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Transport Infrastructure Ireland

# TII Publications



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## Road Pavements – Bituminous Materials

**CC-SPW-00900**  
October 2023

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**Updates to TII Publications resulting in changes to  
Road Pavements – Bituminous Materials CC-SPW-**

**Date:** October 2019

**Page No:**

**Section No:**

**Amendment Details:**

Subclause 10.1.8 Joints, page 48:

- a) (ii) Bitumen emulsion with a cohesion of 1.4 J/cm<sup>2</sup> or above in accordance with IS EN 13808.

Changed to:

- b) (ii) Bitumen emulsion with a cohesion of 1.0 J/cm<sup>2</sup> or above in accordance with IS EN 13808.

Note 2 added to Table 1, page 75:

- a) <sup>2</sup> Not applicable for footways. For Accommodation Works, PSV<sub>55</sub> declared and AAV<sub>16</sub> declared may be used.

Note 3 to Table 3, page 78, has been changed from:

- a) <sup>3</sup> Restricted conditions apply, refer to DN-PAV-03023.  
to  
b) <sup>3</sup> Restricted conditions apply, refer to DN-PAV-03023. Not applicable for Accommodation Works or footways.

Note 5 added to Mixture Designation Column 2 and 4 (Type C HRAs) in Table 5, page 80:

- a) <sup>5</sup> Attention is drawn to the limited experience with Type C fine aggregate designed mixtures. Problems may occur with obtaining durable material with low permeability because the harshness of this type of mixture makes compaction more difficult.

Table 13b, page 88:

- a) Temperature changed from 60°C to 45°C.

Table 19, page 95:

- a) Test method temperature for Resistance to Permanent Deformation and Resistance to Permanent Deformation HRA changed from 60°C to 45°C.  
b) Note 5 added to Sample Preparation for Resistance to Permanent Deformation and Resistance to Permanent Deformation HRA:  
<sup>5</sup> Guidance on test specimen thickness for resistance to permanent deformation is given in EN 12697-22.

Table 20, page 96:

- a) Test method temperature for Resistance to Permanent Deformation and Resistance to Permanent Deformation HRA changed from 60°C to 45°C.

- b) Note 2 added to Sample Preparation for Resistance to Permanent Deformation HRA:

<sup>2</sup> Specimen thickness for resistance to permanent deformation shall be that at which the mixture was laid on the road, less material trimmed as part of sample preparation. HRA cores with pre-coated chippings can be trimmed to achieve a flat and chippings-free surface or alternatively, turned and tested on the underside.

**Date:** July 2022

**Page No:**

**Section No:**

**Amendment Details:**

Clause 1.7:

- a) Addition or amendment to definitions and abbreviations relevant to binder content (“Additive”, “B”, “B<sub>min</sub>”, “B<sub>vol</sub>” and “Optimum binder content”).
- b) Addition or amendment to definitions and abbreviations relevant to Warm Mix Asphalt (“Additive” and “Warm Mix Asphalt – WMA”).

Clauses 3.1, 4.1, 5.1 and 6.1:

- a) Permission to use or not use Warm Mix Asphalt additives in each bituminous mixture type.
- b) Addition of the letter “W” to the mixture designation for mixtures produced with a Warm Mix Asphalt additive.

Clauses 3.2.5, 4.2.6, 5.2.5 and 6.2.5:

- a) Permission to use or not use Warm Mix Asphalt additives in each bituminous mixture type.
- b) Addition of Warm Mix Asphalt additives to the non-exhaustive list of additives when permitted.
- c) Additional requirement applicable to additives to ensure reusability and recyclability of bituminous mixtures at their end of life.

Clauses 3.3.3, 4.3.3, 5.3.3 and 6.3.3:

Additional requirement for the reporting of the binder content.

Clause 10.1.7:

Last sentence of the clause amended to: “This **shall could** be demonstrated utilising the cores that are being extracted for void analysis.”.

Clauses 10.1.9, 10.1.9.1, 10.1.9.2 and 10.1.9.3

Amended to allow for the use of the density gauge as an alternative to the extraction of cores in the control of compaction, from an air void content perspective.

Clauses 10.1.10.1, 10.1.10.2 and 10.1.10.3

Amended to allow for the use of the density gauge as an alternative to the extraction of cores in the control of compaction, from a resistance to permanent deformation perspective.

Table 2, Table 5, Table 8 and Table 11:

- a) Amendment of the specifications relative to the binder content.
- b) Amendment of the specifications relative to the resistance to permanent deformation (AC, HRA and SMA only).
- c) Note on the maximum temperature of mixtures produced with a Warm Mix Asphalt additive when permitted.

Table 3, Table 6 and Table 9:

- a) Amendment of the specifications relative to air void content (HRA and SMA only).
- b) Amendment of the specifications relative to the resistance to permanent deformation.
- c) Amendment of the specifications relative to the water sensitivity.
- d) Specifications on stiffness removed (AC only).
- e) Note on the minimum delivery and rolling temperatures of mixtures produced with a Warm Mix Asphalt additive when permitted.

Table 19:

Note 2 amended.

**Date:** October 2023

**Page No:**

**Section No:**

**Amendment Details:**

Clause 1.7 Environmental Product Declaration

- a) Requirement for an Environmental Product Declaration for all bituminous mixtures.

Clause 1.8 Definitions

- a) Inclusion of definitions for Reclaimed Asphalt Feedstock, Reclaimed Asphalt and Reclaimed Asphalt Pavement (RAP) (Site-won-asphalt), RA Stockpile, Provisional Type Approval Installation Trial (prTAIT) and Virgin Binder.

Clause 2.1 Cold Milling of Bituminous Bound Flexible Pavement

- a) Requirement to comply with EPA regulations around the milling and management of milled bituminous bound pavement layers.

- b) Requirement to record milled bituminous mixture designation and originating pavement layer.

#### Clause 3 Asphalt Concrete Products

- a) Bituminous mixture Type Test requirements where Reclaimed Asphalt is a constituent of the mixture.

#### Clause 3.2.1 Binder

- a) Reference to the methodology for the determination of the mixture binder penetration when Reclaimed Asphalt is a constituent of the mixture.

#### Clause 3.2.4 Reclaimed Asphalt

- a) Updated references to Reclaimed Asphalt requirement tables.
- b) Updated references bituminous mixture Reclaimed Asphalt content ranges and related requirements.

#### Clause 3.2.5 Additives

- a) Include “rejuvenating agents” as an allowable additive.

#### Clause 3.3.3 Binder Content

- a) Requirement for minimum Virgin Binder content within a bituminous mixture.

#### Clause 5.2.4 Reclaimed Asphalt

- a) Requirement that Reclaimed Asphalt use is not permitted in Stone Mastic Asphalt surface course mixtures.

#### Clause 8.7 Surface Course Preservation Systems

- a) A new clause permitting the use of Surface Course Preservation Systems and their requirements.

#### Clause 9 Reclaimed Asphalt:

- a) Inclusion of polymer modified bitumen as an allowable constituent of Reclaimed Asphalt.
- b) Updated references to Reclaimed Asphalt requirement tables.
- c) Guidance and requirements on the storage and management of Reclaimed Asphalt Pavement and Reclaimed Asphalt.
- d) Updated requirements related to bituminous mixture design where Reclaimed Asphalt is a constituent.
- e) Updates to allow for RA contents of up to 70% by mass of the bituminous mixture.
- f) Updated requirements for bituminous mixture Type Test reports where Reclaimed Asphalt is a constituent.

#### Clause 10.1.10.1 Performance Requirements Specific to Asphalt Concrete Base and Binder Course Mixtures

- a) Reference to additional bituminous mixture requirements when Reclaimed Asphalt is a constituent of the mixture.

Table 1 Asphalt Concrete – Requirements for Constituent Materials

- a) Reclaimed Asphalt Maximum Allowable content updated to 70%.

Table 2 Asphalt Concrete – Product Composition and Properties

- a) Inclusion of Warm-mix maximum temperatures.
- b) Note 6 reference to guidance on plant heating and cold starting of the manufacturing process.

Table 3 Asphalt Concrete – Requirements of the Works

- a) Inclusion of Warm-mix minimum temperatures.
- b) Note 2 updated to specify coring of the constructed pavement layer.

Table 6 Hot Rolled Asphalt – Requirements of the Works

- a) Note 1 updated to specify coring of the constructed pavement layer.

Table 8 Stone Mastic Asphalt – Product Composition and Properties

- a) Inclusion of Warm-mix maximum temperatures.
- b) Note 4 reference to guidance on plant heating and cold starting of the manufacturing process.

Table 9 Stone Mastic Asphalt – Requirements of the Works

- a) Inclusion of Warm-mix minimum temperatures.
- b) Note 1 updated to specify coring of the constructed pavement layer.

Table 12 Porous Asphalt – Requirements of the Works

- a) Note 1 updated to specify coring of the constructed pavement layer.

Table 13a Assessment of the Reclaimed Asphalt Feedstock

- a) Reclaimed Asphalt bituminous mixture content ranges updated.
- b) Additional requirements for Maximum size of RA particles and Cohesion test
- c) Updated test frequency

Table 13b Requirements of the Reclaimed Asphalt Feedstock

- a) Updated tests and test result requirements for Reclaimed Asphalt Feedstock.
- b) Bituminous mixture Reclaimed Asphalt content ranges updated.

Table 13c Mixture Design Evaluation when Reclaimed Asphalt is a Constituent

- a) Updated tests and test frequencies for the Works where Reclaimed Asphalt is a constituent of the bituminous mixture laid.
- b) Bituminous mixture Reclaimed Asphalt content ranges updated.

Table 13d Additional Works Requirements when Reclaimed Asphalt is a Constituent

- a) Updated tests and test result requirements for bituminous mixture design evaluation where Reclaimed Asphalt is a constituent.
- b) Bituminous mixture Reclaimed Asphalt content ranges updated.



Table 13e Reclaimed Asphalt – Requirements for Recalculation of Mixture Design

- c) Updated specification to refer to mean binder content and mean penetration value.
- d) Bituminous mixture Reclaimed Asphalt content ranges updated.

