 7.N]	40/60 70/100 100/150
Cationic bitumen emulsion to BS EN 13808 [Ref 4.N]	≤ 100 (Class 3) ≤ 150 (Class 4)

5.11 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to bitumen for application to joints and edges of pavement layers.

6. Ex situ cold recycled bound material

General requirements for ex situ cold recycled bound materials

6.1 Ex situ cold recycled bound material (CRBM) shall be as specified in CC 202/WSR/006.

Ex situ cold recycled bound material (CRBM)		
Pavement course material reference	**Mixture type**	**Stiffness class**
(a)	(b)	(c)

a) Enter a unique reference, from options as defined in Pavement course materials of WSR 202/001, to define the pavement course material reference.

b) Enter a value, from options QVE, SVE, to define the ex situ CRBM mixture type.

c) Enter a value, from options B2, B3, B4, to define the ex situ CRBM stiffness class.

Constituent requirements, verification and documentation for ex situ CRBM

Processed aggregate for ex situ CRBM

6.2 Processed aggregate for ex situ CRBM shall contain less than 2% Class X material by mass.

6.3 Verification shall be undertaken for the constituents of the processed aggregate of the ex situ CRBM by testing in accordance with BS EN 933-11 [Ref 38.N].

6.4 The frequency of processed aggregate constituents testing shall be 1 per 2 weeks.

6.5 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the constituents of the processed aggregate of the ex situ CRBM.

6.6 Processed aggregate for ex situ CRBM shall not be frozen during the production of ex situ CRBM.

Bituminous binder for ex situ CRBM

6.7 Bitumen emulsion for ex situ CRBM shall be compliant with BS EN 13808 [Ref 4.N].

6.8 The bitumen emulsion for ex situ CRBM shall meet the performance characteristics as stated in table 6.8.

Table 6.8 Performance characteristics for bitumen emulsion for ex situ CRBM	
Characteristic	Requirement
Minimum nominal binder content	38% (Class 3)
Maximum penetration grade	160/220 (Class 5)

6.9 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to bitumen emulsion for ex situ CRBM.

6.10 Bitumen for foamed bitumen for ex situ CRBM shall be compliant with BS EN 12591 [Ref 7.N].

6.11 The bitumen for foamed bitumen for ex situ CRBM shall meet the following performance characteristics: penetration grade 160/220 or harder.

6.12 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the bitumen for foamed bitumen for ex situ CRBM.

Other constituents for ex situ CRBM

6.13 Cement for ex situ CRBM shall be compliant with BS EN 197-1 [Ref 18.N].

6.14 The cement for ex situ CRBM shall meet the following performance characteristics: CEM I, CEM II/A-L, CEM II/A-S, CEM II/A-V, CEM II/B-L, CEM II/B-S, CEM II/B-V, CEM IV/A.

6.15 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the cement for ex situ CRBM.

6.16 Portland-composite cement for ex situ CRBM shall be compliant with BS EN 197-5 [Ref 19.N].

6.17 The Portland-composite cement shall meet the following performance characteristics: CEM II/C-M.

6.18 Granulated blast furnace slag (GBS) for ex situ CRBM shall be compliant with BS EN 14227-2 [Ref 29.N].

6.19 Ground granulated blast furnace slag (GGBS) for ex situ CRBM shall be compliant with BS EN 14227-2 [Ref 29.N].

6.20 Lime for ex situ CRBM shall be compliant with BS EN 14227-11 [Ref 40.N].

6.21 Fly ash for ex situ CRBM shall be compliant with BS EN 14227-4 [Ref 28.N].

6.22 The following Documentation shall be submitted for the GBS, GGBS, lime and Fly ash prior to the commencement of production of ex situ CRBM: technical data sheets.

6.23 The requirements for "Documentation" in Section 2 of GC 101 [Ref 23.N] shall apply to the technical data sheets for GBS, GGBS, lime and Fly ash for ex situ CRBM.

Product requirements, verification and documentation for ex situ CRBM

6.24 The particle size distribution of the ex situ CRBM excluding bitumen shall be within the limits in table 6.24.

Table 6.24 Particle size distribution zones for ex situ CRBM

Sieve (mm)	Percentage by mass passing	
	Zone A	Zone B
40	100	100
31,5	100	100
20	100	100
14	85 - 100	85 - 100
10	68 - 100	68 - 100
4	38 - 74	38 - 94
2	26 - 58	26 - 84
0,5	13 - 38	13 - 64
0,250	9 - 28	9 - 51
0,063	5 - 21	5 - 38

6.25 The minimum added cement, lime and bitumen content by mass for the ex situ CRBM material type shall be within the limits in table 6.25.

Table 6.25 Minimum added cement, lime and bitumen content by mass for ex situ CRBM by material type

Material type	Cement	Lime	Added residual bitumen (foamed or emulsion)
QVE	1%	-	3%

SVE	-	1.5%	3%

6.26 Test specimens for ex situ CRBM mixture design and end product testing shall be 150 ±3 mm (diameter) x 75 ±2 mm (height).

Mixture design for ex situ CRBM

6.27 Prior to the commencement of the works, a laboratory mixture design for the ex situ CRBM shall be undertaken, unless an existing mix design representative of the mix proportions, constituents and site material properties is already available.

6.28 A new mixture design shall be undertaken where the constituents or mixture proportions of the ex situ CRBM are changed.

6.29 The mixture design of ex situ CRBM shall meet the requirements in table 6.29.

Table 6.29 Mixture design requirements for ex situ CRBM

Characteristic		Individual specimens	Mean from test set
Indirect Tensile Stiffness Modulus ($ITSM_d$)	Class B2	N/A	2500 MPa
	Class B3	N/A	3100 MPa
	Class B4	N/A	4700 MPa
Retained Indirect Tensile Stiffness Modulus ($ITSM_R$)	Class B2	N/A	75% minimum
	Class B3		
	Class B4		

6.30 Verification shall be undertaken for the $ITSM_d$ of the mixture design of the ex situ CRBM, by testing in accordance with BS EN 12697-26 [Ref 15.N], using specimens manufactured and cured in accordance with BS 9228 [Ref 34.N].

6.31 The frequency of $ITSM_d$ testing shall be 1 set of 6 specimens per mixture design.

6.32 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the $ITSM_d$ of the mixture design of the ex situ CRBM.

6.33 Verification shall be undertaken for the $ITSM_R$ of the mixture design of the ex situ CRBM, by testing in accordance with BS EN 12697-26 [Ref 15.N], using specimens manufactured, cured and conditioned in accordance with BS 9228 [Ref 34.N].

6.34 The frequency of $ITSM_R$ testing shall be 1 set of 6 specimens per mixture design.

6.35 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of $ITSM_R$ of the mixture design of the ex situ CRBM.

6.36 Prior to the commencement of the works, the following shall be declared for the ex situ CRBM as determined from the mixture design:

1. particle size distribution zone;

2. target water content;

3. target added cement or lime content; and,

4. target added residual bitumen content.

6.37 The following Documentation shall be submitted for the ex situ CRBM prior to the commencement of installation of the ex situ CRBM: mixture design test report including particle size distribution zone, target water content, target added cement or lime content, target added residual bitumen content, refusal density, mean $ITSM_d$ and mean $ITSM_R$.

6.38 The requirements for "Documentation" in Section 2 of GC 101 [Ref 23.N] shall apply to the mixture design test report of the ex situ CRBM.

Production requirements and verification for ex situ CRBM

6.39 The particle size distribution of the ex situ CRBM shall be within the particle size distribution zone declared in the mixture design test report.

6.40 Verification shall be undertaken for the particle size distribution of samples of the ex situ CRBM taken at the mixing plant by testing in accordance with BS EN 933-1 [Ref 39.N].

6.41 The frequency of particle size distribution testing shall be 1 per day.

6.42 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the particle size distribution of samples of the ex situ CRBM.

6.43 The water content of the ex situ CRBM shall be the target water content ± 2%.

6.44 Verification shall be undertaken for the water content of samples of the ex situ CRBM taken at the mixing plant by testing in accordance with BS 1924-1 [Ref 26.N].

6.45 The frequency of water content testing shall be 1 per day.

6.46 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the water content of samples of the ex situ CRBM.

6.47 The mean Indirect Tensile Stiffness Modulus ($ITSM_d$) of the ex situ CRBM for a set of 6 specimens shall be not less than 2,375 MPa for Class B2, not less than 2,945 MPa for Class B3 and not less than 4,465 MPa for Class B4.

6.48 Verification shall be undertaken for the Indirect Tensile Stiffness Modulus ($ITSM_d$) of samples of the ex situ CRBM taken at the mixing plant or from site by testing in accordance with BS EN 12697-26 [Ref 15.N] using specimens manufactured and cured in accordance with BS 9228 [Ref 34.N].

6.49 The frequency of $ITSM_d$ testing shall be 1 set of 6 specimens per day or 1 set of 6 specimens per 1000 t of material, whichever is the greater.

6.50 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the $ITSM_d$ of samples of the ex situ CRBM.

Installation requirements and verification for ex situ CRBM

6.51 Ex situ CRBM shall be paver laid.

6.52 Joints in ex situ CRBM shall comply with "Formation of joints in bituminous layers" in Section 5 of this document.

6.53 The finished surface of the ex situ CRBM shall be free from segregation.

6.54 Individual in situ bulk density measurements of the compacted ex situ CRBM shall be not less than 93% of the refusal density declared in the mixture design test report.

6.55 The rolling mean of 5 in situ bulk density measurements of the compacted ex situ CRBM shall be not less than 95% of the refusal density declared in the mixture design test report.

6.56 Verification shall be undertaken for the in situ bulk density of the compacted ex situ CRBM by measurement in accordance with BS 1924-2 [Ref 25.N] using a correlated nuclear density gauge in accordance with BS 9228 [Ref 34.N].

6.57 The frequency of in situ bulk density testing shall be 1 per 20 metres in alternate wheel tracks.

6.58 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the in situ bulk density of the compacted ex situ CRBM.

6.59 On completion of compaction, the ex situ CRBM shall be sprayed with bitumen emulsion in accordance with BS 9228 [Ref 34.N] at rate of spread of 1.0 to 1.5 l/m^2.

6.60 Where the ex situ CRBM surface is opened to traffic prior to overlay, the ex situ CRBM shall be blinded with fine aggregate or sand applied at a rate of 5.5 to 7.0 kg/m^2.

NI/6.61 No nationally determined requirement is provided.

6.62 Verification shall be undertaken for the surface modulus of the ex situ CRBM by testing using a calibrated, correlated Light Weight Deflectometer (LWD) in accordance with BS 1924-2 [Ref 25.N].

6.63 The frequency of testing of the surface modulus shall be at 20 m intervals along each lane, staggered 10 m between adjacent lanes.

6.64 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the surface modulus of the ex situ CRBM.

6.65 The LWD used for assessing the surface modulus of the ex situ CRBM shall have either a site specific correlation with a Falling Weight Deflectometer (FWD), or an annual correlation certificate.

6.66 Prior to the construction of the overlying layers, the transverse regularity of the ex situ CRBM, measured as the difference between the surface and the underside of a straightedge shall be not more than 10 mm.

6.67 Verification shall be undertaken for the transverse regularity of the ex situ CRBM by testing using a straightedge of a minimum 2 m length in accordance with BS 8420 [Ref 31.N].

6.68 The frequency of transverse regularity testing shall be every 20 m in wheel tracks where rutting is visible.

6.69 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of transverse regularity of the ex situ CRBM.

6.70 Prior to the construction of the overlying layer, the surface level of the ex situ CRBM shall comply with Surface levels requirements and verification of flexible pavement courses in "General requirements for flexible pavement construction" in Section 1 of this document.

NI/6.71 No nationally determined requirement is provided.