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# 1. General Requirements and Definitions

## 1.1 General

This Series gives general requirements for the properties of the aggregates and bitumen used in plant-produced bituminous mixtures and of the required minimum properties and procedures for surface treatments and ancillary road construction products and processes.

The design of road pavements – incorporating such bituminous mixtures, surface treatments and ancillary processes – shall use DN-PAV-03074 Design of Bituminous Mixtures, Surface Treatments, and Miscellaneous Products and Processes for reference during the design process.

## 1.2 Construction Products Regulation

For general details regarding the Construction Products Regulation, refer to Specification for Works Series 000 (CC-SPW-00010). With regard to bituminous materials, Transport Infrastructure Ireland has prepared this Specification so as to comply with the CPR in respect of road construction products for use on National Roads in Ireland.

## 1.3 Harmonised Technical Specifications

### 1.3.1 Harmonised European Standards (hEN)

Harmonised European Standards provide assessment methods and performance requirements for construction products. The specific product requirements listed in this Specification are derived from the following hENs where applicable:

- i. IS EN 13108-1 Bituminous Mixtures - Material Specifications Asphalt Concrete
- ii. IS EN 13108-4 Bituminous Mixtures - Material Specifications - Hot Rolled Asphalt
- iii. IS EN 13108-5 Bituminous Mixtures - Material Specifications - Stone Mastic Asphalt
- iv. IS EN 13108-6 Bituminous Mixtures - Material Specifications - Mastic Asphalt
- v. IS EN 13108-7 Bituminous Mixtures - Material Specifications - Porous Asphalt
- vi. IS EN 13108-8 Bituminous Mixtures - Material Specifications - Reclaimed Asphalt
- vii. IS EN 13108-20 Bituminous Mixtures - Material Specifications - Type Testing
- viii. IS EN 13108-21 Bituminous Mixtures - Material Specifications - Factory Production Control
- ix. IS EN 12591 Bitumen and bituminous binders - Specifications for paving grade bitumens
- x. IS EN 14023 Bitumen and bituminous binders - Specification framework for polymer modified bitumens
- xi. IS EN 13808 Bitumen and bituminous binders - Framework for specifying cationic bituminous emulsions
- xii. IS EN 13043 Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas
- xiii. IS EN 12271 Surface dressing - Requirements
- xiv. IS EN 12273 Slurry Surfacing - Requirements

- xv. IS EN 14188-1 Joint fillers and sealants - Part 1: Specifications for hot applied sealants
- xvi. IS EN 15381 Geotextiles and geotextile-related products - Characteristics required for use in pavements and asphalt overlays

Note: Where hENs refer to Construction Product Directive 8106/EEC the provisions of Construction Product Regulation (EU) No. 305/2011 prevail over any conflicting provisions of the hENs. To assist in understanding the different terminology that exists between the Directive and the Regulation, CC-SPW-00010 contains the equivalent terms.

## 1.4 Assessment and Verification of Constancy of Performance (AVCP)

Further to the detail provided in CC-SPW-00010 Section 6, the two AVCP systems relevant to this document are:

- i. 2+ where the manufacturer and the notified body have responsibilities.
- ii. 4 where the manufacturer has sole responsibility.

The system in place for a particular product is given in Annex ZA.2 of the respective hEN; the systems applicable for this Series are as follows:

- i. System 2+ shall apply to all bituminous mixtures, bituminous binders, aggregate with a declared PSV of 50+, microsurfacing, surface dressing and geotextiles.
- ii. System 4 shall apply to aggregate with a declared PSV of less than 50 and all other constituents unless otherwise specified in Annex ZA.2 of the respective hEN.

## 1.5 Quality Assurance and Control

### Bituminous Mixtures

Demonstration of the conformity of the production of bituminous mixtures shall be as described in:

- i. IS EN 13108-20 Type Testing; and
- ii. IS EN 13108-21 Factory Production Control

For each product to be incorporated into the Works, the DoP, CE Mark, and Type Test reports shall be supplied to the Employer's Representative for review prior to commencement of the Works. During production of bituminous mixtures for incorporation into the Works, the operating compliance reports required under Factory Production Control (FPC) shall be submitted at weekly intervals to the Employer's Representative. The minimum Operating Compliance Level (OCL) for the frequency of analysis of finished product shall be Level X as set out in IS EN 13108-21 Table A.3.

### Surface Dressing and Microsurfacing

Demonstration of the conformity of the surface dressing and microsurfacing shall be as described in the appropriate Annex of IS EN 12271 for surface dressing and IS EN 12273 for microsurfacing.

Annex A and B of the hENs detail the FPC requirements including minimum inspection / test frequencies.

Annex C of the hENs detail the Type Approval Installation Trial (TAIT) requirements including performance characteristics measured over a defined period. This is generally one year.

For each product to be incorporated into the Works, the TAIT report, DoP and CE Mark shall be supplied to the Employer’s Representative for review prior to commencement of the Works.

## 1.6 Products not covered by a Harmonised Technical Specification

Other products and processes contained in this series that are not covered by a harmonised technical specification shall undergo an assessment and approval process. This process is very similar to the hEN format as the product is expected to fulfil a similar level of FPC and achieve certain performance characteristics. Details of the process can be found in DN-PAV-03074 and DN-PAV-03075.

Each product or process shall have defined FPC requirements and shall undergo a Provisional Type Approval Installation Trial (prTAIT) over a specified period. This sits outside of European Standards but will be used by Transport Infrastructure Ireland for monitoring and approval purposes. Details are contained in the appropriate Clause of this Series.

In all cases, the product or process shall be manufactured to a quality management system in accordance with IS EN 9001 or equivalent.

## 1.7 Environmental Product Declaration

All bituminous mixtures specified in this document are required to have an Environmental Product Declaration (EPD). The EPD shall be developed according to TII Publication DN-PAV-03077 Complementary Product Category Rules for Bituminous Mixtures (c-PCR Bituminous Mixtures).

## 1.8 Definitions, Symbols and Abbreviations

AC	<p>General designation for Asphalt Concrete. Asphalt Concrete is a continuously graded or gap-graded bituminous mixture in which the aggregates form an interlocking structure.</p> <p>The designation of AC is followed by an indication of <i>D</i>, the upper sieve size of the aggregate in the mixture, in millimetres (mm) and the binder designation. EXAMPLE AC 20 70/100 - Asphalt Concrete with a maximum aggregate size of 20 mm and a 70/100 paving grade binder.</p>
Additive	<p>Constituent material that can be added in small quantities to influence specific properties of the mixture such as:</p> <ul style="list-style-type: none"> <li>(i) Additives to produce Warm Mix Asphalt mixtures,</li> <li>(ii) Additives to improve the fuel resistance of bituminous mixtures,</li> <li>(iii) Additives to alter the colour of bituminous mixtures,</li> <li>(iv) Additives to improve the affinity between aggregate and bitumen,</li> <li>(v) Additives to improve the mechanical properties of bituminous mixtures (e.g. fibres, polymers, nano materials),</li> <li>(vi) Additives to rejuvenate the aged bitumen from Reclaimed Asphalt.</li> </ul>
'B'	<p>Input binder content: Expression of the binder content by mass added to the mixture at manufacturing stage:</p> <ul style="list-style-type: none"> <li>(i) paving grade bitumen,</li> <li>(ii) polymer modified bitumen, and</li> <li>(iii) active binder content from Reclaimed Asphalt.</li> </ul>

	<p>And Output binder content: Expression of the binder content by mass to be found on analysis as determined in accordance with I.S. EN 12697-1 or I.S. EN 12697-39:</p> <ul style="list-style-type: none"> <li>(i) paving grade bitumen,</li> <li>(ii) polymer modified bitumen,</li> <li>(iii) binder content from Reclaimed Asphalt,</li> <li>(iv) some soluble additives (when using I.S. EN 12697-1), and</li> <li>(v) some additives (when using I.S. EN 12697-39).</li> </ul> <p>Expressed in percentage by mass of the total mixture to the nearest 0,1%. Factory Production Control tolerances are applied to the binder content appropriate to the mixture's design.</p>
'B <sub>min</sub> '	<p><b>Minimum binder content</b> by mass required for a specific bituminous mixture, where the binder content is corrected for a mixture in which the aggregate density is assumed to be equal to 2,650 Mg/m<sup>3</sup>. This is the binder content declared on the CE Mark, Declaration of Performance and Type Test Report. 'B<sub>min</sub>' is declared to the nearest 0,2%.</p>
'B <sub>vol</sub> '	<p><b>Minimum binder volume</b> required for a specific bituminous mixture. When using the binder volume for mix validation at Type Testing stage, the equivalent binder content by mass shall be declared in the mix formulation for the purposes of evaluation of conformity during Factory Production Control.</p>
Base	<p>Main structural element of a pavement. The base may be laid in one or more courses, described as "upper" base, "lower" base.</p>
Binder course	<p>Part of the pavement between the surface course and the base.</p>
Bond Coat	<p>A polymer modified bituminous binder used to promote adhesion between layers. A bond coat may be in the form of a bituminous emulsions or a hot applied binder.</p>
Course	<p>Structural element of a pavement constructed with a single material. A course may be laid in one or more layers.</p>
Contractor	<p>Installer of the Works.</p>
Design Working Life	<p>The period for which a product/system is to be used for its intended purpose without repair being necessary.</p>
Employer	<p>As defined in the Public Works Contract.</p>
Employer's Representative	<p>As defined in the Public Works Contract.</p>
Reclaimed Asphalt Feedstock	<p>A quantity of Reclaimed Asphalt (RA) with classified properties, suitable and ready to be used as constituent material for the manufacturing of bituminous mixtures and for which a data sheet exists.</p>
HRA	<p>General designation for Hot Rolled Asphalt. Hot Rolled Asphalt is a dense, gap graded bituminous mixture in which the mortar of fine aggregate, filler and binder are major contributors to the performance of the laid material.</p> <p>The designation of HRA is followed by an indication of the coarse aggregate content, in percent, an indication of <i>D</i>, the upper sieve size of the aggregate in the mixture, in millimetres (mm), the fine aggregate type and binder designation.</p> <p>EXAMPLE HRA 30/14 F 40/60 - Hot Rolled Asphalt containing 30% coarse aggregate with a maximum aggregate size of 14mm, a Type F Fine aggregate and a 40/60 paving grade binder.</p>
Layer	<p>Element of a pavement laid in a single operation</p>

Low-Energy Bound Mixture (LEBM)	Subbase, base and binder courses produced in a fixed, mobile or in situ mixing plant from cold graded aggregate processed from quarried sources and /or arisings from the excavation of roads, blended if necessary with other aggregate and bound with low energy binders such as hydraulic, foamed bitumen or bitumen emulsion.
Manufacturer	Entity that makes the specified product or system
Microsurfacing	A surface treatment consisting of a mixture of aggregates, bituminous emulsion, water and additives, which is mixed and laid in-place. Microsurfacing products may consist of one or more layers.
Minimum thickness	The thickness that the layer may be at a given point to cater for allowable tolerances in the installation. Under no circumstances shall it be taken as a thickness that the layer may be reduced to for installation purposes.
Nominal thickness	The thickness of the compacted layer as specified in the contract documents. It is the thickness that the layer shall be measured against in terms of compliance with the Specification.
Optimum binder content	Only applicable to HRA - Expression of the binder content determined in accordance with Annex G of S.R. 28:2018, to I.S. EN 13108-4. In some instances, the optimum binder content will need to be increased to satisfy the minimum requirement on 'B'.
Porous Asphalt (PA)	<p>General designation for Porous Asphalt. Porous Asphalt is gap graded so as to have a very high content of interconnecting voids that allow the passage of water and air in order to provide the compacted mixture with drainage and noise reducing characteristics. It is exclusively used as a surface course material.</p> <p>The designation of PA is followed by an indication of <i>D</i>, the upper sieve size of the aggregate in the mixture, in millimetres (mm) and binder designation. EXAMPLE PA 14 PMB 65/105-70 – A Porous Asphalt with a maximum aggregate size of 14mm and a 65/105-70 Polymer Modified Binder.</p>
Pavement	Structure, composed of one or more courses, to assist the passage of traffic over terrain.
Producer	Defined as either 'Manufacturer' or 'Contractor' as appropriate.
Purchaser	As per definition for 'Employer'.
Reclaimed Asphalt (RA)	The processed Reclaimed Asphalt Pavement (site-won asphalt), suitable and ready to be used as constituent material for asphalt, after being tested, assessed and classified according to this standard.
Reclaimed Asphalt Pavement (RAP) (Site-won-asphalt)	The material to be recycled, in the form of milled asphalt road layers or as slabs ripped up from asphalt pavements, or being asphalt from reject, surplus or failing production. These materials will require assessment and often processing before being suitable as a constituent material.
Reclaimed Filler	Filler that has been extracted from the production operation when manufacturing bituminous mixtures. It is typically drawn off to a silo on the manufacturing plant before being proportionally weighed back into the production process.
Recipe Surface Dressing	The application of binder and chippings where the Purchaser (Employer) takes responsibility for the design and instructs the Producer (Contractor) how to install the Surface Dressing Works is termed Recipe Surface Dressing (RSD).
Regulating course	Course of variable thickness applied to an existing course or surface to provide the necessary profile for a further course of consistent thickness
Residual binder	The amount of binder left after evaporation of the water content of the bitumen emulsion.



Stone Mastic Asphalt (SMA)	General designation for Stone Mastic Asphalt. Stone Mastic Asphalt is a gap-graded asphalt mixture with bitumen as a binder, composed of a coarse crushed aggregate skeleton bound with a mastic mortar. The designation of SMA is followed by an indication of <i>D</i> , the upper sieve size of the aggregate in the mixture, in millimetres (mm) and the binder designation. EXAMPLE SMA 10 PMB 65/105-60 – A Stone Mastic Asphalt with a maximum aggregate size of 10mm and a 65/105-60 Polymer Modified Binder.
Reclaimed Asphalt Stockpile	A quantity of RA stored and the properties of the RA have not been determined.
Surface course	Upper course of the pavement, which is in contact with the traffic.
Surface Dressing Product	An end performance installed Product complying with IS EN 12271. Surface Dressing Product with CE marking enables performance requirements and control procedures for the installation of surface dressing as a product to be specified. The performance and procedures are demonstrated through Type Approval Installation Trials (TAIT) for particular site categories.
Tack Coat	A conventional bitumen emulsion used for adhesion between layers. A Tack Coat may only be used in small or inaccessible areas where a bond coat application is not achievable.
Provisional Type Approval Installation Trial (prTAIT)	A prTAIT demonstrates that the characteristics of a product comply with the declared characteristics. The prTAIT consists of a section where the product has been installed using Factory Production Control (FPC) and which has been subjected to in service performance over a period of one year. After this period, detailed information is recorded to clearly identify the product, its performance and the intended uses.
Virgin Binder	Fresh binder that is added to a bituminous mixture that is not from the Reclaimed Asphalt content of a mixture.
Warm Mix Asphalt - WMA	WMA are produced at lower temperatures, typically 20-40°C lower, compared to equivalent Hot Mix Asphalts (HMA) but always above 100°C. WMA can either be produced using chemical additives or organic additives.

*Symbols and abbreviations not covered above shall be as per the applicable European Standard*

## **2. Preparatory Work**

### **2.1 Cold Milling of Bituminous Bound Flexible Pavement**

The milling and management of milled bituminous bound pavement layers shall be carried out according to the requirements defined by Article 27 (by product) and Article 28 (end of waste) as defined in European Union (Waste Management) Regulations, 2011 - 2020 (transposing EU law).

When cold milling of bituminous bound flexible pavement is required, it shall be as specified in Appendix 7/9. The process shall be carried out so as not to produce excessive quantities of fumes, smoke or dust. Dust shall be minimised by damping with water from spray bars fitted to cold milling machines and road sweepers.

The transverse profile of the milled surface shall be uniform for the lane width. For any variation greater than 10mm, when measured transversely by a 3 metre straight edge, adjustments shall be made before work continues. Any discontinuity between adjacent milling passes exceeding 10mm, when measured transversely by a 3 metre straight edge, shall be rectified by further milling or regulating in accordance with Clause 2.2 of this Series before placing bituminous materials.

The cut edges shall be left neat, vertical and in straight lines. In addition, where the edge forms a permanent joint at surface course level, they shall be saw cut for the depth of the layer. The Contractor shall brush and sweep the cut edges and surface by mechanical means to produce a clean surface.

Carriageways shall be milled to the tolerance for surface levels specified in Clause 702 for binder course. If the tolerances in this Clause are exceeded, the full extent of the non-compliant area shall be rectified by further milling or by regulating in accordance with Clause 2.2 of this Series.

Existing ironwork shall not be disturbed by the milling action. Where necessary, surfacing in the vicinity of ironwork and in other small or irregular areas shall be removed with the use of pneumatic tools or other suitable methods.

Where milling is carried out on a carriageway open to traffic, temporary ramping and traffic management measures to ensure the safe passage of vehicles shall be provided.

Where milling is required over extensive areas, the Contractor shall programme the work to allow removal of full lane widths as far as practicable. The Contractor shall notify his proposals for milling to the Employer's Representative within the works proposals.

Immediately after milling, surplus material including all dust and loose debris shall be removed by a machine of suitable and efficient design and the milled surface swept and cleaned by mechanical means to produce a clean and regular running surface.

Where a milled bituminous material layer shall be used to produce Reclaimed Asphalt, the milled bituminous mixture designation and originating pavement layer shall be recorded in the destination Reclaimed Asphalt stockpile data sheet referred to in Section 9.3.

### **2.2 Regulating**

Regulating shall consist of one or more layers of bituminous material with their finished surfaces laid to achieve the requisite nominal thickness and surface regularity for pavement layers in accordance with Table 16 and CC-SPW-00700.

Each layer of regulating course shall be installed with the use of a bond coat in accordance with Clause 10.1.4. The bond coat is an integral part of the regulating layer.

### 3. Asphalt Concrete Products

Asphalt Concrete mixtures shall comply with this Specification which is derived from IS EN 13108-1. Assessment and Verification of Constancy of Performance shall be carried out to System 2+ in accordance with IS EN 13108-1. The DoP, CE Mark, Type Testing and FPC information detailed under CC-SPW-00010 and Clause 1 of this Series shall be provided.

Type testing shall be in accordance with EN13108-20. Where Reclaimed Asphalt is a constituent of bituminous mixture the amount of reclaimed asphalt, and the mix group(s) from which the reclaimed asphalt has been or will be derived shall be stated on the Type Test report. Supporting Reclaimed Asphalt feedstock information as detailed in Clause 9.3 shall be appended to the Type Test report.

#### 3.1 Mixture Designations

The mixture designations available are:

3.1.1	AC	32	dense	base	40/60	des
3.1.2	AC	32	dense	base	70/100	des
3.1.3	AC	32	HDM	base	40/60	des
3.1.4	AC	20	dense	bin	40/60	des
3.1.5	AC	20	dense	bin	70/100	des
3.1.6	AC	20	HDM	bin	40/60	des
3.1.7	AC	14	close	surf	70/100	des
3.1.8	AC	14	close	surf	160/220	des
3.1.9	AC	10	close	surf	70/100	des
3.1.10	AC	10	close	surf	160/220	des
3.1.11	AC	14	open	surf	70/100	des
3.1.12	AC	14	open	surf	160/220	des
3.1.13	AC	10	open	surf	70/100	des
3.1.14	AC	10	open	surf	160/220	des
3.1.15	AC	6	dense	surf	70/100	des
3.1.16	AC	6	dense	surf	160/220	des

For mixtures produced with a WMA additive, the letter “W” shall be added to the mixture designation after the binder designation. Example: “AC 32 dense base 40/60 W des”.