6.72 Verification shall be undertaken for the back-analysed stiffness modulus of the ex situ CRBM by testing using a Falling Weight Deflectometer (FWD), at a pavement temperature within 15 °C to 25 °C, and otherwise in accordance with CS 229 [Ref 20.N].

6.73 The frequency of FWD testing shall be at 20 m intervals along each lane, staggered 10 m between adjacent lanes.

6.74 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the ex situ CRBM with an FWD.

6.75 The back-analysed stiffness modulus of the ex situ CRBM shall be derived by modelling the pavement as a three-layer system.

Installation documentation for ex situ CRBM

6.76 The following Documentation for the ex situ CRBM shall be submitted as continuous records: equipment calibration records, constituent testing results, mixture proportion records, laying records, surface level records and test reports.

6.77 The requirements of "Records" in Section 3 of GC 101 [Ref 23.N] shall apply to the equipment calibration records, constituent testing results, mixture proportion records, laying records, surface level records and test reports for ex situ CRBM.

7. Constituents for bituminous mixtures

Aggregates requirements for bituminous mixtures

7.1 Aggregates for bituminous mixtures shall be compliant with BS EN 13043 [Ref 2.N].

7.2 The aggregates for bituminous mixtures shall meet the following performance characteristics: as detailed in PD 6691 [Ref 24.N] for the respective bituminous mixtures.

7.3 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to aggregates for bituminous mixtures.

7.4 Coarse aggregate shall meet the requirements as detailed in table 7.4.

Table 7.4 Coarse aggregate properties for bituminous mixtures

Properties	Requirement	Applicability
Resistance to fragmentation	LA_{30}	Aggregates other than air-cooled blast furnace slag
	LA_{50}	Air-cooled blast furnace slag
Water absorption	$WA_{24}2$	Aggregates other than air-cooled blast furnace slag or where the Magnesium sulfate soundness requirement is achieved
Magnesium sulfate soundness	MS_{25}	Only required if the water absorption is greater than $WA_{24}2$ for aggregates other than air-cooled blast furnace slag
Dicalcium silicate disintegration of air-cooled blast furnace slag	Free from iron dicalcium silicate disintegration	Air-cooled blast furnace slag
Iron disintegration of air-cooled blast furnace slag	Free from iron disintegration	Air-cooled blast furnace slag
Volume stability of steel slag	V_{10}	Steel slag

7.5 Hydrated lime shall be compliant with BS EN 459-1 [Ref 17.N].

7.6 The hydrated lime shall meet the following performance characteristics: CL 90-S as detailed in BS EN 459-1 [Ref 17.N].

7.7 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the hydrated lime.

Reclaimed asphalt

7.8 Reclaimed asphalt shall be compliant with BS EN 13108-8 [Ref 11.N] following PD 6691 [Ref 24.N] for the production of bituminous mixtures.

Recycled coarse aggregate and recycled concrete aggregate

NI/7.9 The quality control procedure for recycled coarse aggregate and recycled concrete aggregate used in bituminous mixtures shall be in accordance with WRAP Quality Protocol [Ref 42.N].

Bitumen requirements for bituminous mixtures

7.10 Paving grade bitumen shall be compliant with BS EN 12591 [Ref 7.N].

7.11 The paving grade bitumen shall meet the following performance characteristics: be in accordance with BS EN 12591 [Ref 7.N].

7.12 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to paving grade bitumen.

7.13 Hard paving grade bitumen shall be compliant with BS EN 13924-1 [Ref 6.N].

7.14 The hard paving grade bitumen shall meet the following performance characteristics: National Annex ZA of BS EN 13924-1 [Ref 6.N].

7.15 Polymer modified bitumen shall be compliant with BS EN 14023 [Ref 5.N].

7.16 The polymer modified bitumen shall meet the following performance characteristics: be in accordance with BS EN 14023 [Ref 5.N].

7.17 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to polymer modified bitumen.

8. Designed asphalt concrete base course

Constituent requirements for designed asphalt concrete base course

8.1 Constituents for designed asphalt concrete base course shall be in accordance with "Constituents for bituminous mixtures" in Section 7 of this document.

Product requirements for designed asphalt concrete base course

8.2 The mixture designation for designed asphalt concrete base course shall be one of the following as detailed in table 8.2.

Table 8.2 Mixture designation for designed asphalt concrete base course	
Warm mix asphalt	Hot mix asphalt
AC 32 dense base 40/60 des W	AC 32 dense base 40/60 des
AC 32 HDM base 40/60 des W	AC 32 HDM base 40/60 des

8.3 The maximum temperature of warm mix designed asphalt concrete base course shall be 150 °C, when measured in accordance with BS EN 12697-13 [Ref 16.N].

8.4 The designed asphalt concrete base course shall be compliant with BS EN 13108-1 [Ref 8.N] following PD 6691 [Ref 24.N].

8.5 The designed asphalt concrete base course shall meet the following performance characteristics: V_{max7}, $V_{min0.5}$, $WTS_{AIR0.8}$ at 60 °C, $S_{min1800}$ and $ITSR_{80}$.

8.6 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the designed asphalt concrete base course.

8.7 The stiffness of designed asphalt concrete base course shall be determined in accordance with Annex E of BS 594987 [Ref 3.N].

Installation requirements and verification for designed asphalt concrete base course

8.8 Designed asphalt concrete base course shall be installed by organisations registered to and operating in compliance with a quality management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 23.N].

8.9 Prior to placing designed asphalt concrete base course on any new or existing bound substrate, a bond coat shall be applied in accordance with BS 594987 [Ref 3.N].

8.10 Verification shall be undertaken for the rate of spread of bond coat by testing in accordance with BS 594987 [Ref 3.N].

8.11 The frequency of the rate of spread of bond coat testing shall be once per week.

8.12 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of rate of spread of the bond coat.

8.13 Designed asphalt concrete base course shall be transported, laid and compacted in accordance with BS 594987 [Ref 3.N].

8.14 The minimum temperature immediately prior to the compaction of warm mix designed asphalt concrete base course shall be 90 °C, when measured in accordance with BS EN 12697-13 [Ref 16.N].

8.15 Joints in designed asphalt concrete base course shall be in accordance with the "Formation of joints in bituminous layers" in Section 5 of this document.

8.16 On completion of compaction of the designed asphalt concrete base course, the mean of six consecutive in situ air void content measurements in the wheel tracks shall be not more than 7%, where wheel tracks are 600 mm wide with the inside edges offset from the centre of the lane by 720 mm.

8.17 Verification shall be undertaken for the in situ air void content of the designed asphalt concrete base course by measurement using a correlated indirect density gauge in accordance with BS 594987 [Ref 3.N].

8.18 The frequency of in situ air void content measurements shall be 1 per 20 m in alternate wheel tracks.

8.19 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the in situ air void content of the designed asphalt concrete base course.

8.20 On completion of compaction of the designed asphalt concrete base course, the mean in situ air void content of core pairs taken from the wheel tracks shall be not more than 7%.

8.21 Verification shall be undertaken for the in situ air void content of the designed asphalt concrete base course by testing core pairs taken from the wheel tracks in accordance with BS 594987 [Ref 3.N].

8.22 The frequency of in situ air void content testing shall be 1 per 1,000 linear metres.

8.23 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the in situ air void content of the designed asphalt concrete base course.

8.24 On completion of compaction of the designed asphalt concrete base course, the mean in situ air void content of core pairs taken at unsupported edges shall be not more than 9%.

8.25 Verification shall be undertaken for the in situ air void content of the designed asphalt concrete base course by testing core pairs, centred 100 mm from the final joint position at unsupported edges, in accordance with BS 594987 [Ref 3.N].

8.26 The frequency of in situ air void content testing shall be 1 per 250 linear metres.

8.27 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the in situ air void content of the designed asphalt concrete base course.

8.28 Prior to the construction of the overlying layer, the surface level of the designed asphalt concrete base course shall comply with Surface levels requirements and verification of flexible pavement courses in "General requirements for flexible pavement construction" in Section 1 of this document.

9. EME2 asphalt concrete base course

Constituent requirements for EME2 asphalt concrete base course

9.1 Constituents for EME2 asphalt concrete base course shall be in accordance with "Constituents for bituminous mixtures" in Section 7 of this document.

Product requirements for EME2 asphalt concrete base course

9.2 The mixture designation for EME2 asphalt concrete base course shall be one of the following as detailed in table 9.2.

Table 9.2 Mixture designation for the EME2 asphalt concrete base course	
Warm mix asphalt	Hot mix asphalt
AC 10 EME2 base 10/20 des W	AC 10 EME2 base 10/20 des
AC 10 EME2 base 15/25 des W	AC 10 EME2 base 15/25 des
AC 14 EME2 base 10/20 des W	AC 14 EME2 base 10/20 des
AC 14 EME2 base 15/25 des W	AC 14 EME2 base 15/25 des
AC 20 EME2 base 10/20 des W	AC 20 EME2 base 10/20 des
AC 20 EME2 base 15/25 des W	AC 20 EME2 base 15/25 des

9.3 The maximum temperature of warm mix EME2 asphalt concrete base course shall be 160 °C, when measured in accordance with BS EN 12697-13 [Ref 16.N].

9.4 EME2 asphalt concrete base course shall be compliant with BS EN 13108-1 [Ref 8.N] following PD 6691.

9.5 The EME2 asphalt concrete base course shall meet the following performance characteristics: V_{max6}, $P_{7.5}$ at 60 °C and $S_{min5500,}$ i/C_{min75}.

9.6 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to EME2 asphalt concrete base course.

Installation requirements and verification for EME2 asphalt concrete base course

9.7 EME2 asphalt concrete base course shall be installed by organisations registered to and operating in compliance with a quality management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 23.N].

9.8 Prior to placing EME2 asphalt concrete base course on any new or existing bound substrate, a bond coat shall be applied in accordance with BS 594987 [Ref 3.N].

9.9 Verification shall be undertaken for the rate of spread of bond coat by testing in accordance with BS 594987 [Ref 3.N].

9.10 The frequency of the rate of spread of bond coat testing shall be once per week.

9.11 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the rate of spread of bond coat.

9.12 EME2 asphalt concrete base course shall be transported, laid and compacted in accordance with BS 594987 [Ref 3.N].

9.13 The minimum temperature immediately prior to the compaction of warm mix EME2 asphalt concrete base course shall be 110 °C, when measured in accordance with BS EN 12697-13 [Ref 16.N].

9.14 Joints in EME2 asphalt concrete base course shall comply with "Formation of joints in bituminous layers" in Section 5 of this document.

9.15 On completion of compaction of the EME2 asphalt concrete base course, the mean of six consecutive in situ air void content measurements in the wheel tracks shall be not more than 6%, where wheel tracks are 600 mm wide with the inside edges offset from the centre of the lane by 720 mm.

9.16 Verification shall be undertaken for the in situ air void content of the EME2 asphalt concrete base course by measurement using a correlated indirect density gauge in accordance with BS 594987 [Ref 3.N].

9.17 The frequency of in situ air void content measurement shall be 1 per 20 m in alternate wheel tracks.

9.18 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the in situ air void content of the EME2 asphalt concrete base course.

9.19 On completion of compaction of the EME2 asphalt concrete base course, the mean in situ air void content of core pairs taken from the wheel tracks shall be not more than 6%.

9.20 Verification shall be undertaken for the in situ air void content of the EME2 asphalt concrete base course by testing core pairs taken from the wheel tracks in accordance with BS 594987 [Ref 3.N].

9.21 The frequency of in situ air void content testing shall be 1 per 1,000 linear metres.

9.22 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the in situ air void content of the EME2 asphalt concrete base course.

9.23 On completion of compaction of the EME2 asphalt concrete base course, the mean in situ air void content of core pairs taken at unsupported edges shall be not more than 8%.

9.24 Verification shall be undertaken for the in situ air void content of the EME2 asphalt concrete base course by testing core pairs, centred 100 mm from the final joint position at unsupported edges, in accordance with BS 594987 [Ref 3.N].