Each mixture shall comply with the requirements regarding constituents, composition and installation into the Works as laid out in this Series. It is the responsibility of the Designer to ensure the particular mix chosen is suitable for the site location and the applicable design criteria required shall be recorded in Appendix 7/1.

#### 3.2 Constituent Materials

##### 3.2.1 Binder

The binder shall be petroleum bitumen in accordance with Table 14. The binder grade shall be in accordance with the requirements of Table 2 unless otherwise specified in Appendix 7/1.

Where Reclaimed Asphalt constitutes greater than 20% by mass of the mixture, the penetration grade of the RA and Virgin Binder combined within the mixture shall be determined according to procedure detailed in Clause 9. The combined mixture binder grade shall be in accordance with the requirements of Table 2 unless otherwise specified in Appendix 7/1.

### **3.2.2 Aggregates**

#### **Aggregates - General**

All aggregates shall be in accordance with the requirements of Table 1 and shall comply with the requirements of this Specification.

#### **Coarse Aggregates for Surface Courses**

Aggregates for use in surface courses are the point of contact between the vehicle tyre and road surface, accordingly they shall be of a single rock type and source. In addition, they shall comply with the PSV and AAV requirements stated in Appendix 7/1.

In addition, friction after polishing testing shall be carried out in accordance with IS EN 12697-49. All testing, shall be in accordance with Appendix 1/5.

### **3.2.3 Filler**

Filler shall comply with the requirements of Table 1.

### **3.2.4 Reclaimed Asphalt**

Reclaimed Asphalt shall be assessed and classified according to IS EN 13108-8, Table 13a, Table 13b and Clause 9.

Where Reclaimed Asphalt is a constituent of the asphalt concrete mixture, the additional requirements of Clause 9 and Table 13c, Table 13d and Table 13e shall also be adhered to.

#### **Permitted use**

The use of Reclaimed Asphalt shall not be allowed in the production of any surface courses.

Where Reclaimed Asphalt constitutes less than or equal to 20% by mass of the mixture there are no additional requirements for the mixture over and above the requirements of a mixture without RA as detailed in Table 1 and Table 2.

Where Reclaimed Asphalt constitutes greater than 20% and less than or equal to 50% by mass of the mixture, the additional requirements for the mixture detailed in Table 13c shall be adhered to. These requirements are over and above the requirements of Table 1 and Table 2.

Where Reclaimed Asphalt constitutes greater than 50% and less than or equal to 70% by mass of the mixture, the additional requirements for the mixture detailed in Table 13c shall be adhered to. These requirements are over and above the requirements of Table 1 and Table 2.

### **3.2.5 Additives**

Additives for Asphalt Concrete mixtures may include for example: fibres, pigments, adhesion agents, rejuvenating agents and WMA additives. The suitability of such additives shall be demonstrated in accordance with IS EN 13108-1.

The use of the additives in any bituminous mixture shall not prevent the reusability or recyclability of the bituminous mixture at its end of life.

## **3.3 Product Composition**

### **3.3.1 General**

The requirements under this Clause relate to the composition of the product and shall be detailed in the Type Testing documentation accompanying the DoP and CE Mark. Separate and additional requirements for the placement of products in the Works are contained in Clause 10 of this Series.

Grading specifications are presented as grading envelopes in Table 2 within which the manufacturer's declared target grading must fall. The manufacturer's declared target grading in combination with the tolerances from IS EN 13108-21 result in the overall grading envelope of the product to be supplied.

Where Reclaimed Asphalt constitutes greater than 20% of the product, the additional design process requirements of Clause 9.4, and Tables 13b and 13c shall also be carried out.

### **3.3.2 Compositional Grading**

The grading of the target composition shall fall within the grading envelope given in Table 2.

### **3.3.3 Binder Content**

The minimum binder content is given in Table 2.

Where Reclaimed Asphalt is a constituent of the mixture, Virgin Binder shall not be less than 30% of the total binder content. The determination of the quantity of Virgin Binder to be added to a mixture, with Reclaimed Asphalt as a constituent, shall take consideration of the Reclaimed Asphalt content by mass in the mixture and the resulting mixture binder penetration grade as determined by the procedures detailed in Clause 9.

The binder content shall be expressed in percentage by mass of the total mixture. The binder content shall be expressed to the nearest 0,1 % for FPC purposes.

### **3.3.4 Void Content**

The void content at design shall be reported as  $V_{max}$  and  $V_{min}$  categories as defined in Table 2.

### **3.3.5 Water Sensitivity**

Water Sensitivity provides an indication of mixture durability using the ratio of the indirect tensile strength of wet (water conditioned) specimens to that of dry specimens, expressed as a percentage. Products shall comply with the requirements of Table 2.

### **3.3.6 Stiffness**

The stiffness of base and binder course design mixtures shall be in accordance with the requirements of Table 2.

### **3.3.7 Temperature**

The maximum temperature is given in Table 2. Maximum temperature applies at any place in the plant and is declared on the CE Mark for the product.

### **3.3.8 Resistance to Permanent Deformation**

For base and binder course design mixtures, the resistance to permanent deformation shall comply with the requirements of Table 2.

## 4. Hot Rolled Asphalt Products

Hot Rolled Asphalt mixtures shall comply with this Specification which is derived from IS EN 13108-4. Assessment and Verification of Constancy of Performance shall be carried out to System 2+ in accordance with IS EN 13108-4. The DoP, CE Marking, Type Testing and FPC information detailed under CC-SPW-00010 and Clause 1 of this Series shall be provided.

### 4.1 Mixture Designations

The mixture designations available are:

4.1.1	HRA 30/14 F	surf	40/60	des
4.1.2	HRA 35/14 F	surf	40/60	des
4.1.3	HRA 30/14 C	surf	40/60	des
4.1.4	HRA 35/14 C	surf	40/60	des
4.1.5	HRA 0/2 F	surf	40/60	des

The use of Warm Mix Asphalt additives is not permitted in Hot Rolled Asphalt products.

Each mixture shall comply with the requirements regarding constituents, composition and installation into the Works as laid out in this Series. It is the responsibility of the Designer to ensure the particular mix chosen is suitable for the site location and the applicable design criteria required shall be recorded in Appendix 7/1.

### 4.2 Constituent Materials

#### 4.2.1 Binder

The binder shall be petroleum bitumen in accordance with Table 14. The binder grade shall be in accordance with the requirements of Table 5 unless otherwise specified in Appendix 7/1.

#### 4.2.2 Aggregates

##### Aggregates - General

All aggregates shall be in accordance with the requirements of Table 4 and shall comply with the requirements of this Specification.

#### 4.2.3 Filler

Filler shall comply with the requirements of Table 4. Reclaimed filler shall not be used for surface courses.

#### 4.2.4 Coated Chippings

The chippings and the manner of coating, when used for rolling into the surface of rolled asphalt, shall be in accordance with IS EN 13108-4 Annex C, this Clause, Table 4 and Table 5.

The chippings shall comply with the PSV and AAV requirements stated in Appendix 7/1. In addition, friction after polishing testing shall be carried out in accordance with IS EN 12697-49. All testing shall be in accordance with Appendix 1/5.

When tested using the Hot Sand test for the adhesivity of binder on precoated chippings for HRA in accordance with IS EN 12697-37, the proportion of retained sand shall not be less than 4,0% for  $D \geq 16\text{mm}$  and 5,0% for  $D < 16\text{mm}$ . Not more than 7,5% of the chippings shall fail the visual assessment.

#### **4.2.5 Reclaimed Asphalt**

Reclaimed Asphalt is not permitted for use in Hot Rolled Asphalt surface course mixtures.

#### **4.2.6 Additives**

Additives for Hot Rolled Asphalt surface course design mixtures may include for example: fibres, pigments and adhesion agents. The suitability of such additives shall be demonstrated in accordance with IS EN 13108-4.

The use of Warm Mix Asphalt additives is not permitted in Hot Rolled Asphalt products.

The use of the additives in any bituminous mixture shall not prevent the reusability or recyclability of the bituminous mixture at its end of life.

### **4.3 Product Composition**

#### **4.3.1 General**

The requirements under this Clause relate to the composition of the product and shall be detailed in the Type Testing documentation accompanying the DoP and CE Mark. Separate and additional requirements for the placement of products in the Works are contained in Clause 10.

Grading specifications are presented as grading envelopes in Table 5 within which the manufacturer's declared target grading must fall. The manufacturer's declared target grading in combination with the tolerances from IS EN 13108-21 result in the overall grading envelope of the product to be supplied.

#### **4.3.2 Compositional Grading**

The grading of the target composition shall fall within the grading envelope given in Table 5.

The compliance grading of precoated chippings shall fall within the grading envelope given in Table 5.

#### **4.3.3 Binder Content**

The optimum binder content for HRA shall be determined through a design procedure, in accordance with Annex G of S.R. 28:2018. The requirement on the minimum value of binder content 'B' is given in Table 5. Where the optimum binder content is less than that given in Table 5, then the value given in Table 5 shall be used.

For surface course design mixtures, the minimum binder volume shall be determined in accordance with IS EN 13108-4 and comply with Table 5.

The binder content shall be expressed in percentage by mass of the total mixture. The binder content shall be expressed to the nearest 0,1 % for FPC purposes.

#### **4.3.4 Void Content**

For surface course design mixtures, the void content at target composition shall be in accordance with Table 5.

#### **4.3.5 Water Sensitivity**

Water Sensitivity provides an indication of mixture durability using the ratio of the indirect tensile strength of wet (water conditioned) specimens to that of dry specimens, expressed as a percentage. It shall comply with the requirements of Table 5.

#### **4.3.6 Deformation Resistance**

For surface course design mixtures, the resistance to permanent deformation shall comply with the requirements of Table 5.

#### **4.3.7 Temperature**

The maximum temperature is given in Table 5. Maximum temperature applies at any place in the plant and is declared on the CE Mark for the product.