9.25 The frequency of in situ air void content testing shall be 1 per 250 linear metres.

9.26 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the in situ air void content of the EME2 asphalt concrete base course.

9.27 Prior to the construction of the overlying layer, the surface level of the EME2 asphalt concrete base course shall comply with the Surface levels requirements and verification of flexible pavement courses in "General requirements for flexible pavement construction" in Section 1 of this document.

10. Designed asphalt concrete binder course

Constituent requirements for designed asphalt concrete binder course

10.1 Constituents for designed asphalt concrete binder course shall be in accordance with "Constituents for bituminous mixtures" in Section 7 of this document.

Product requirements for designed asphalt concrete binder course

10.2 The mixture designation for designed asphalt concrete binder course shall be one of the following as detailed in table 10.2.

Table 10.2 Mixture designation for designed asphalt concrete binder course	
Warm mix asphalt	Hot mix asphalt
AC 20 dense bin 40/60 des W	AC 20 dense bin 40/60 des
AC 20 HDM bin 40/60 des W	AC 20 HDM bin 40/60 des

10.3 The maximum temperature of warm mix designed asphalt concrete binder course shall be 150 °C, when measured in accordance with BS EN 12697-13 [Ref 16.N].

10.4 Designed asphalt concrete binder course shall be compliant with BS EN 13108-1 [Ref 8.N] following PD 6691 [Ref 24.N].

10.5 The designed asphalt concrete binder course shall meet the following performance characteristics: V_{max7}, $V_{min0.5}$, $WTS_{AIR0.8}$ at 60 °C, $S_{min1800}$ and $ITSR_{80}$.

10.6 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the designed asphalt concrete binder course.

10.7 The stiffness of designed asphalt concrete binder course shall be determined in accordance with Annex E of BS 594987 [Ref 3.N].

Installation requirements and verification for designed asphalt concrete binder course

10.8 Designed asphalt concrete binder course shall be installed by organisations registered to and operating in compliance with a quality management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 23.N].

10.9 Prior to placing designed asphalt concrete binder course on any new or existing bound substrate, a bond coat shall be applied in accordance with BS 594987 [Ref 3.N].

10.10 Verification shall be undertaken for the rate of spread of bond coat by testing in accordance with BS 594987 [Ref 3.N].

10.11 The frequency of the rate of spread of bond coat testing shall be once per week.

10.12 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the rate of spread of bond coat.

10.13 Designed asphalt concrete binder course shall be transported, laid and compacted in accordance with BS 594987 [Ref 3.N].

10.14 The minimum temperature immediately prior to the compaction of warm mix designed asphalt concrete binder course shall be 90 °C, when measured in accordance with BS EN 12697-13 [Ref 16.N].

10.15 Joints in designed asphalt concrete binder course shall comply with "Formation of joints in bituminous layers" in Section 5 of this document.

10.16 On completion of compaction of the designed asphalt concrete binder course, the mean in situ air void content of core pairs taken from the wheel tracks shall be not more than 7%, where wheel tracks are 600 mm wide with the inside edges offset from the centre of the lane by 720 mm.

10.17 Verification shall be undertaken for the in situ air void content of the designed asphalt concrete binder course by measurement using a correlated indirect density gauge in accordance with BS 594987 [Ref 3.N].

10.18 The frequency of in situ air void content measurement shall be 1 per 20 m in alternate wheel tracks.

10.19 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the in situ air void content of the designed asphalt concrete binder course.

10.20 On completion of compaction of the designed asphalt concrete binder course, the mean in situ air void content of core pairs taken from the wheel tracks shall be not more than 7%.

10.21 Verification shall be undertaken for the in situ air void content of the designed asphalt concrete binder course by testing core pairs taken from the wheel tracks in accordance with BS 594987 [Ref 3.N].

10.22 The frequency of in situ air void content testing shall be 1 per 1,000 linear metres.

10.23 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the in situ air void content of the designed asphalt concrete binder course.

10.24 On completion of compaction of the designed asphalt concrete binder course, the mean in situ air void content of core pairs taken at unsupported edges shall be not more than 9%.

10.25 Verification shall be undertaken for the in situ air void content of the designed asphalt concrete binder course by testing core pairs, centred 100 mm from the final joint position at unsupported edges in accordance with BS 594987 [Ref 3.N].

10.26 The frequency of in situ air void content testing shall be 1 per 250 linear metres.

10.27 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the in situ air void content of the designed asphalt concrete binder course.

10.28 Prior to the construction of the overlying layer, the surface level of the designed asphalt concrete binder course shall comply with Surface levels requirements and verification of flexible pavement courses in "General requirements for flexible pavement construction" in Section 1 of this document.

11. EME2 asphalt concrete binder course

Constituent requirements for EME2 asphalt concrete binder course

11.1 Constituents for EME2 asphalt concrete binder course shall be in accordance with "Constituents for bituminous mixtures" in Section 7 of this document.

Product requirements for EME2 asphalt concrete binder course

11.2 The mixture designation for EME2 asphalt concrete binder course shall be one of the following as detailed in table 11.2.

Table 11.2 Mixture designation for EME2 asphalt concrete binder course	
Warm mix asphalt	Hot mix asphalt
AC 10 EME2 bin 10/20 des W	AC 10 EME2 bin 10/20 des
AC 10 EME2 bin 15/25 des W	AC 10 EME2 bin 15/25 des
AC 14 EME2 bin 10/20 des W	AC 14 EME2 bin 10/20 des
AC 14 EME2 bin 15/25 des W	AC 14 EME2 bin 15/25 des
AC 20 EME2 bin 10/20 des W	AC 20 EME2 bin 10/20 des
AC 20 EME2 bin 15/25 des W	AC 20 EME2 bin 15/25 des

11.3 The maximum temperature of warm mix EME2 asphalt concrete binder course shall be 160 °C, when measured in accordance with BS EN 12697-13 [Ref 16.N].

11.4 EME2 asphalt concrete binder course shall be compliant with BS EN 13108-1 [Ref 8.N] following PD 6691 [Ref 24.N].

11.5 The EME2 asphalt concrete binder course shall meet the following performance characteristics: V_{max6}, i/C_{min75}, $P_{7.5}$ at 60 °C and $S_{min5500}$.

11.6 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the EME2 asphalt concrete binder course.

Installation requirements and verification for EME2 asphalt concrete binder course

11.7 EME2 asphalt concrete binder course shall be installed by organisations registered to and operating in compliance with a quality management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 23.N].

11.8 Prior to placing EME2 asphalt concrete binder course on any new or existing bound substrate, a bond coat shall be applied in accordance with BS 594987 [Ref 3.N].

11.9 Verification shall be undertaken for the rate of spread of bond coat by testing in accordance with BS 594987 [Ref 3.N].

11.10 The frequency of the rate of spread of bond coat testing shall be once per week.

11.11 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the rate of spread of bond coat.

11.12 EME2 asphalt concrete binder course shall be transported, laid and compacted in accordance with BS 594987 [Ref 3.N].

11.13 Joints in EME2 asphalt concrete binder course shall comply with "Formation of joints in bituminous layers" in Section 5 of this document.

11.14 The minimum temperature immediately prior to the compaction of warm mix EME2 asphalt concrete binder course shall be 110 °C, when measured in accordance with BS EN 12697-13 [Ref 16.N].

11.15 On completion of compaction of the EME2 asphalt concrete binder course, the mean of six consecutive in situ air void content measurements in the wheel tracks shall be not more than 6%, where wheel tracks are 600 mm wide with the inside edges offset from the centre of the lane by 720 mm.

11.16 Verification shall be undertaken for the in situ air void content of the EME2 asphalt concrete binder course by measurement using a correlated indirect density gauge in accordance with BS 594987 [Ref 3.N].

11.17 The frequency of in situ air void content measurement shall be 1 per 20 m in alternate wheel tracks.

11.18 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the in situ air void content of the EME2 asphalt concrete binder course.

11.19 On completion of compaction of the EME2 asphalt concrete binder course, the mean in situ air void content of core pairs taken from the wheel tracks shall be not more than 6%.

11.20 Verification shall be undertaken for the in situ air void content of the EME2 asphalt concrete binder course by testing core pairs taken from the wheel tracks in accordance with BS 594987 [Ref 3.N].

11.21 The frequency of in situ air void content testing shall be 1 per 1,000 linear metres.

11.22 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the in situ air void content of the EME2 asphalt concrete binder course.

11.23 On completion of compaction of the EME2 asphalt concrete binder course, the mean in situ air void content of core pairs taken at unsupported edges shall be not more than 8%.

11.24 Verification shall be undertaken for the in situ air void content of the EME2 binder course by testing core pairs, centred 100 mm from the final joint position at unsupported edges in accordance with BS 594987 [Ref 3.N].

11.25 The frequency of in situ air void content testing shall be 1 per 250 linear metres.

11.26 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the in situ air void content of the EME2 asphalt concrete binder course.

11.27 Prior to the construction of the overlying layer, the surface level of the EME2 asphalt concrete binder course shall comply with the Surface levels requirements and verification of flexible pavement courses in "General requirements for flexible pavement construction" in Section 1 of this document.

12. Stone mastic asphalt binder course

Constituent requirements for stone mastic asphalt binder course

12.1 Constituents for stone mastic asphalt (SMA) binder course shall be in accordance with "Constituents for bituminous mixtures" in Section 7 of this document.

Product requirements for SMA binder course

12.2 The mixture designation for SMA binder course shall be one of the following as detailed in table 12.2.

Table 12.2 Mixture designation for the SMA binder course	
Warm mix asphalt	Hot mix asphalt
SMA 6 bin 40/60 W	SMA 6 bin 40/60
SMA 6 bin PMB W	SMA 6 bin PMB
SMA 10 bin 40/60 W	SMA 10 bin 40/60
SMA 10 bin PMB W	SMA 10 bin PMB
SMA 14 bin 40/60 W	SMA 14 bin 40/60
SMA 14 bin PMB W	SMA 14 bin PMB
SMA 20 bin 40/60 W	SMA 20 bin 40/60
SMA 20 bin PMB W	SMA 20 bin PMB

12.3 The maximum temperature of warm mix SMA binder course, when measured in accordance with BS EN 12697-13 [Ref 16.N], shall be as detailed in table 12.3.

Table 12.3 Maximum temperature for warm mix asphalt used in the SMA binder course	
Binder grade	Maximum temperature (°C)
Paving grade bitumen conforming to BS EN 12591 [Ref 7.N]	150
Polymer modified bitumen conforming to BS EN 14023 [Ref 5.N]	Documented and declared by the producer

12.4 SMA binder course shall be compliant with BS EN 13108-5 [Ref 12.N] following PD 6691 [Ref 24.N].

12.5 The SMA binder course shall meet the following performance characteristics: $V_{max4,}$ $WTS_{AIR0.6}$ at 60 °C and $ITSR_{80}$.

12.6 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the SMA binder course.

Installation requirements and verification for SMA binder course

12.7 SMA binder course shall be installed by organisations registered to and operating in compliance with a quality management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 23.N].

12.8 Prior to placing SMA binder course on any new or existing bound substrate, a bond coat shall be applied in accordance with BS 594987 [Ref 3.N].

12.9 Verification shall be undertaken for the rate of spread of bond coat by testing in accordance with BS 594987 [Ref 3.N].

12.10 The frequency of the rate of spread of bond coat testing shall be once per week.

12.11 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of rate of spread of the bond coat.

12.12 SMA binder course shall be transported, laid and compacted in accordance with BS 594987 [Ref 3.N].

12.13 The minimum temperature immediately prior to the compaction of warm mix SMA binder course, when measured in accordance with BS EN 12697-13 [Ref 16.N], shall be as detailed in table 12.13.

Table 12.13 Minimum temperature of warm mix SMA binder course immediately prior to compaction

Binder grade	Minimum temperature immediately prior to compaction (°C)
Paving grade bitumen conforming to BS EN 12591 [Ref 7.N]	90
Polymer modified bitumen conforming to BS EN 14023 [Ref 5.N]	Documented and declared by the producer

12.14 Joints in SMA binder course shall comply with "Formation of joints in bituminous layers" in Section 5 of this document.

12.15 On completion of compaction of the SMA binder course, the mean of six consecutive in situ air void content measurements shall be as detailed in Table 12.15.

Table 12.15 Mean in situ air void content of the SMA binder course

Nominal thickness	Mean in situ air void content in the centre of the mat (%)	Mean in situ air void content at unsupported edges (%)

(mm)		
≥ 30	≤ 5	≤ 7
20 - 30	≤ 7	≤ 9

12.16 Verification shall be undertaken for the in situ air void content measurement of the SMA binder course by measurement in the centre of the mat using a correlated indirect density gauge in accordance with BS 594987 [Ref 3.N].

12.17 The frequency of in situ air void content measurement shall be 1 per 50 m.

12.18 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurements of the in situ air void content of the SMA binder course.

12.19 Verification shall be undertaken for the in situ air void content measurements of the SMA binder course by measurement centred 200 mm from the final joint position at unsupported edges using an indirect density gauge in accordance with BS 594987 [Ref 3.N].

12.20 The frequency of in situ air void content measurement shall be 1 per 50 m.

12.21 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the in situ air void content of the SMA binder course.

12.22 Prior to the construction of the overlying layer, the surface level of the SMA binder course shall comply with the Surface levels requirements and verification of flexible pavement courses in "General requirements for flexible pavement construction" in Section 1 of this document.

13. Performance hot rolled asphalt binder course

Constituent requirements for performance hot rolled asphalt binder course

13.1 Constituents for performance hot rolled asphalt (HRA) binder course shall be in accordance with "Constituents for bituminous mixtures" in Section 7 of this document.

13.2 The coarse aggregate in performance HRA binder course shall be compliant with BS EN 13043 [Ref 2.N].

13.3 The coarse aggregate in performance HRA binder course shall meet the following performance characteristics: crushed rock or slag.

13.4 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the coarse aggregate in the performance HRA binder course.

Product requirements for performance HRA binder course

13.5 The performance HRA binder course shall be HRA 35/14 F surf 40/60 Perf or HRA 35/14 F surf PMB Perf.

13.6 Performance HRA binder course shall be compliant with BS EN 13108-4 [Ref 10.N] following PD 6691 [Ref 24.N].

13.7 The performance HRA binder course shall meet the following performance characteristics: $B_{vol15.5}$, $V_{max4,}$ $WTR_{AIR7.5}$ at 60 °C and $RD_{AIR7.0}$ at 60 °C.

13.8 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to performance HRA binder course.

Installation requirements and verification for performance HRA binder course

13.9 Performance HRA binder course shall be installed by organisations registered to and operating in compliance with a quality management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 23.N].

13.10 Prior to placing performance HRA binder course on any new or existing bound substrate other than bridge deck waterproofing, a bond coat shall be applied in accordance with BS 594987 [Ref 3.N].

13.11 Verification shall be undertaken for the rate of spread of the bond coat by testing in accordance with BS 594987 [Ref 3.N].

13.12 The frequency of the rate of spread of bond coat testing shall be once per week.

13.13 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the rate of spread of bond coat.

13.14 Performance HRA binder course shall be transported, laid and compacted in accordance with BS 594987 [Ref 3.N].

13.15 Performance HRA binder course shall be laid at a nominal thickness of 45 mm to 60 mm.

13.16 Performance HRA binder course when installed directly on a waterproofing system shall be laid at a temperature of less than 145 °C, unless otherwise permitted in the product acceptance scheme certification for the waterproofing system.

13.17 Joints in performance HRA binder course shall comply with "Formation of joints in bituminous layers" in Section 5 of this document.

13.18 On completion of compaction of the performance HRA binder course, the mean of six consecutive in situ air void content measurements shall be not more than 5.5%.

13.19 Verification shall be undertaken for the in situ air void content of the performance HRA binder course by measurement in the centre of the mat using a correlated indirect density gauge in accordance with BS 594987 [Ref 3.N].

13.20 The frequency of in situ air void content measurement shall be 1 per 20 m.

13.21 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the in situ air void content of the performance HRA binder course.

13.22 Prior to the construction of the overlying layer, the surface level of the performance HRA binder course shall comply with the Surface levels requirements and verification of flexible pavement courses in "General requirements for flexible pavement construction" in Section 1 of this document.

14. Recipe hot rolled asphalt binder course

General requirements for recipe hot rolled asphalt binder course

14.1 Recipe hot rolled asphalt (HRA) binder courses (recipe mixtures) shall be as specified in CC 202/WSR/014.

Recipe hot rolled asphalt (HRA) binder courses (recipe mixtures)		
Pavement course material reference	**Installation requirements**	**Surface level requirements**
(a)	(b)	(c)

a) Enter a unique reference, from options as defined in Pavement course materials of WSR 202/001, to define the corresponding reference for the material.

b) Enter text, to define the installation requirements for the mixture, where different from those in BS 594987 [Ref 3.N].

c) Enter text, to define the surface level requirements for the mixture relative to the design level.

Constituent requirements for recipe HRA binder course

14.2 Constituents for recipe HRA binder course shall comply with "Constituents for bituminous mixtures" in Section 7 of this document.

Product requirements for recipe HRA binder course

14.3 The mixture designation for recipe HRA binder course shall be HRA 60/20 bin 40/60.

14.4 Recipe HRA binder course shall be compliant with BS EN 13108-4 [Ref 10.N].

14.5 The recipe HRA binder course shall meet the following performance characteristics: grading and binder content for HRA mixtures from PD 6691 [Ref 24.N].

14.6 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the recipe HRA binder course.

Installation requirements for recipe HRA binder course

14.7 Recipe HRA binder course shall be installed by organisations registered to and operating in compliance with a quality management

scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 23.N].

14.8 Prior to placing recipe HRA binder course on any new or existing bound substrates, a bond coat shall be applied in accordance with BS 594987 [Ref 3.N], unless otherwise stated in CC 202/WSR/014.

14.9 Recipe HRA binder course shall be transported, laid and compacted in accordance with BS 594987 [Ref 3.N], unless otherwise stated in CC 202/WSR/014.

15. Thin surface course systems

General requirements for thin surface course systems

15.1 Thin surface course systems (TSCS) shall be as specified in CC 202/WSR/015.

Thin surface course systems (TSCS)					
Pavement course material reference	**Location type**	**Maximum nominal aggregate size**	**Binder type**	**Road/tyre noise level**	**Fuel resisting properties**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, from options as defined in Pavement course materials of WSR 202/001, to define the corresponding reference for the material.

b) Enter a value, from options High speed road, Lower speed road, Roundabout on high speed road, Roundabout on lower speed road, Lay-by, Emergency area, Maintenance hardstanding, to define the road type in accordance with table 15.63.

c) Enter a value, from options 14 mm, 10 mm, 6 mm, to define the maximum nominal aggregate size for the TSCS.

d) Enter one or more values, from options Polymer modified bitumen (PMB), Paving grade bitumen, to define the permitted binder type in the mixture.

e) Enter a value, from options Level 4 [Road Surface Influence of -6dB(A)], Level 3 [Road Surface Influence of -3.5dB(A)], Level 2 [Road Surface Influence of -2.5dB(A)], Level 1 [Road Surface Influence of -0.5dB(A)], Level 0 [Road Surface Influence of +1.2dB(A)], No requirement, to define road/tyre noise level.

f) Enter a value, from options Ci_{max6}, No requirement, to define the fuel resisting properties (applicable to TSCS used in lay-bys, emergency areas and maintenance hardstanding locations).

Constituent requirements for TSCS

15.2 Constituents for TSCS shall be in accordance with "Constituents for bituminous mixtures" in Section 7 of this document.

15.3 The coarse aggregate for TSCS shall be crushed rock or steel slag in accordance with "Constituents for bituminous mixtures" in Section 7 of this document.

15.4 The Flakiness Index (FI) of the coarse aggregate used for TSCS shall not be greater than FI_{20}.

15.5 The added filler used in TSCS shall be limestone filler, hydrated lime or cement.

15.6 Limestone filler or hydrated lime used as added filler for TSCS shall be in accordance with "Constituents for bituminous mixtures" in Section 7 of this document.

15.7 Cement used as added filler for TSCS shall be compliant with BS EN 197-1 [Ref 18.N].

15.8 The cement used as added filler for TSCS shall meet the following performance characteristics: requirements as detailed in BS EN 197-1 [Ref 18.N].

15.9 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the cement used as added filler for TSCS.

Product requirements for TSCS

15.10 The requirements for "Product acceptance schemes" in Section 12 of GC 101 [Ref 23.N] shall apply to the TSCS.

15.11 TSCS shall be compliant with BS EN 13108-1 [Ref 8.N], BS EN 13108-2 [Ref 9.N] or BS EN 13108-5 [Ref 12.N].

15.12 The TSCS shall meet the performance characteristics as stated in table 15.12.

Table 15.12 Performance characteristics of TSCS

Performance characteristics	BS EN 13108, Part 1 (AC with PMB to BS EN 14023)	BS EN 13108, Part 2 (BBTM with PMB to BS EN 14023)		BS EN 13108, Part 5 (SMA with paving grade bitumen to BS EN 12591 or PMB to BS EN 14023)
Resistance to permanent deformation and mechanical stability	$WTS_{AIR0.6}$ at 60 °C	P_{max} (to be reported)		$WTS_{AIR0.6}$ at 60 °C
	$WTS_{AIR0.15}$ at 60 °C for lay-bys, emergency areas and maintenance hardstanding locations			
Water sensitivity	$ITSR_{80}$	$ITSR_{90}$		$ITSR_{80}$
Design void content	V_{min1} to V_{max5}	Maximum upper sieve size (mm)	Design void content categories V_i or V_v	$V_{min1.5}$ to V_{max5}

		14	N/A	
		10	3 to 6	
		6		

15.13 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the TSCS.

15.14 The minimum target design binder content for TSCS shall be compliant with BS EN 13108-1 [Ref 8.N], BS EN 13108-2 [Ref 9.N] or BS EN 13108-5 [Ref 12.N].

15.15 The minimum target design binder content for the TSCS shall meet the performance characteristics as stated in table 15.15.

Table 15.15 Minimum target design binder content for TSCS

Maximum aggregate sieve size (mm)	Minimum target design binder content (B_{min})	
	Mixture types: BS EN 13108, Part 1 and 2 (AC and BBTM with PMB to BS EN 14023)	Mixture types: BS EN 13108, Part 5 (SMA with paving grade bitumen to BS EN 12591 or PMB to BS EN 14023)
14	5.0	6.0
10	5.2	6.2
6	5.4	Not used

15.16 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the minimum target design binder content for the TSCS.

15.17 The maximum temperature of warm mix TSCS measured in accordance with BS EN 12697-13 [Ref 16.N] shall be as detailed in table 15.17.

Table 15.17 Maximum temperature for warm mix asphalt used in the TSCS

Binder grade	Maximum temperature of warm mix TSCS (°C)
Paving grade bitumen conforming to BS EN 12591 [Ref 7.N]	150
Polymer modified bitumen conforming to BS EN 14023 [Ref 5.N]	Documented and declared by the producer

15.18 TSCS shall have undergone a System Installation Performance Trial (SIPT).

15.19 The Product Acceptance Scheme for the TSCS shall demonstrate that the product has met the requirements of the SIPT.