## 5. Stone Mastic Asphalt Products

Stone Mastic Asphalt mixtures shall comply with this Specification which is derived from IS EN 13108-5. Assessment and Verification of Constancy of Performance shall be carried out to System 2+ in accordance with IS EN 13108-5. The DoP, CE Marking, Type Testing and FPC information detailed under CC-SPW-00010 and Clause 1 of this Series shall be provided.

### 5.1 Mixture Designations

The mixture designations available are:

5.1.1	SMA	10	surf	PMB 65/105-60	des
5.1.2	SMA	10	surf	40/60	des
5.1.3	SMA	14	surf	PMB 65/105-60	des
5.1.4	SMA	14	surf	40/60	des
5.1.5	SMA	6	bin	40/60	des
5.1.6	SMA	6	bin	70/100	des
5.1.7	SMA	6	bin	PMB 65/105-60	des
5.1.8	SMA	10	bin	40/60	des
5.1.9	SMA	10	bin	70/100	des
5.1.10	SMA	10	bin	PMB 65/105-60	des
5.1.11	SMA	14	bin	40/60	des
5.1.12	SMA	14	bin	70/100	des
5.1.13	SMA	14	bin	PMB 65/105-60	des

NOTE: Mixture designations 5.1.2 and 5.1.4 above are not permitted on roads carrying greater than 100 commercial vehicles per lane per day.

For mixtures produced with a WMA additive, the letter “W” shall be added to the mixture designation after the binder designation. Example: “SMA 10 surf 40/60 W des”.

Each mixture shall comply with the requirements regarding constituents, composition and installation into the Works as laid out in this Series. It is the responsibility of the Designer to ensure the particular mix chosen is suitable for the site location and the applicable design criteria required shall be recorded in Appendix 7/1.

### 5.2 Constituent Materials

#### 5.2.1 Binder

The binder shall be petroleum bitumen in accordance with Table 14. The binder grade shall be in accordance with the requirements of Table 8 unless otherwise specified in Appendix 7/1.

#### 5.2.2 Aggregates

##### Aggregates - General

All aggregates shall be in accordance with the requirements of Table 7 and shall comply with the requirements of this Specification.

##### Coarse Aggregates for Surface Courses

Aggregates for use in surface courses are the point of contact between the vehicle tyre and road surface, accordingly they shall be of a single rock type and source. In addition, they shall comply with the PSV and AAV requirements stated in Appendix 7/1.

In addition, friction after polishing testing shall be carried out in accordance with IS EN 12697-49. All testing shall be in accordance with Appendix 1/5.

### **5.2.3 Filler**

Filler shall comply with the requirements of Table 7. Reclaimed filler shall not be used for surface courses.

### **5.2.4 Reclaimed Asphalt**

Reclaimed Asphalt is not permitted for use in SMA surface course mixtures.

### **5.2.5 Additives**

Additives for Stone Mastic Asphalt mixtures may include for example: fibres, pigments, adhesion agents and WMA additives. The suitability of such additives shall be demonstrated in accordance with IS EN 13108-5.

The use of the additives in any bituminous mixture shall not prevent the reusability or recyclability of the bituminous mixture at its end of life.

## **5.3 Product Composition**

### **5.3.1 General**

The requirements under this Clause relate to the composition of the product and shall be detailed in the Type Testing documentation accompanying the DoP and CE Mark. Separate and additional requirements for the placement of products in the Works are contained in Clause 10.

Grading specifications are presented as grading envelopes in Table 8 within which the manufacturer's declared target grading must fall. The manufacturer's declared target grading in combination with the tolerances from IS EN 13108-21 result in the overall grading envelope of the product to be supplied.

### **5.3.2 Compositional Grading**

The grading of the target composition shall fall within the grading envelope given in Table 8.

### **5.3.3 Binder Content**

The minimum binder content is given in Table 8.

The binder content shall be expressed in percentage by mass of the total mixture. The binder content shall be expressed to the nearest 0,1 % for FPC purposes.

### **5.3.4 Void Content**

Void content shall be reported as Vmax and Vmin categories in accordance with Table 8.

### **5.3.5 Water Sensitivity**

Water Sensitivity provides an indication of mixture durability using the ratio of the indirect tensile strength of wet (water conditioned) specimens to that of dry specimens, expressed as a percentage. It shall comply with the requirements of Table 8.

### **5.3.6 Resistance to Permanent Deformation**

The resistance to permanent deformation shall comply with the requirements of Table 8.

### **5.3.7 Binder Drainage**

Binder Drainage shall comply with the requirements of Table 8. Where necessary stabilising additives (fibres) shall be added to surface course mixtures in order to comply with the binder drainage requirements.

Notwithstanding the binder drainage requirements, stabilising additives (fibres) shall be included when the mixture contains paving grade bitumen in accordance with Table 8.

### **5.3.8 Temperature**

The maximum temperature is given in Table 8. Maximum temperature applies at any place in the plant and is declared on the CE Mark for the product.

## 6. Porous Asphalt Products

Porous Asphalt mixtures shall comply with this Specification which is derived from IS EN 13108-7. Assessment and Verification of Constancy of Performance shall be carried out to System 2+ in accordance with IS EN 13108-7. The DoP, CE Marking, Type Testing and FPC information detailed under CC-SPW-00010 and Clause 1 of this Series shall be provided.

### 6.1 Mixture Designations

The mixture designation available is:

#### 6.1.1 PA 14 surf PMB 65/105-70 des

The use of Warm Mix Asphalt additives is not permitted in Porous Asphalt products.

Each mixture shall comply with the requirements regarding constituents, composition and installation into the Works as laid out in this Series. It is the responsibility of the Designer to ensure the particular mix chosen is suitable for the site location and the applicable design criteria required shall be recorded in Appendix 7/1.

### 6.2 Constituent Materials

#### 6.2.1 Binder

The binder shall be polymer modified bitumen in accordance with Table 14. The binder grade shall be in accordance with the requirements of Table 11 unless otherwise specified in Appendix 7/1.

#### 6.2.2 Aggregates

##### Aggregates - General

All aggregates shall be in accordance with the requirements of Table 10 and shall comply with the requirements of this Specification.

##### Coarse Aggregates for Surface Courses

Aggregates for use in surface courses are the point of contact between the vehicle tyre and road surface, accordingly they shall be of a single rock type and source. In addition, they shall comply with the PSV and AAV requirements stated in Appendix 7/1. In addition, friction after polishing testing shall be carried out in accordance with IS EN 12697-49. All testing, shall be in accordance with Appendix 1/5.

#### 6.2.3 Filler

Filler shall comply with the requirements of Table 10, of which at least 2% by mass of the total aggregate shall be hydrated lime filler. Reclaimed filler shall not be used.

#### 6.2.4 Reclaimed Asphalt

Reclaimed Asphalt is not permitted for use in Porous Asphalt mixtures.

#### 6.2.5 Additives

Additives for Porous Asphalt mixtures may include for example: fibres, pigments and adhesion agents. The suitability of such additives shall be demonstrated in accordance with IS EN 13108-7.

The use of Warm Mix Asphalt additives is not permitted in Porous Asphalt products.

The use of the additives in any bituminous mixture shall not prevent the reusability or recyclability of the bituminous mixture at its end of life.

## **6.3 Product Composition**

### **6.3.1 General**

The requirements under this Clause relate to the composition of the product and shall be detailed in the Type Testing documentation accompanying the DoP and CE Mark. Separate and additional requirements for the placement of products in the Works are contained in Clause 10.

Grading specifications are presented as grading envelopes in Table 11 within which the manufacturer's declared target grading must fall. The manufacturer's declared target grading in combination with the tolerances from IS EN 13108-21 result in the overall grading envelope of the product to be supplied.

### **6.3.2 Compositional Grading**

The grading of the target composition shall fall within the grading envelope given in Table 11.

The grading curve of the aggregates shall be broadly parallel to the limits of the envelope and shall not vary from the low limit on one size of sieve to the high limit on the adjacent sieve or vice-versa. The composition shall have due consideration for the hydraulic conductivity requirements of the Works given in Table 12.

### **6.3.3 Binder Content**

The binder content shall be established from binder drainage in accordance with Table 19 and Figure 6.3.3.a. The minimum binder content is given in Table 11.

The binder content shall be expressed in percentage by mass of the total mixture. The binder content shall be expressed to the nearest 0,1 % for FPC purposes.

### **6.3.4 Void Content**

Void content shall be reported as Vmax and Vmin categories in accordance with Table 11.

### **6.3.5 Water Sensitivity**

Water Sensitivity provides an indication of mixture durability using the ratio of the indirect tensile strength of wet (water conditioned) specimens to that of dry specimens, expressed as a percentage. It shall comply with the requirements of Table 11.

### **6.3.6 Particle Loss (Cantabro Wear Test)**

Particle Loss shall comply with the requirements of Table 11.

### **6.3.7 Binder Drainage**

Binder Drainage shall comply with the requirements of Table 11 and where necessary stabilising additives (fibres) shall be added in order to comply with the requirements of Table 11.

### **6.3.8 Temperature**

The maximum temperature is given in Table 11. Maximum temperature applies at any place in the plant and is declared on the CE Mark for the product.