System Installation Performance Trial (SIPT) requirements and verification for TSCS

15.20 The TSCS assessed under the SIPT shall be installed in accordance with the manufacturer's method statement.

15.21 The TSCS area assessed under the SIPT shall be a minimum of 200 m in length and 3.5 m in width.

15.22 The TSCS area assessed under the SIPT shall have an inspection protocol in accordance with TRL 674 [Ref 21.N].

15.23 The visual inspection of the TSCS assessed under the SIPT shall have a performance of 'Good' or 'Excellent' as detailed in TRL 674 [Ref 21.N].

15.24 Verification shall be undertaken for the visual inspection of the TSCS assessed under the SIPT in accordance with TRL 674 [Ref 21.N].

15.25 The frequency of the visual inspection assessed under the SIPT shall be one set before opening to traffic, 12 months after opening to traffic and 24 months after opening to traffic.

15.26 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the visual inspection of the TSCS assessed under the SIPT.

15.27 The initial surface macrotexture depth of the TSCS assessed under the SIPT shall be as detailed in table 15.63.

15.28 Verification shall be undertaken for the initial surface macrotexture depth measurements assessed under the SIPT in accordance with BS EN 13036-1 [Ref 36.N].

15.29 The frequency of measurement for the initial surface macrotexture depth shall be one set before opening to traffic.

15.30 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the initial surface macrotexture depth of the TSCS assessed under the SIPT.

15.31 The retained surface macrotexture depth of the TSCS assessed under the SIPT shall be as detailed in table 15.72.

15.32 Verification shall be undertaken for the retained surface macrotexture depth measurements of the TSCS assessed under the SIPT in accordance with BS EN 13036-1 [Ref 36.N].

15.33 The frequency of measurement for the retained surface macrotexture depth assessed shall be one set at 12 months after opening to traffic and at 24 months after opening to traffic.

15.34 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the retained surface macrotexture depth of the TSCS assessed under the SIPT.

15.35 The torque bond strength between the TSCS and the substrate assessed under the SIPT shall be not less than 535 kPa.

15.36 Verification shall be undertaken for the torque bond strength between the TSCS and the substrate assessed under the SIPT by measurement in accordance with BS EN 12697-48 [Ref 14.N] with a minimum of six measurements evenly spaced across the SIPT area.

15.37 The frequency of measurement for the torque bond strength testing between the TSCS and the substrate assessed under the SIPT shall be one set within 56 days after opening to traffic.

15.38 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the torque bond strength assessed under the SIPT.

15.39 The resistance to permanent deformation of the TSCS assessed under the SIPT shall be as detailed in table 15.14.

Road/tyre noise

15.40 Road/tyre noise characteristics of TSCS assessed under the SIPT shall have a declared level as detailed in table 15.40.

Table 15.40 Road/tyre noise levels of TSCS

Level	Road Surface Influence (RSI)
4	-6.0 dB (A)
3	-3.5 dB (A)
2	-2.5 dB (A)
1	-0.5 dB (A)
0	+1.2 dB (A)
NR	No requirement

15.41 The comparative material for assessing and measuring the road/tyre noise levels of TSCS shall be "Performance hot rolled asphalt surface course " in Section 17 of this document.

15.42 The measurement of road/tyre noise levels, in accordance with BS EN ISO 11819-1 [Ref 1.N], of the TSCS used in the SIPT shall be carried out when the road surface is dry.

15.43 The measurement of road/tyre noise levels, in accordance with BS EN ISO 11819-1 [Ref 1.N], of the TSCS used in the SIPT shall be carried out when the road surface temperature ($T_{surface}$) is 5 °C to 50 °C.

15.44 The measurement of road/tyre noise levels, in accordance with BS EN ISO 11819-1 [Ref 1.N], of the TSCS used in the SIPT shall be carried out when the air temperature (T_{air}) is 5 °C to 30 °C.

15.45 The measurement of road/tyre noise levels, in accordance with BS EN ISO 11819-1 [Ref 1.N], of the TSCS used in the SIPT shall be carried out on sites with a road speed category that is classified as Medium or High.

15.46 The measurement of road/tyre noise levels, in accordance with BS EN ISO 11819-1 [Ref 1.N], of the TSCS used in the SIPT shall be carried out at a frequency range to include 100 Hz to 5000 Hz (centre frequencies of the one-third octave bands).

15.47 The microphone location at each measurement site for the measurement of road/tyre noise levels, in accordance with BS EN ISO 11819-1 [Ref 1.N], of the TSCS used in the SIPT shall be recorded and marked for identification for a minimum period of 2 years.

15.48 Linear regression analysis for high speed road category shall not consider vehicles travelling at speeds less than 60 km/h in accordance with AFNOR S31-119 [Ref 37.N].

15.49 The vehicle sound level shall be calculated as the ordinate sound level of the regression line at the reference speed for the road category as detailed in table 15.49.

Table 15.49 Reference speeds (km.h-1) for different road speed categories

Vehicle category	Road speed category (km.h-1)	
	Medium	High
L	80	110
H1	70	90
H2	70	90

Category L vehicles - light vehicles including passenger cars and car derived vans, excluding vehicles towing trailers.
Category H1 vehicles - commercial trucks with 2 axles and greater than 3.5 tonnes.
Category H2 vehicles - commercial trucks with more than 2 axles and greater than 3.5 tonnes.

15.50 The road surface influence (RSI) for high road speed category roads shall be calculated from the following equation:

15.51 The road surface influence (RSI) for medium road speed category roads shall be calculated from the following equation:

15.52 Verification shall be undertaken for the road/tyre noise levels of the TSCS used in the SIPT by measurement in accordance with BS EN ISO 11819-1 [Ref 1.N].

15.53 The frequency of measurement for the road/tyre noise levels shall be one set between 12 months and 18 months after opening to traffic.

15.54 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the road/tyre noise levels of the TSCS assessed under the SIPT.

Product documentation for TSCS

15.55 The following Documentation shall be submitted for the TSCS prior to the commencement of the installation of the TSCS: Product Acceptance Scheme certification.

15.56 The requirements for "Documentation" in Section 2 of GC 101 [Ref 23.N] shall apply to the TSCS.

Installation requirements and verification for TSCS

15.57 TSCS shall be installed by organisations registered to and operating in compliance with a quality management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 23.N].

15.58 TSCS shall be installed in accordance with the manufacturer's installation method statement.

15.59 The minimum temperature immediately prior to the rolling of warm mix asphalt used in TSCS, when measured in accordance with BS EN 12697-13 [Ref 16.N], shall be as detailed in table 15.59.

Table 15.59 Minimum rolling temperatures of warm mix asphalt used in TSCS

Binder grade	Minimum temperature (°C)
Paving grade bitumen conforming to BS EN 12591 [Ref 7.N]	90
Polymer modified bitumen conforming to BS EN 14023 [Ref 5.N]	Documented and declared by the producer

Joints

15.60 Joints in TSCS shall comply with "Formation of joints in bituminous layers" in Section 5 of this document.

Initial surface macrotexture depth

15.61 The initial surface macrotexture depth of the installed TSCS shall be as detailed in table 15.61.

Table 15.61 Requirements for the initial surface macrotexture depth for trunk roads and motorways for TSCS

Location type	Surfacing Type	Mean per 1,000 m section (mm)		Mean for a set of 10 measurements (mm)
		Minimum	Maximum	Minimum
High speed roads Posted speed limit ≥ 50 miles/hour (80 km/hr)	Upper (D) aggregate size of 14 mm	1.3	1.8	1.0
	Upper (D) aggregate size of 10 mm	1.1	1.6	0.9
	Upper (D) aggregate size of 6 mm	1.0	1.5	0.9
Lower speed roads Posted speed limit ≤ 40 miles/hour (65 km/hr)	Upper (D) aggregate size of 14 mm or less	1.0	1.5	0.9
Roundabouts on high speed roads Posted speed limit ≥ 50 miles/hour (80 km/hr)	Upper (D) aggregate size of 10 mm or less	1.1	1.6	0.9
Roundabouts on lower speed roads Posted speed limit ≤ 40 miles/hour (65 km/hr)	Upper (D) aggregate size of 10 mm or less	1.0	1.5	0.9
Lay-bys, emergency areas and maintenance hardstanding locations	Upper (D) aggregate size of 14 mm or less	-	-	0.9

NI/15.62 The initial surface macrotexture depth of TSCS for roads other than trunk roads and motorways shall be as stated in CC 202/WSR/015.

NI/SI.15.62 The initial surface macrotexture depth of TSCS for roads other than trunk roads and motorways shall be [enter free text].

15.63 Verification shall be undertaken for the initial surface macrotexture depth of the installed TSCS by measurement in accordance with BS EN 13036-1 [Ref 36.N].

15.64 The frequency of measurement for the initial surface macrotexture depth shall be 10 individual measurements at 5 m spacing along a diagonal line across the lane width per 250 m of carriageway lane.

15.65 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the initial surface macrotexture depth of the installed TSCS.

15.66 Verification shall be undertaken for the initial surface macrotexture depth of the installed TSCS in lay-bys, emergency areas and maintenance hardstanding locations by measurement in accordance with BS EN 13036-1 [Ref 36.N].

15.67 The frequency of measurement for the initial surface macrotexture depth shall be one set of minimum eight measurements per lay-by, emergency area and maintenance hardstanding location.

15.68 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the initial surface macrotexture depth of the installed TSCS for lay-bys, emergency areas and maintenance hardstanding locations.

Torque bond strength

15.69 The torque bond strength between the TSCS and the substrate shall be not less than 535 kPa.

Retained surface macrotexture depth

15.70 For a period of 2 years after opening to traffic, the retained surface macrotexture depth of the installed TSCS shall be as detailed in table 15.70, where the retained surface macrotexture depth is the mean of one set of 10 measurements at 10 m intervals along the centre of the most heavily worn wheel track, where wheel tracks are 600 mm wide with the inside edges offset from the centre of the lane by 720 mm, measured in accordance with BS EN 13036-1 [Ref 36.N].

Table 15.70 Retained surface macrotexture requirements for TSCS	
Surfacing type	Mean surface macrotexture depth per 100 m section (mm)

Systems with an upper (D) aggregate size of 14 mm laid on motorway trunk and high speed A roads	0.9
Systems with an upper (D) aggregate size of 10 mm laid on motorway trunk and high speed A roads	0.8
Systems with an upper (D) aggregate size of 6 mm laid on motorway trunk and high speed A roads	0.7

Surface levels

15.71 Prior to opening to traffic, the surface level of the TSCS shall comply with the Surface levels requirements and verification of flexible pavement courses in "General requirements for flexible pavement construction" in Section 1 of this document.

Surface regularity

15.72 Prior to opening to traffic, the surface regularity of the TSCS shall comply with the Surface regularity requirements and verification of surface courses in "General requirements for flexible pavement construction" in Section 1 of this document.

Overall performance requirements: guarantee period for TSCS

15.73 For a period of 5 years after opening to traffic, if the durability of the installed TSCS is lower than 'acceptable condition' as defined in TRL 674 [Ref 21.N], replacement of the TSCS shall be executed.

15.74 The guarantee of the installed TSCS shall exclude defects arising from accidental damage or damage caused by settlement, subsidence or failure of the underlying carriageway on which the TSCS was installed.

16. Coloured thin surface course systems

Constituent requirements for coloured thin surface course systems

16.1 Constituent requirements for coloured thin surface course systems (TSCS) shall comply with Constituent requirements for TSCS in "Thin surface course systems" in Section 15 of this document.

16.2 The maximum aggregate size for coloured TSCS shall be 14 mm.

Product requirements and verification for coloured TSCS

16.3 Product requirements for coloured TSCS shall comply with Product requirements for TSCS in "Thin surface course systems" in Section 15 of this document.

16.4 Coloured TSCS shall be compliant with GD 301 (GSR) [Ref 22.N].

16.5 The loss of mass to demonstrate fuel resisting properties of the coloured TSCS shall be C_{imax6}.

System Installation Performance Trial (SIPT) requirements and verification for coloured TSCS

16.6 System Installation Performance Trial (SIPT) requirements for the coloured TSCS shall comply with System Installation Performance Trial (SIPT) requirements for TSCS in "Thin surface course systems" in Section 15 of this document.