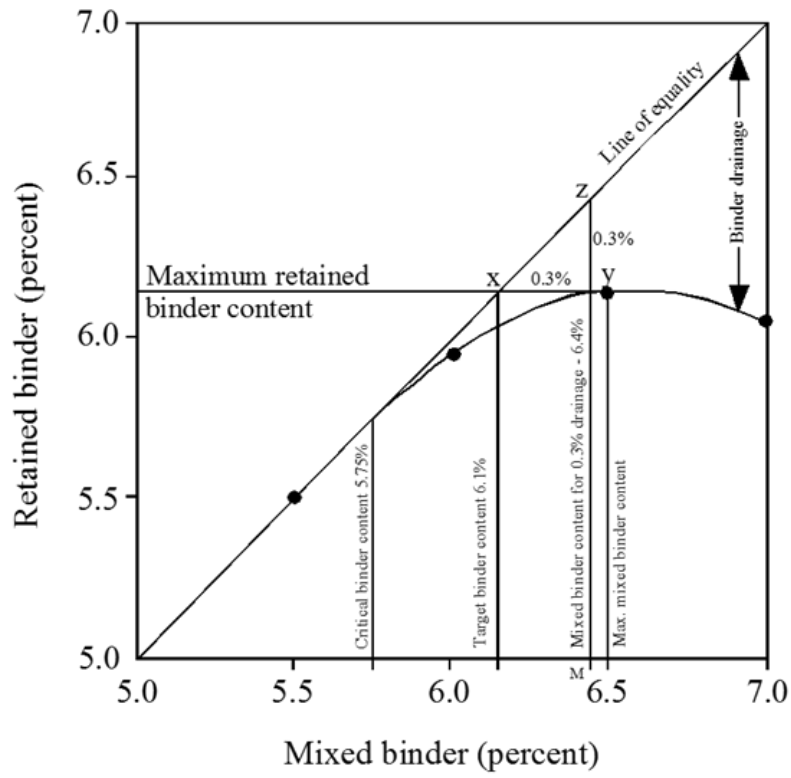


Figure 6.3.3.a

## 7. Surface Treatments

### 7.1 Microsurfacing

Microsurfacing shall comply with this Specification which is derived from IS EN 12273. The title of IS EN 12273 is Slurry Surfacing, however when made with larger aggregate sizes they are often referred to as Microsurfacing. This Clause only refers to microsurfacing products.

The requirements under this Clause relate to constituents and composition. Separate and additional requirements for installation in the Works are contained in Clause 10.2.2.

The Producer shall be responsible for the microsurfacing product which shall be CE marked in accordance with IS EN 12273. The Producer shall provide the Employer's Representative with a Design Proposal for each product to be incorporated into the Works at least 10 days prior to the Works being undertaken detailing:

- i. How the microsurfacing will achieve the performance requirements in terms of macrotexture and maximum levels of defects for the intended use as set out in this Clause and contained in Appendix 7/10 and ensuring that the microsurfacing has an initial stability such that it is capable of withstanding the normal traffic for the site when first opened.
- ii. The approved TAIT documentation to include the period for which the performance characteristics have been retained.
- iii. The proposed method of executing the work, which shall also be subject to the approval of Transport Infrastructure Ireland.
- iv. That the microsurfacing will be carried out in accordance with IS EN 12273 and the requirements of Appendix 7/10.

The performance of the design, materials and workmanship shall be maintained for a minimum period of five years, or the period specified in Appendix 7/10, from the date of completion of the Works. This period shall be known as the 'Design Working Life'.

#### 7.1.1 Constituent Materials

##### 7.1.1.1 Binder

The binder shall be polymer modified cationic bituminous emulsion.

##### 7.1.1.2 Aggregates

The PSV and AAV of the chippings shall be as specified in Appendix 7/10.

##### 7.1.1.3 Additives

The Producer shall provide the Employer's Representative with details of the additives to be used. If the additive is to provide a colour, the defined colour, type and quantity required shall also be provided to the Employer's Representative.

#### 7.1.2 Product Composition

##### 7.1.2.1 Product Types

Unless otherwise specified in Appendix 7/10, the permitted type of microsurfacing shall be a two layer system or a one layer system with a machine integrated bond coat application.

The declared type shall include maximum aggregate size (D as defined in IS EN 13043) and binder type (for each layer)

### **7.1.2.2 Design Proposal**

In the Design Proposal the Producer shall state the aggregate characteristics and sources to be used and provide an example of the target grading curve, binder content and type, details of the proposed filler and fibres if used. The grading and binder content shall not differ from the proposed target values by more than the tolerances detailed in the Design Proposal.

### **7.1.2.3 Surface Preparation**

Where specified in Appendix 7/10, the substrate shall be prepared using a milling machine with a fine mill drum.

### **7.1.2.4 Application of Bond Coat**

A bond coat shall be applied prior to the microsurfacing as demonstrated in the TAIT.

## **7.1.3 Performance Requirements**

### **7.1.3.1 Defects Determined by Visual Inspection**

Each site where microsurfacing is installed shall be subject to assessment over the 'Design Working Life'. The Producer shall be responsible for maintaining the visual assessment performance requirements set out in Appendix 7/10 throughout the 'Design Working Life'.

The Producer shall be responsible for assessing the site and measuring the defects, by visual assessment, after one year of completion of the installation and at one year intervals thereafter for the five year 'Design Working Life' period, or period specified in Appendix 7/10. Permitted categories of defects shall be in accordance with the requirements of Appendix 7/10. The assessment shall be conducted in accordance with IS EN 12274-8.

The Purchaser shall monitor the performance levels of the microsurfacing during 'Design Working Life', and bring any defects to the attention of the Producer.

### **7.1.3.2 Macrotexture**

Each site where microsurfacing is installed shall be subject to assessment over the 'Design Working Life'. The Producer shall be responsible for maintaining the surface macrotexture performance requirements set out in Appendix 7/10 throughout the 'Design Working Life'. The Producer shall ensure that the microsurfacing has sufficient initial macrotexture depth to enable performance levels to be achieved.

The Producer shall be responsible for measuring the macrotexture after one year of completion of the installation and at one year intervals thereafter for the five year 'Design Working Life' period, or period specified in Appendix 7/10. Permitted categories of defects shall be in accordance with the requirements of Appendix 7/10.

The Purchaser shall monitor the performance levels of the microsurfacing during 'Design Working Life', and bring any defects to the attention of the Producer.

### **7.1.3.3 Surface Shear Strength**

Unless otherwise specified in Appendix 7/10, the performance of the product's bond to the substrate shall be carried out on the finished surface by conducting the surface shear strength test in accordance with prCEN/TS 12697-51. The test shall be carried out at the times specified in Appendix 7/10.



The test shall be carried out at two locations within the Works area, with at least one of these to be in the wheel track zone. The results achieved shall be recorded and notified to the Employer's Representative.

#### **7.1.4 Construction Products Regulation**

As detailed under Clause 1.4, the Assessment and Verification of Constancy of Performance (AVCP) for microsurfacing shall be System 2+ in accordance with IS EN 12273. The DoP, CE Mark, Type Approval Installation Trial and FPC information detailed under CC-SPW-00010 and Clause 1 of this Series shall be provided.

##### **7.1.4.1 Factory Production Control (FPC)**

A Notified Body shall certify the FPC system for the proposed microsurfacing product in accordance with IS EN 12273.

##### **7.1.4.2 Determination of Product Type - Type Approval Installation Trial (TAIT)**

The proposed microsurfacing shall have been subject to a Type Approval Installation Trial (TAIT) in accordance with IS EN 12273. The TAIT shall have been carried out on a site with similar characteristics and traffic category to that to be treated in the Contract. The TAIT shall have been installed in accordance with the Producer's certified Factory Production Control system.

##### **7.1.4.3 Declaration of Performance (DoP)**

The Producer shall provide the Employer's Representative with the DoP for the proposed microsurfacing.

The Producer shall continue to monitor the TAIT site and declare the period for which the performance characteristics have been retained.

##### **7.1.4.4 CE Marking**

The Producer shall provide the Employer's Representative with the CE Marking for the proposed microsurfacing.

## **7.2 Surface Dressing**

### **7.2.1 General**

Recipe Surface Dressing (RSD) shall be designed by the Employer in accordance with DN-PAV-03074 and comply with the requirements of Clause 7.2.2 and Appendix 7/21.

Surface Dressing Product (End Performance) shall be designed and installed by the Producer, shall be CE marked in accordance with IS EN 12271, and shall comply with the requirements of Clause 7.2.3 and Appendix 7/3.

### **7.2.2 Recipe Surface Dressing (RSD)**

Recipe Surface Dressing shall comply with this Specification, Table 17 and Table 18 and Appendix 7/21. The Producers of the individual constituent materials shall provide the Employer's Representative with details of the source and characteristics of all constituents to be used, including the DoP, CE Marking, Type Testing and FPC information detailed under CC-SPW-00010 and Clause 1 of this Series.

The requirements under this Clause relate to constituents and composition. Separate and additional requirements for installation in the Works are contained in Clause 10.2.3.1.

## **7.2.2.1 Constituent Materials**

### **7.2.2.1.1 Binder**

The binder shall be in accordance with columns 3, 4, 5 or 6 of Table 15 as required by the design, and shall be CE Marked in accordance with IS EN 13808.

Fluxed and cutback bitumen binders shall not be permitted.

### **7.2.2.1.2 Aggregates**

Unless otherwise specified in Appendix 7/21, all chippings shall be in accordance with the requirements of Table 17 and Table 18 and CE Marked in accordance with IS EN 13043. Chippings from different sources shall be kept separate and shall not be blended.

Chippings shall comply with the PSV and AAV requirements stated in Appendix 7/21. In addition, friction after polishing testing shall be carried out in accordance with IS EN 12697-49. All testing shall be in accordance with Appendix 1/5.

### **7.2.2.2 Composition RSD**

The Employer shall undertake a design in accordance with DN-PAV-03074 and this information including the product type shall be provided in Appendix 7/21.

Additional requirements for the accuracy of distribution of both binder and aggregates and the appropriate tolerances on rates of spread are contained under Clauses 10.2.3.1.3 and 10.2.3.1.4.

## **7.2.3 Surface Dressing Product (End Performance)**

Surface Dressing Product shall comply with this Specification which is derived from IS EN 12271.

The requirements under this Clause relate to constituents and composition. Separate and additional requirements for installation in the Works are contained in Clause 10.2.3.2.

The Producer shall be responsible for the surface dressing product which shall be CE Marked in accordance with IS EN 12271. The Producer shall provide the Employer's Representative with a Design Proposal for each product to be incorporated into the Works at least 10 days prior to the Works being undertaken detailing:

- i. How the surface dressing will achieve the performance requirements in terms of macrotexture and maximum levels of defects for the intended use as set out in this Clause and contained in Appendix 7/3 and ensuring that the surface dressing has an initial stability such that it is capable of withstanding the normal traffic for the site when first opened.
- ii. The approved TAIT documentation to include the period for which the performance characteristics have been retained.
- iii. Carry out the surface dressing in accordance with IS EN 12271 and the requirements specified in Appendix 7/3.