16.7 The corrected Pendulum Test Value (PTV_{Corr}) of the coloured TSCS assessed under the SIPT shall be a mean value of not less than 60 (PTV_{Corr60}), with no individual value less than 55 (PTV_{Corr55}).

16.8 Verification shall be undertaken for the PTV_{Corr} of the coloured TSCS assessed under the SIPT by measurement in accordance with BS EN 13036-4 [Ref 35.N]with a set of a minimum of eight measurements evenly spread across the SIPT area.

16.9 The frequency of measurement of the PTV_{Corr} of the coloured TSCS assessed under the SIPT shall be one set at 12 months after opening to traffic and at 24 months after opening to traffic.

16.10 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the PTV_{Corr} of the coloured TSCS assessed under the SIPT.

Product documentation for coloured TSCS

16.11 The following Documentation shall be submitted for the coloured TSCS prior to the commencement of installation: Product Acceptance Scheme certificate.

16.12 The requirements for "Documentation" in Section 2 of GC 101 [Ref 23.N] shall apply to the coloured TSCS: Product Acceptance Scheme certificate.

Installation requirements and verification for coloured TSCS

16.13 Coloured TSCS shall comply with the Installation requirements and verification for TSCS in "Thin surface course systems" in Section 15 of this document.

16.14 The initial surface macrotexture depth of the coloured TSCS shall be not less than 0.9 mm.

16.15 Verification shall be undertaken for the initial surface macrotexture depth of the coloured TSCS by measurement in accordance with BS EN 13036-1 [Ref 36.N], with a set of a minimum of eight measurements evenly spread across the area.

16.16 The frequency of initial surface macrotexture depth measurements shall be one set per area.

16.17 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the initial surface macrotexture depth of the coloured TSCS.

16.18 The mean corrected Pendulum Test Value (PTV_{Corr}) of the coloured TSCS shall be a mean value of not less than 60 (PTV_{Corr60}) with no individual value less than 55 (PTV_{Corr55}).

16.19 Verification shall be undertaken for the PTV_{Corr} of the coloured TSCS by testing in accordance with BS EN 13036-4 [Ref 35.N] with a set of a minimum of eight measurements evenly spread across the area.

16.20 The frequency of PTV_{Corr} measurements shall be one set per area.

16.21 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the PTV_{Corr} of the coloured TSCS.

Overall performance requirements: guarantee period for the coloured TSCS

16.22 Coloured TSCS shall comply with the Overall performance requirements: guarantee period for TSCS in "Thin surface course systems" in Section 15 of this document.

16.23 For a period of 5 years after opening to traffic, the coloured TSCS shall meet the requirements as detailed in GD 301 (GSR) [Ref 22.N].

16.24 For a period of 5 years after opening to traffic, the skid resistance of the coloured TSCS shall be not less than PTV_{Corr60}.

17. Performance hot rolled asphalt surface course

General requirements for performance hot rolled asphalt surface course

17.1 Performance hot rolled asphalt (HRA) surface course shall be as specified in CC 202/WSR/017.

Performance hot rolled asphalt (HRA) surface course		
Pavement course material reference	**Location type**	**Fuel resisting properties**
(a)	(b)	(c)

a) Enter a unique reference, from options as defined in Pavement course materials of WSR 202/001, to define the corresponding reference for the material.

b) Enter a value, from options High speed roads, Lower speed roads, Roundabouts on high speed roads, Roundabouts on lower speed roads, lay-by, maintenance hardstanding, emergency area, to define the road type to select the appropriate macrotexture in accordance with table 17.21.

c) Enter a value, from options Ci_{max6}, No requirement (Ci_{maxNR}), to define the fuel resisting properties of the performance HRA surface course.

Constituent requirements for performance HRA surface course

17.2 Constituents for performance HRA surface course shall be in accordance with "Constituents for bituminous mixtures" in Section 7 of this document.

17.3 The coarse aggregate in performance HRA surface course shall be compliant with BS EN 13043 [Ref 2.N].

17.4 The coarse aggregate in performance HRA surface course shall meet the following performance characteristics: crushed rock or slag.

17.5 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the coarse aggregate in performance HRA surface course.

17.6 Coated chippings for application to performance HRA surface course shall be compliant with BS EN 13108-4 [Ref 10.N] following the guidance provided in PD 6691 [Ref 24.N].

17.7 The coated chippings for application to performance HRA surface course shall meet the following performance characteristics: 14/20 mm, FI_{20}, the proportion of retained sand (P_{rs})> 4% and the visual assessment of the failed chippings (P_{fc}) < 7.5%.

17.8 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the coated chippings for application to performance HRA surface course.

Product requirements for performance HRA surface course

17.9 Performance HRA surface course shall be HRA 35/14 F Surf 40/60 Perf or HRA 35/14 F Surf PMB Perf.

17.10 Performance HRA surface course shall be compliant with BS EN 13108-4 [Ref 10.N] following PD 6691 [Ref 24.N].

17.11 The performance HRA surface course shall meet the performance characteristics as stated in table 17.11.

Table 17.11 Performance characteristics of the HRA surface course

Performance characteristics	Requirement
Minimum binder volume	$B_{vol15.5}$
Void content	V_{max5}
Resistance to deformation	$WTR_{AIR7.5}$ at 60 °C $RD_{AIR7.0}$ at 60 °C
	$RD_{AIR3.0}$ at 60 °C for lay-bys, maintenance hardstanding and emergency area locations

17.12 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the performance HRA surface course.

Installation requirements and verification for performance HRA surface course

17.13 Performance HRA surface course shall be installed by organisations registered to and operating in compliance with a quality management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 23.N].

17.14 Prior to placing performance HRA surface course on any new or existing bound substrate, a bond coat shall be applied in accordance with BS 594987 [Ref 3.N].

17.15 Verification shall be undertaken for the rate of spread of bond coat by testing in accordance with BS 594987 [Ref 3.N].

17.16 The frequency of the rate of spread of bond coat testing shall be once per week.

17.17 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the rate of spread of bond coat.

17.18 Performance HRA surface course shall be transported, laid and compacted in accordance with BS 594987 [Ref 3.N].

17.19 Joints in performance HRA surface course shall comply with "Formation of joints in bituminous layers" in Section 5 of this document.

17.20 The initial surface macrotexture depth of the performance HRA surface course before opening to traffic shall be in accordance with table 17.20.

Table 17.20 Requirements for the initial surface macrotexture depth of the performance HRA surface course

Location type	Mean per 1,000 m section (mm)		Mean for a set of 10 measurements (mm)
	Minimum	Maximum	Minimum
High speed roads Posted speed limit ≥ 50 miles/hour (80 km/hr)	1.5	2.0	1.2
Lower speed roads Posted speed limit ≤ 40 miles/hour (65 km/hr)	1.2	1.7	1.0
Roundabouts on high speed roads Posted speed limit ≥ 50 miles/hour (80 km/hr)	1.2	1.7	1.0
Roundabouts on lower speed roads Posted speed limit ≤ 40 miles/hour (65 km/hr)	1.0	1.5	0.9
Lay-bys, emergency areas and maintenance hardstandings	-	-	0.9

17.21 Verification shall be undertaken for the initial surface macrotexture depth of the performance HRA surface course by measurement in accordance with BS EN 13036-1 [Ref 36.N].

17.22 The frequency of the initial surface macrotexture depth shall be 10 individual measurements at 5 m spacing along a diagonal line across the lane width per 250 m of carriageway lane.

17.23 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the initial surface macrotexture depth of the performance HRA surface course.

17.24 Verification shall be undertaken for initial surface macrotexture depth of the performance HRA surface course by measurement in accordance with BS EN 13036-1 [Ref 36.N].

17.25 The frequency of the initial surface macrotexture depth shall be one set of a minimum of eight measurements for each performance HRA surface course used in lay-bys, emergency areas and maintenance hardstandings.

17.26 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the initial surface macrotexture depth for the performance HRA surface course used in lay-bys, emergency areas and maintenance hardstandings.

17.27 Prior to the trafficking of the installed performance HRA surface course, the temperature within the mat shall be less than 35 °C.

17.28 Prior to opening to traffic, the surface level of the performance HRA surface course shall comply with the Surface levels requirements and verification of flexible pavement courses in "General requirements for flexible pavement construction" in Section 1 of this document.

17.29 Prior to opening to traffic, the surface regularity of the performance HRA surface course shall comply with the Surface regularity requirements and verification of surface courses in "General requirements for flexible pavement construction" in Section 1 of this document.

18. Recipe and designed hot rolled asphalt surface course

General requirements for recipe and designed hot rolled asphalt surface course

18.1 Recipe and designed hot rolled asphalt (HRA) surface course shall be as specified in CC 202/WSR/018.

Recipe and designed hot rolled asphalt (HRA) surface course			
Pavement course material reference	**Coated chippings**	**Installation requirements**	**Surface level requirements**
(a)	(b)	(c)	(d)

a) Enter a unique reference, from options as defined in Pavement course materials of WSR 202/001, to define the corresponding reference for the material.

b) Enter one or more values, from options 14/20 mm, 8/14 mm, Not required, to define the size of the coated chippings.

c) Enter text, to define the installation requirements for the mixture, where different from those in BS 594987 [Ref 3.N].

d) Enter text, to define the surface level requirements for the mixture relative to the design level.

Constituent requirements for recipe and designed HRA surface course

18.2 Constituents for recipe and designed HRA surface course shall comply with "Constituents for bituminous mixtures" in Section 7 of this document.

18.3 The coarse aggregate in recipe and designed HRA surface course shall be compliant with BS EN 13043 [Ref 2.N].

18.4 The coarse aggregate in recipe and designed HRA surface course shall meet the following performance characteristics: crushed rock or slag, PSV_{44}.

18.5 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the coarse aggregate in recipe and designed HRA surface course.

18.6 Coated chippings for application to recipe and designed HRA surface course shall be compliant with BS EN 13108-4 [Ref 10.N].

18.7 The coated chippings for application to recipe and designed HRA surface course shall meet the following performance characteristics: 14/20 mm or 8/14 mm, FI_{20}, the proportion of retained sand (P_{rs}) > 4% and the visual assessment of the failed chippings (P_{fc}) < 7.5%.

18.8 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the coated chippings for application to recipe and designed HRA surface course.

Product requirements for recipe and designed HRA surface course

18.9 The mixture designation for recipe and designed HRA surface course shall be one of the following as detailed in Table 18.9.

Table 18.9 Mixture designation for recipe and designed HRA surface course

Mixture Type	Designation
Recipe	HRA 0/2 F surf 40/60 rec
	HRA 30/10 F surf 40/60 rec
	HRA 30/14 F surf 40/60 rec
	HRA 35/14 F surf 40/60 rec
Designed	HRA 30/14 F surf 40/60 des
	HRA 35/14 F surf 40/60 des
	HRA 55/10 F surf 40/60 des
	HRA 55/14 F surf 40/60 des
	HRA 30/14 C surf 40/60 des
	HRA 35/14 C surf 40/60 des
	HRA 55/10 C surf 40/60 des
	HRA 55/14 C surf 40/60 des

18.10 Recipe and designed HRA surface course shall be compliant with BS EN 13108-4 [Ref 10.N].

18.11 The recipe and designed HRA surface course shall meet the following performance characteristics: grading and binder content for HRA mixtures from PD 6691 [Ref 24.N].

18.12 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the recipe and designed HRA surface course.

Installation requirements for recipe and designed HRA surface course

18.13 Recipe and designed HRA surface course shall be installed by organisations registered to and operating in compliance with a quality

management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 23.N].

18.14 Prior to placing recipe and designed HRA surface course on any new or existing bound substrate, a bond coat shall be applied in accordance with BS 594987 [Ref 3.N], unless otherwise stated in CC 202/WSR/018.

18.15 Recipe and designed HRA surface course shall be transported, laid and compacted in accordance with BS 594987 [Ref 3.N], unless otherwise stated in CC 202/WSR/018.

18.16 The initial surface macrotexture depth of chipped recipe and designed HRA surface course before opening to traffic shall be in accordance with Table 18.16, unless otherwise stated in CC 202/WSR/018.

Table 18.16 Initial surface macrotexture depth of chipped recipe and designed HRA surface course

Location type	Mean per 1,000 m section (mm)		Mean for a set of 10 measurements (mm)
	Minimum	Maximum	Minimum
High speed roads Posted speed limit ≥ 50 miles/hour (80 km/hr)	1.5	2.0	1.2
Lower speed roads Posted speed limit ≤ 40 miles/hour (65 km/hr)	1.2	1.7	1.0
Roundabouts on high speed roads Posted speed limit ≥ 50 miles/hour (80 km/hr)	1.2	1.7	1.0
Roundabouts on lower speed roads Posted speed limit ≤ 40 miles/hour (65 km/hr)	1.0	1.5	0.9

18.17 Verification shall be undertaken for the initial surface macrotexture depth of chipped recipe and designed HRA surface course by measurement in accordance with BS EN 13036-1 [Ref 36.N].

18.18 The frequency of the initial surface macrotexture depth of chipped recipe and designed HRA surface course shall be 10 individual measurements at 5 m spacing along a diagonal line across the lane width with one set per 250 m of carriageway lane.

18.19 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the initial surface macrotexture depth of chipped recipe and designed HRA surface course.

19. Recipe asphalt concrete surface, binder, and base courses

General requirements for recipe asphalt concrete surface, binder and base courses

19.1 Recipe asphalt concrete surface, binder and base courses shall be as specified in CC 202/WSR/019.

Recipe asphalt concrete surface, binder and base courses		
Pavement course material reference	**Installation requirements**	**Surface level requirements**
(a)	(b)	(c)

a) Enter a unique reference, from options as defined in Pavement course materials of WSR 202/001, to define the corresponding reference for the material.

b) Enter text, to define the installation requirements for the mixture, where different from those in BS 594987 [Ref 3.N].

c) Enter text, to define the surface level requirements for the mixture relative to the design level.

Constituent requirements for recipe asphalt concrete surface, binder and base courses

19.2 Constituents for recipe asphalt concrete shall be in accordance with "Constituents for bituminous mixtures" in Section 7 of this document.

Product requirements for recipe asphalt concrete surface, binder and base courses

19.3 The mixture designation for recipe asphalt concrete shall be one of the following as detailed in table 19.3.

Table 19.3 Mixture designations for the recipe asphalt concrete	
Pavement course	Mixture designation
Surface course (recipe mixtures)	AC 10 close surf 100/150 AC 10 close surf 70/100 AC 14 close surf 100/150 AC 14 close surf 70/100
Binder course (recipe mixtures)	AC 20 dense bin 40/60 rec
Base (recipe mixtures)	AC 32 dense base 40/60

	rec AC 32 dense base 100/150 rec

19.4 Recipe asphalt concrete shall be compliant with BS EN 13108-1 [Ref 8.N].

19.5 The recipe asphalt concrete shall meet the following performance characteristics: grading and binder content for asphalt concrete mixtures from PD 6691 [Ref 24.N].

19.6 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the recipe asphalt concrete.

Installation requirements for recipe asphalt concrete surface, binder and base courses

19.7 Recipe asphalt concrete surface, binder and base courses shall be installed by organisations registered to and operating in compliance with a quality management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 23.N].

19.8 Prior to placing recipe asphalt concrete surface, binder and base courses on any new or existing bound substrate, a bond coat shall be applied in accordance with BS 594987 [Ref 3.N], unless otherwise stated in CC 202/WSR/019.

19.9 Recipe asphalt concrete surface, binder and base courses shall be transported, laid and compacted in accordance with BS 594987 [Ref 3.N], unless otherwise stated in CC 202/WSR/019.

20. Bituminous mixtures overlaying waterproofing on concrete bridge decks

General requirements for bituminous mixtures overlaying waterproofing on concrete bridge decks

20.1 Bituminous mixtures overlaying waterproofing on concrete bridge decks shall be as specified in CC 202/WSR/020.

Bituminous mixtures overlaying waterproofing on concrete bridge decks	
Pavement course material reference	**Installation requirements**
(a)	(b)

a) Enter a unique reference, from options as defined in Pavement course materials of WSR 202/001, to define the corresponding reference for the material.

b) Enter text, to define the installation requirements for the mixture.

Product requirements and documentation for bituminous mixtures overlaying waterproofing on concrete bridge decks

20.2 Bituminous mixtures directly overlaying the waterproofing on concrete bridge decks shall comply with the waterproofing system manufacturer's method statement.

20.3 Bituminous mixtures overlaying waterproofing on concrete bridge decks shall meet the minimum adhesion and bond strengths for waterproofing systems as detailed in "Waterproofing for concrete decks of highway structures" in Section 2 of CC 488 [Ref 41.N].

20.4 The following Documentation shall be submitted for the waterproofing system assessed in combination with the specified bituminous mixture prior to the commencement of installation: Product Acceptance Scheme certification.

20.5 The requirements for "Documentation" in Section 2 of GC 101 [Ref 23.N] shall apply to the waterproofing system assessed in combination with the specified bituminous mixture.

Installation requirements for bituminous mixtures overlaying waterproofing on concrete bridge decks

20.6 Vibratory rollers shall not be used in vibratory mode on concrete bridge decks.

20.7 The waterproofing system shall be free from any contamination, damage, and defects as outlined in the Product Acceptance Scheme certification at the point of the overlay.

20.8 The installation of bituminous mixtures directly overlaying the waterproofing system shall be installed in accordance with the waterproofing system manufacturer's method statement and BS 594987 [Ref 3.N].

20.9 The temperature of the bituminous mixtures directly overlaying the waterproofing system during installation and compaction shall remain above the minimum activation temperature for the tack or bond coat system as detailed in "Waterproofing for concrete decks of highway structures" in Section 2 of CC 488 [Ref 41.N].

NI/21. Stone mastic asphalt surface course

Constituent requirements for stone mastic asphalt (SMA) surface course

NI/21.1 The coarse and fine aggregates for SMA surface course shall be compliant with BS EN 13043 [Ref 2.N].

NI/21.2 The coarse and fine aggregates for SMA surface course shall meet the performance characteristics as stated in table NI/21.2.

Table NI/21.2 Requirements for coarse and fine aggregates for the SMA surface course

Properties	**Requirement**
Crushed or broken particles in coarse and fine aggregate	$C_{100/0}$
Resistance to fragmentation of coarse aggregates	LA_{30}
Magnesium sulfate soundness of coarse aggregates	MS_{25}
Water absorption	$WA_{24}2$
Flakiness index	FI_{20}
Fines content for coarse aggregate	f_2
Fines content for fine aggregate	f_{22}
Fines quality	MB_F10

NI/21.3 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the coarse and fine aggregates for SMA surface course.

NI/21.4 SMA surface course shall not contain reclaimed asphalt.

NI/21.5 The added filler used in SMA surface course shall be limestone filler, hydrated lime or cement.

NI/21.6 The limestone filler or hydrated lime used as added filler in SMA surface course shall be in accordance with "Constituents for bituminous mixtures" in Section 7 of this document.

NI/21.7 The cement used as added filler in SMA surface course shall be compliant with BS EN 197-1 [Ref 18.N].

NI/21.8 The cement used as added filler in SMA surface course shall meet the following performance characteristics: requirements as detailed in BS EN 197-1 [Ref 18.N].

NI/21.9 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the cement used as added filler in SMA surface course.

NI/21.10 Cellulose fibres shall be added at a rate of not less than 0.3% by weight of the total mixture of the SMA surface course.

Requirements for polymer modified bitumen for the SMA surface course

NI/21.11 The polymer modified bitumen used in SMA surface course shall be compliant with BS EN 14023 [Ref 5.N].

NI/21.12 The polymer modified bitumen used in SMA surface course shall meet the performance characteristics as stated in table NI/21.12.

Table NI/21.12 Requirements for the polymer modified bitumen used in the SMA surface course

Properties	Unit	Classes for polymer modified bitumen	
		Site specific application	General application
Penetration at 25°C	0.1 mm	75-130 (Class 7)	40-100 (Class 5)
Softening point	°C	≥ 75 (Class 3)	≥ 65 (Class 5)
Cohesion by force ductility	J/cm^2	≥ 2 at 5 °C (Class 3)	≥ 3 at 10 °C (Class 7)
Resistance to hardening Retained penetration Increase in softening point	 % °C	 ≥ 50 (Class 5) ≤ 8 (Class 2)	 ≥ 50 (Class 5) ≤ 8 (Class 2)
Fraas breaking point	°C	≤ -15 (Class 7)	≤ -7 (Class 4)
Elastic recovery at 25°C	%	≥ 80 (Class 2)	≥ 50 (Class 5)
Plasticity range	°C	≥ 85 (Class 2)	≥ 70 (Class 5)
Storage stability Difference in softening point Difference in penetration	 °C 0.1 mm	 ≤ 5 (Class 2) ≤ 9 (Class 2)	 ≤ 5 (Class 2) ≤ 9 (Class 2)

NI/21.13 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the polymer modified bitumen used in SMA surface course.

Product requirements for SMA surface course

NI/21.14 The mixture designation for SMA surface course shall be one of the following as detailed in table NI/21.14.

Table NI/21.14 Mixture designation for SMA surface course

Warm mix asphalt	Hot mix asphalt
SMA 10 surf PMB W	SMA 10 surf PMB

NI/21.15 The maximum temperature of warm mix SMA surface course measured in accordance with BS EN 12697-13 [Ref 16.N] shall be as detailed in table NI/21.15.

Table NI/21.15 Maximum temperature for warm mix asphalt used in the SMA surface course	
Binder grade	Maximum temperature (°C)
Polymer modified bitumen conforming to BS EN 14023 [Ref 5.N]	Documented and declared by the producer

NI/21.16 SMA surface course shall be compliant with BS EN 13108-5 [Ref 12.N] following PD 6691 [Ref 24.N].

NI/21.17 The SMA surface course shall meet the following performance characteristics: $B_{min6.4}$, V_{max5}, $V_{min1.5}$, $PRD_{AIR6.0}$ at 60 °C, $WTS_{AIR0.6}$ at 60 °C and $ITSR_{90}$.

NI/21.18 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 23.N] shall apply to the SMA surface course.

Type Approval Installation Trial (TAIT) requirements and verification for SMA surface course

NI/21.19 SMA surface course shall undergo a Type Approval Installation Trial (TAIT) in accordance with the manufacturer's installation method statement.

NI/21.20 The TAIT for the SMA surface course shall be 50 m to 100 m in length.

NI/21.21 The TAIT for the SMA surface course shall be 3.0 m to 4.5 m in width.

NI/21.22 The SMA surface course in the TAIT shall have a minimum compacted thickness of 40 mm.

NI/21.23 Prior to opening to traffic and for 2 years, the mean surface macrotexture depth of the SMA surface course in the TAIT shall be 0.8 mm to 1.4 mm.

NI/21.24 Verification shall be undertaken for the surface macrotexture depth of the SMA surface course in the TAIT by measurement in accordance with BS EN 13036-1 [Ref 36.N] with a set of 10 individual measurements at 5 m spacing along a diagonal line across the TAIT.

NI/21.25 The frequency of the measurement of the surface macrotexture depth of the SMA surface course in the TAIT shall be one set before opening to traffic and 24 months after opening to traffic.