The performance of the design, materials and workmanship shall be maintained for a minimum period of five years, or the period specified in Appendix 7/3, from the date of completion of the Works. This period shall be known as the 'Design Working Life'.

### **7.2.3.1 Constituent Materials**

#### **7.2.3.1.1 Binder**

The binder shall be polymer modified cationic bituminous emulsion with a minimum peak cohesion as specified in Appendix 7/3.

#### **7.2.3.1.2 Aggregates**

The PSV and AAV of the chippings shall be as specified in Appendix 7/3.

### **7.2.3.2 Product Composition**

#### **7.2.3.2.1 Product Types**

The system(s) of surface dressing permitted shall be as specified in Appendix 7/3.

#### **7.2.3.2.2 Application of Binder**

The category for accuracy of spread of binder and the category for tolerance on the rate of spread of binder shall be as specified in Appendix 7/3 as selected from Table 22a. Testing shall be conducted at a frequency according to the traffic volume as detailed in Table 22b.

#### **7.2.3.2.3 Application of Chippings**

The category of rate of spread of chippings required and the category for tolerance on the rate of spread of chippings shall be as specified in Appendix 7/3 as selected from Table 22a. Testing shall be conducted at a frequency according to the traffic volume as detailed in Table 22b.

### **7.2.3.3 Performance Requirements**

#### **7.2.3.3.1 Defects Determined by Visual Inspection**

Each site where surface dressing product is installed shall be subject to assessment over the 'Design Working Life'. The Producer shall be responsible for maintaining the visual assessment performance requirements set out in Appendix 7/3 throughout the 'Design Working Life'.

The Producer shall be responsible for assessing the site and measuring the defects, by visual assessment, after one year of completion of the installation and at one year intervals thereafter for the five year 'Design Working Life' period, or period specified in Appendix 7/3. Permitted categories of defects shall be in accordance with the requirements of Appendix 7/3. The assessment shall be conducted in accordance with IS EN 12272-2.

The Purchaser shall monitor the performance levels of the surface dressing product during 'Design Working Life', and bring any defects to the attention of the Producer.

#### **7.2.3.3.2 Macrotexture**

Each site where surface dressing product is installed shall be subject to assessment over the 'Design Working Life'. The Producer shall be responsible for maintaining the surface macrotexture performance requirements set out in Appendix 7/3 throughout the 'Design Working Life'. The Producer shall ensure that the surface dressing has sufficient initial macrotexture depth to enable performance levels to be achieved.

The Producer shall be responsible for measuring the macrotexture after one year of completion of the installation and at one year intervals thereafter for the five year 'Design Working Life' period, or period specified in Appendix 7/3. Permitted categories of defects shall be in accordance with the requirements of Appendix 7/3.

The Purchaser shall monitor the performance levels of the surface dressing during 'Design Working Life', and bring any defects to the attention of the Producer.

### **7.2.3.4 Construction Products Regulation**

As detailed under Clause 1.4, the Assessment and Verification of Constancy of Performance (AVCP) for surface dressing product shall be System 2+ in accordance with IS EN 12271. The DoP, CE Mark, Type Approval Installation Trial and FPC information detailed under CC-SPW-00010 and Clause 1 of this Series shall be provided.

#### **7.2.3.4.1 Factory Production Control (FPC)**

A Notified Body shall certify the FPC system for the proposed surface dressing product in accordance with IS EN 12271.

#### **7.2.3.4.2 Determination of Product Type - Type Approval Installation Trial (TAIT)**

The proposed surface dressing product shall have been subject to a Type Approval Installation Trial (TAIT) in accordance with EN 12271. The TAIT shall have been carried out on a site with similar characteristics and traffic category to that to be treated in the Contract. The TAIT shall have been installed in accordance with the Producer's certified Factory Production Control system.

#### **7.2.3.4.3 Declaration of Performance (DoP)**

The Producer shall provide the Employer's Representative with the DoP for the proposed surface dressing product.

The Producer shall continue to monitor the TAIT site and declare the period for which the performance characteristics have been retained.

#### **7.2.3.4.4 CE Marking**

The Producer shall provide the Employer's Representative with the CE Marking for the proposed Surface Dressing Product.

## **7.3 High Friction Surfacing**

High friction surfacing shall comply with this Specification.

The requirements under this Clause relate to constituents and composition. Separate and additional requirements for installation in the Works are contained in Clause 10.2.4.

The performance of the design, materials and workmanship shall be maintained for a minimum period of five years, or the period specified in Appendix 7/11, from the date of completion of the Works. This period shall be known as the 'Design Working Life'.

### **7.3.1 Constituent Materials**

#### **7.3.1.1 Binder**

Unless otherwise specified in Appendix 7/11, the binder shall be one of the following:

- i. Cold binders (principally thermosetting products):
  - a) Epoxy resin;
  - b) Bitumen extended epoxy resin;
  - c) Polyurethane;

- d) Polyurea; and
  - e) Methyl methacrylate.
- ii. Hot binders (thermoplastic products):
- a) Rosin ester; and
  - b) Hydrocarbon resin.

The binder shall comply with the requirements of Table 23a.

### **7.3.1.2 Aggregates**

Aggregate shall be manufactured or natural, be from a single source and free from foreign matter, in accordance with the requirements of Table 23b or Table 23c and shall comply with the requirements of this Clause.

Aggregates for use in surface courses are the point of contact between the vehicle tyre and road surface, accordingly they shall be of a single rock type and source. In addition, they shall comply with the PSV and AAV requirements stated in Table 23b and Table 23c unless otherwise specified in Appendix 7/11.

## **7.3.2 Product Composition**

### **7.3.2.1 Product Types**

High friction surfacing shall be one of two systems:

- i. A system comprising of a binder, applied as a continuous film by machine or manually to bond to a prepared road surface, over which aggregate is broadcast to adhere to the binder prior to curing; or
- ii. A system with binder mixed with aggregate applied as a screed, generally at high temperature, to bond to a prepared road surface.

## **7.3.3 Performance Requirements**

The proposed product/system shall be subject to a provisional Type Approval Installation Trial (prTAIT) in accordance with Clause 1.6 and the requirements of DN-PAV-03075. The product composition shall be deemed suitable after evidence of compliance of the constituent materials is supplied by the Contractor and the performance requirements of this Clause and Clause 10.2.4.7 are achieved.

### **7.3.3.1 Defects Determined by Visual Inspection**

Each site where high friction surfacing is installed shall be subject to assessment over the 'Design Working Life'. The Contractor shall be responsible for maintaining the visual assessment performance requirements set out in Appendix 7/11 throughout the 'Design Working Life'.

The Contractor shall be responsible for assessing the site and measuring the defects, by visual assessment, after one year of completion of the installation and at one year intervals thereafter for the five year 'Design Working Life' period, or period specified in Appendix 7/11. Permitted level of defects shall be in accordance with the requirements of Appendix 7/11. The assessment shall be conducted in accordance with DN-PAV-03075.

The Purchaser shall monitor the performance levels of the high friction surfacing during 'Design Working Life', and bring any defects to the attention of the Contractor.

### **7.3.3.2 Macrotexture**

Each site where high friction surfacing is installed shall be subject to assessment over the 'Design Working Life'. The Contractor shall be responsible for maintaining the surface macrotexture performance requirements set out in Appendix 7/11 throughout the 'Design Working Life'. The Contractor shall ensure that the high friction surfacing has sufficient initial macrotexture depth to enable performance levels to be achieved.

The Producer shall be responsible for measuring the macrotexture after one year of completion of the installation and at one year intervals thereafter for the five year 'Design Working Life' period, or period specified in Appendix 7/11. Permitted level of defects shall be in accordance with the requirements of Appendix 7/11.

The Purchaser shall monitor the performance levels of the high friction surfacing during 'Design Working Life', and bring any defects to the attention of the Producer.

### **7.3.4 Declaration of Performance (DoP)**

The Producer shall continue to monitor the prTAIT site and declare the period for which the performance characteristics have been retained.

## 8. Miscellaneous Products and Processes

### 8.1 Low Energy Bound Mixtures

Low Energy Bound Mixtures (LEBM) shall comply with this Specification.

Low Energy Bound Mixtures (LEBM) shall be produced ex situ, in either fixed or mobile mixing plants, or in situ by machinery capable of pulverising the existing road pavement and uniformly mixing controlled amounts of water and binder agents to the full depth in one pass.

The requirements under this Clause relate to constituents and composition. Separate and additional requirements for installation in the Works are contained in Clause 10.3.1 of this Series.

#### 8.1.1 Constituent Materials

The constituent materials of the LEBM shall be CE marked, where appropriate.

##### 8.1.1.1 Binder

Binder shall conform to the following standards unless otherwise specified in Appendix 7/12:

- i. Bitumen used for foaming shall be Grade 70/100 or 160/220 and comply with IS EN 12591 and the requirements of Table 14. The foam shall have a minimum expansion ratio of 10% and a half-life of 8 seconds. A minimum of 1% Portland cement shall also be incorporated in such mixes as an adhesion agent / filler aggregate.
- ii. Bitumen emulsion shall be cationic bituminous emulsion in accordance with the requirements of Table 24b. Fluxed and cutback bitumen binders shall not be permitted. A minimum of 1% Portland cement shall also be incorporated in such mixes as an adhesion agent / filler aggregate.
- iii. Cement shall be CEM I conforming to IS EN 197-1.

##### 8.1.1.2 Aggregates

Aggregate shall comprise of Reclaimed Asphalt and/or virgin aggregate.

Aggregate shall include:

- i. Asphalt, concrete or granular material planed or excavated from roads or other paved areas outside of the Works and stockpiled.
- ii. Primary or secondary aggregate from other sources.
- iii. Asphalt, concrete or granular material planed or excavated from the road or other paved areas inside of the Works being resurfaced/reconstructed.