NI/21.26 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the surface macrotexture depth of the SMA surface course in the TAIT.

NI/21.27 On completion of compaction of the SMA surface course in the TAIT, the mean in situ air void content shall be not more than 6%.

NI/21.28 Verification shall be undertaken for the in situ air void content of the SMA surface course in the TAIT by testing core pairs taken from the centre of the mat in accordance with BS 594987 [Ref 3.N].

NI/21.29 The frequency of in situ air void content testing shall be one set per TAIT.

NI/21.30 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the in situ air void content of the SMA surface course in the TAIT.

NI/21.31 Where the TAIT for the SMA surface course has an unsupported edge, on completion of compaction, the mean in situ air void content at the unsupported edge shall be not more than 7%.

NI/21.32 Verification shall be undertaken for the in situ air void content of the SMA surface course by testing core pairs, centred 100 mm from the final joint position at unsupported edges in accordance with BS 594987 [Ref 3.N].

NI/21.33 The frequency of in situ air void content testing shall be one set per TAIT.

NI/21.34 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the in situ air void content at unsupported edges of the SMA surface course in the TAIT.

NI/21.35 The resistance to deformation of the SMA surface course in the TAIT shall be $PRD_{AIR6.0}$ at 60 °C and $WTS_{AIR0.6}$ at 60 °C.

NI/21.36 Verification shall be undertaken for the resistance to deformation of the SMA surface course by testing six cores taken from the TAIT in accordance with BS EN 12697-22 [Ref 13.N].

NI/21.37 The frequency of testing of the resistance to deformation of the SMA surface course in the TAIT shall be one set per TAIT.

NI/21.38 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the resistance to deformation of the SMA surface course in the TAIT.

Product documentation for the SMA surface course

NI/21.39 The following Documentation shall be submitted for the SMA surface course prior to the commencement of the installation of the SMA surface course: SMA surface course TAIT results.

NI/21.40 The requirements for "Documentation" in Section 2 of GC 101 [Ref 23.N] shall apply to the SMA surface course TAIT test results.

Installation requirements and verification for the SMA surface course

NI/21.41 SMA surface course shall be installed by organisations registered to and operating in compliance with a quality management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 23.N].

NI/21.42 Prior to placing SMA surface course on any new or existing bound substrate, a bond coat shall be applied in accordance with BS 594987 [Ref 3.N].

NI/21.43 Verification shall be undertaken for the rate of spread of bond coat by testing in accordance with BS 594987 [Ref 3.N].

NI/21.44 The frequency of the rate of spread of bond coat testing shall be once per week.

NI/21.45 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the testing of the rate of spread of bond coat.

NI/21.46 SMA surface course shall be transported, laid and compacted in accordance with BS 594987 [Ref 3.N].

NI/21.47 The minimum temperature immediately prior to the compaction of the warm mix SMA surface course, when measured in accordance with BS EN 12697-13 [Ref 16.N] shall be as detailed in table NI/21.47.

Table NI/21.47 Minimum rolling temperatures of warm mix SMA surface course

Binder grade	Minimum temperature (°C)
Polymer modified bitumen conforming to BS EN 14023 [Ref 5.N]	Documented and declared by the producer

NI/21.48 Joints in SMA surface course shall comply with "Formation of joints in bituminous layers" in Section 5 of this document.

NI/21.49 On completion of compaction of the SMA surface course, the mean of six consecutive in situ air void content measurements in the wheel tracks shall be not more than 6%, where wheel tracks are 600 mm wide with the inside edges offset from the centre of the lane by 720 mm.

NI/21.50 Verification shall be undertaken for the in situ air void content of the SMA surface course by measurement with a correlated indirect density gauge, in accordance with BS 594987 [Ref 3.N].

NI/21.51 The frequency of in situ air void content measurement shall be 1 per 20 m in alternate wheel tracks.

NI/21.52 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the in situ air void content of the SMA surface course.

NI/21.53 On completion of compaction of the SMA surface course, the mean of six consecutive in situ air void content measurements at unsupported edges shall be not more than 7%.

NI/21.54 Verification shall be undertaken for the in situ air void content of the SMA surface course by testing using the indirect density gauge, centred 200 mm from the final joint position at unsupported edges in accordance with BS 594987 [Ref 3.N].

NI/21.55 The frequency of in situ air void content measurements shall be 1 per 20 m.

NI/21.56 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement at unsupported edges of the in situ air void content of the SMA surface course.

NI/21.57 The surface macrotexture depth of the installed SMA surface course prior to trafficking shall be 0.8 mm to 1.4 mm.

NI/21.58 Verification shall be undertaken for the surface macrotexture depth measurements of the installed SMA surface course in accordance with BS EN 13036-1 [Ref 36.N].

NI/21.59 The frequency of measurement for the surface macrotexture depth shall be a mean of 10 individual measurements at 5 m spacing along a diagonal line across the lane width with one set per 250 m of carriageway lane.

NI/21.60 The requirements for "Verification" in Section 14 of GC 101 [Ref 23.N] shall apply to the measurement of the surface macrotexture depth of the installed SMA surface course.

NI/21.61 Installed SMA surface course shall comply with the Surface levels requirements and verification of flexible pavement courses in "General requirements for flexible pavement construction" in Section 1 of this document.

NI/21.62 Prior to opening to traffic, the surface level of the SMA surface course shall comply with the Surface regularity requirements and verification of surface courses in "General requirements for flexible pavement construction" in Section 1 of this document.

Overall performance requirements: guarantee period for the SMA surface course

NI/21.63 For a period of 5 years after opening to traffic, the SMA surface course shall be TRACS Condition Category 1 or 2 as defined in CS 230 [Ref 33.N].

NI/21.64 The guarantee of the installed SMA surface course shall exclude defects arising from accidental damage or damage caused by settlement, subsidence or failure of the underlying carriageway on which the SMA surface course was installed.

NI/22. Testing of bituminous mixtures

NI/22.1 No nationally determined requirements.

23. Normative references

The following documents, in whole or in part, are normative references for this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Ref.	Document
Ref 1.N	BSI. BS EN ISO 11819-1, 'Acoustics. Measurement of the influence of road surfaces on traffic noise. Statistical pass-by method'
Ref 2.N	BSI. BS EN 13043, 'Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas (Designated Standard - CPR)'
Ref 3.N	BSI. BS 594987, 'Asphalt for roads and other paved areas. Specification for transport, laying, compaction and product type testing protocols'
Ref 4.N	BSI. BS EN 13808, 'Bitumen and bituminous binders. Framework for specifying cationic bituminous emulsions (Designated Standard - CPR)'
Ref 5.N	BSI. BS EN 14023, 'Bitumen and bituminous binders. Specification framework for polymer modified (Designated Standard - CPR)'
Ref 6.N	BSI. BS EN 13924-1, 'Bitumen and bituminous binders. Specification framework for special paving grade bitumen. Hard paving grade bitumens'
Ref 7.N	BSI. BS EN 12591, 'Bitumen and bituminous binders. Specifications for paving grade bitumens. (Designated Standard - CPR)'
Ref 8.N	BSI. BS EN 13108-1, 'Bituminous mixtures – Material specifications. Asphaltic concrete. (Designated Standard - CPR)'
Ref 9.N	BSI. BS EN 13108-2, 'Bituminous mixtures. Material specifications. Asphalt Concrete for Very Thin Layers (Designated Standard - CPR)'
Ref 10.N	BSI. BS EN 13108-4, 'Bituminous mixtures. Material specifications. Hot Rolled Asphalt (Designated Standard - CPR)'
Ref 11.N	BSI. BS EN 13108-8, 'Bituminous mixtures. Material specifications. Reclaimed asphalt'
Ref 12.N	BSI. BS EN 13108-5, 'Bituminous mixtures. Material

	specifications. Stone Mastic Asphalt. (Designated Standard - CPR)'
Ref 13.N	BSI. BS EN 12697-22, 'Bituminous mixtures. Test methods for hot mix asphalt. Wheel tracking'
Ref 14.N	BSI. BS EN 12697-48, 'Bituminous mixtures. Test methods. Interlayer Bonding '
Ref 15.N	BSI. BS EN 12697-26, 'Bituminous mixtures. Test methods. Stiffness.'
Ref 16.N	BSI. BS EN 12697-13, 'Bituminous mixtures. Test methods. Temperature measurement'
Ref 17.N	BSI. BS EN 459-1, 'Building lime - Definitions, specifications and conformity criteria [Designated standard - CPR]'
Ref 18.N	BSI. BS EN 197-1, 'Cement. Composition, specifications and conformity criteria for common cements. (Designated Standard - CPR)'
Ref 19.N	BSI. BS EN 197-5, 'Cement. Portland-composite cement CEM II/C-M and Composite cement CEM VI'
Ref 20.N	National Highways. CS 229, 'Data for pavement assessment'
Ref 21.N	Transport Research Laboratory. TRL 674, 'Durability of thin surfacing system. Final report after nine years monitoring.'
Ref 22.N	National Highways. GD 301 (GSR), 'GD 301 Smart Motorways Generic Safety Report'
Ref 23.N	National Highways. GC 101 'General requirements for the Specification for Highway Works'
Ref 24.N	BSI. PD 6691, 'Guidance on the use of BS EN 13108, Bituminous mixtures. Material specifications'
Ref 25.N	BSI. BS 1924-2, 'Hydraulically bound and stabilized materials for civil engineering purposes. Sample preparation and testing of materials during and after treatment '
Ref 26.N	BSI. BS 1924-1, 'Hydraulically bound and stabilized materials for civil engineering purposes. Sampling, sample preparation and testing of materials before treatment'
Ref 27.N	BSI. BS 9227, 'Hydraulically bound materials for civil engineering purposes. Specification for production and installation in pavements'
Ref 28.N	BSI. BS EN 14227-4, 'Hydraulically bound mixtures. Specifications. Fly ash for hydraulically bound mixtures '

Ref 29.N	BSI. BS EN 14227-2, 'Hydraulically bound mixtures. Specifications. Slag bound mixtures'
Ref 30.N	National Highways. CC 206 'Maintenance of concrete pavement layers'
Ref 31.N	BSI. BS 8420, 'Methods of measuring irregularities on surfaces of roads, footways and other paved areas using straightedges and wedges'
Ref 32.N	National Highways. CC 201 'Pavement foundation construction'
Ref 33.N	National Highways. CS 230, 'Pavement maintenance assessment procedure'
Ref 34.N	BSI. BS 9228, 'Recycling of roads and other paved areas using bitumen emulsion, foamed bitumen or hydraulic material. Materials, production, installation and product type testing. Specification. Specification for materials, production, installation and product type testing'
Ref 35.N	BSI. BS EN 13036-4, 'Road and airfield surface characteristics. Test methods - Method for measurement of slip/skid resistance of a surface: The pendulum test'
Ref 36.N	BSI. BS EN 13036-1, 'Road and airfield surface characteristics. Test methods. Measurement of pavement surface macrotexture depth using a volumetric patch technique'
Ref 37.N	Association Française de Normalisation. AFNOR S31-119, 'Select Acoustics. In-situ characterization of the acoustic qualities of road surfaces. Pass by acoustic measurement.'
Ref 38.N	BSI. BS EN 933-11, 'Tests for geometrical properties of aggregates. Classification test for the constituents of coarse recycled aggregate'
Ref 39.N	BSI. BS EN 933-1, 'Tests for geometrical properties of aggregates. Determination of particle size distribution. Sieving method'
Ref 40.N	BSI. BS EN 14227-11, 'Unbound and hydraulically bound mixtures. Specifications. Soil treated by lime'
Ref 41.N	National Highways. CC 488 'Waterproofing for concrete structures [Series 2000]'
Ref 42.N	Waste and Resources Action Programme. WRAP Quality Protocol, 'WRAP Quality Protocol: Aggregates from inert waste. End of waste criteria for the production and use of aggregates from inert waste'