Virgin aggregates shall be in accordance with the requirements of Table 24a.

The processed aggregate, including added filler, shall not contain deleterious material that adversely affects the performance of the mixture.

Materials used within 450mm of the designed final surface of a road shall not be frost susceptible. Materials shall be classified as non-frost susceptible if the mean heave is 15mm or less when tested in accordance to BS 812-124.

### **8.1.1.3 Filler**

Filler shall come from primary or secondary sources. Virgin filler shall comply with the requirements of Table 24a.

### **8.1.1.4 Reclaimed Asphalt**

Reuse of asphalt reclaimed directly from the site is permitted provided the material is demonstrated to be homogeneous and allows the mix design to meet the requirements of this Series.

### **8.1.1.5 Water**

Water for moisture content control of the granular material shall normally be obtained from a water company supply and used without testing. Water from an alternative source shall comply with IS EN 1008.

Water shall not contain material that adversely affects the performance of the mixture.

### **8.1.1.6 Additives**

Other constituents, including setting, hardening and adhesion agents, shall only be used to enhance the performance of the mixture provided it is demonstrated that they are not harmful to the stability of the mix over its design life and are suitable for the intended use on site.

## **8.1.2 Product Composition**

The grading of the mixture (the aggregate together with the other constituents including binders) shall comply with one of the zones in Table 24d. Use of Zone B, C, or D shall only be permitted when the results of a full mix design showing compliance with the required performance properties.

The minimum binder content shall comply with Table 24c.

LEBM shall be subject to a Type Test in accordance to DN-PAV-03075 to demonstrate the product composition and constituent materials comply with the requirements of this Specification.

### **8.1.2.1 Mixture Production**

The plant used for production shall be capable of uniformly mixing controlled amounts of water and binder agent(s) into the full depth of LEBM.

The Producer shall provide a written statement and material quality plan detailing the following:

- i. A description of mixture management including aggregate traceability, aggregate stockpiles, aggregate treatment (crushing and screening) and aggregate availability.
- ii. A description of the plant (mixing plant location, aggregate and binder feeders and spreaders, mixing equipment, storage bins, water tank, binder tank, recycler rollers, grader (as applicable) and the production process, preferably including a flow diagram, detailing how material is to be produced in accordance with this Specification.
- iii. Evidence confirming the capabilities of the plant and the calibration of flow meters. Calibration schedules for all parts of the plant involved in determining mixture consistency shall be provided. These shall be accompanied by calibration records and production capacity (tons/hour and tons/day).
- iv. Details of transportation which shall include the expected time between mixing and laying the LEBM.



Ex situ LEBM shall be produced in proprietary mixing plants, which allow sufficient time in the mixer to produce a homogenous mixture. The mixing plant shall have an automated surveillance and data collection system.

For production of in situ LEBM, the following requirements shall be complied with:

The plant used for stabilisation shall be equipped with a spraybar system within the mixing chamber capable of producing and uniformly distributing foamed bitumen binder or bitumen emulsion at a monitored and controlled rate. An accessible sampling jet shall also be fitted that produces foamed bitumen or bitumen emulsion having the same characteristics as that produced by the main spraybar. Flow rate meters for measuring the supply rate of hot bitumen or bitumen emulsion and other liquid additives to the mixture shall be capable of recording the correct rate of flow during all states of pipeline flow (i.e., fully or partially charged).

The plant used shall be capable of processing, diluting, dispersing and encapsulating hazardous tar contaminants into the recycled road structure thereby rendering them safe.

If any corrective virgin aggregate or hydraulic binders (e.g. cement) are needed, they shall be spread uniformly over the full-width of the surface before any pulverisation takes place. The rate of spread of these materials shall be calculated to achieve the target mixture composition.

Pulverisation of the existing road structure shall be carried out in a systematic pattern and to the required depth for all parts of the existing road specified in Appendix 7/12. An overlap of at least 150mm shall be made between adjacent passes. Any material missed along hard edges or around obstructions shall be excavated and placed in the path of subsequent passes of the machine until a uniform fully pulverized aggregate is obtained. The pulverised material shall not be contaminated by material drawn in from the verges.

Moisture content of the pulverised aggregate immediately prior to stabilisation shall be measured in accordance with IS EN 1097-5 using the high temperature method and comply with Table 24g.

If the moisture content of the unstabilised pulverised aggregate fails to meet the specified moisture content range, corrective action shall be taken either by aeration to reduce the moisture content or by controlled addition of water to increase the moisture content as described in DN-PAV-03074.

Prior to stabilisation, pulverised materials within 100mm of restricted hard edges such as kerbs and channels, or around obstructions such as gullies, shall be removed and spread uniformly over the remaining full width of the pulverised material.

Immediately prior to stabilisation, any filler and/or additives shall be spread uniformly over the full width of the layer using a mechanical spreader capable of distributing the material(s) in a uniform controlled manner.

The stabilisation shall be carried out to the required depth in a systematic pattern similar to that used for the pulverisation process, with an overlap of at least 150mm between adjacent passes of the machine.

The binder shall be supplied to the spraybar of the stabilising machine by pumped pipeline from on-board tanks or from a tanker moving in tandem with the stabilising machine.

#### **8.1.2.2 Testing**

The schedule of inspection and test frequencies to be made during production of LEBM shall comply with the minimum frequencies in Table 24e or as amended in Appendix 1/5. It shall be the Producer's responsibility to perform and document all related tests and obtain necessary samples for testing.

## 8.2 Retexturing

Retexturing shall comply with this Specification.

The proposed retexturing shall be subject to a provisional Type Approval Installation Trial (prTAIT) in accordance with Clause 1.6 and the requirements of DN-PAV-03075.

The prTAIT shall have been carried out on a site with similar characteristics and traffic category to that to be treated in the Contract.

Requirements for the selection of retexturing treatments shall be in accordance with Table 25b.

Prior to the commencement of the Works the Contractor shall perform a trial area to demonstrate the consistency of the specified treatment in both the transverse and longitudinal directions. The trial area may form part of the specified treatment area and shall be a minimum of 15m long and extend to the full lane width.

The retexturing works shall not have any detrimental effect on the structural integrity of the surface course.

### 8.2.1 Retexturing Techniques

The retexturing techniques outlined in Table 25b may be applied on the National Roads network. The prTAIT shall demonstrate the ability of the procedure to retexture the surface course type for which it is proposed to be utilised. The procedure shall be capable of applying the treatment in a consistent manner across the full width and length of the area to be improved.

### 8.2.2 Waste Management

All liquids or solid detritus shall be removed from the road surface by the equipment leaving the surface clean and suitable for unrestricted traffic. Residual water shall not be more than is present after light rainfall, there shall be no puddles, standing water or water running in surface channels. No abrasives, grit or other solids shall enter the drainage system.

The Contractor shall ensure that adequate provision is made by physical means as necessary to restrict and prevent any flow of contaminants into these areas and features.

Should inadvertent discharge occur, the Contractor shall take all practical steps to collect the water. The EPA shall be informed and they may undertake monitoring of local sensitive watercourses and catchment areas.

### 8.2.3 Noise

The Contractor shall comply with restrictions as set out in Table 25a in relation to work hours and noise levels for all maintenance work.

The Contractor undertaking the treatment works shall take specific noise abatement measures and comply with the recommendations of the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001. These measures shall ensure that:

- i. No plant used on site shall be permitted to cause an on-going public nuisance due to noise.
- ii. The best means practicable, including proper maintenance of plant, shall be employed to minimise the noise produced by on site operations.
- iii. All vehicles and mechanical plant shall be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.

- iv. Compressors shall be attenuated models fitted with properly lined and sealed acoustic covers which shall be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- v. Machinery that is used intermittently shall be shut down or throttled back to a minimum during periods when not in use.
- vi. Any plant, such as generators or pumps that are required to operate before 07:00hrs or after 19:00hrs shall be surrounded by an acoustic enclosure or portable screen.

### **8.3 Geotextiles and Geotextile-related Products**

Geotextiles and geotextile related products for the control of reflection cracking in flexible pavements shall comply with IS EN 15381 and be CE marked.

#### **8.3.1 Allowable Uses**

The use of geotextile and geotextile-related products in pavement maintenance and new works shall be in accordance with the requirements of this Clause and DN-PAV-03074. Geotextiles and geotextile related products shall be installed in accordance with the manufacturer's requirements. These requirements shall include details on the following:

- i. Surface pre-treatment.
- ii. Minimum laps in both the transverse and longitudinal directions.
- iii. Properties, application and use of bond coat.
- iv. Weather conditions under which installation can occur.
- v. Restrictions on overlay materials.
- vi. Trafficking after installation.

#### **8.3.2 Allowable Products**

Geotextile and geotextile-related products shall be either:

- i. Steel Meshes made from Class A zinc galvanised steel, using double twist mesh and reinforced with high tensile steel bars or twisted flat wire. The elastic modulus shall be a minimum of 200kN/mm<sup>2</sup>. The characteristic tensile strength of the grid shall be 50kN/m in both the transverse and longitudinal directions.
- ii. Geogrid products shall be glass or polymer fibre; knitted and coated or impregnated with a bitumen compound. The tensile strength declared under CE marking shall be a minimum of 50kN/m in both directions. They can include a self-adhesive coating.
- iii. Geocomposites are geogrids as specified in (ii) with an integral non-woven textile backing with the Bitumen Retention Value (Ra) declared under CE marking as a minimum value of 0,35kg/m<sup>2</sup>.

### **8.4 Permanent Repair Material Systems**

Permanent Repair Material Systems (PRMS) shall comply with the requirements of this Specification. PRMS utilise a cold-lay bituminous material which shall be used for the permanent repair of surface defects, filling of road stud cavities and core holes, filling around ironworks, and utility cuttings/openings.

PRMS shall be produced in plants that are independently accredited to IS EN ISO 9001 or an equivalent quality management system.

PRMS may be proprietary products.

As PRMS are currently not covered by a harmonised European standard, product/system manufacturers or Contractors may provide a European Technical Assessment (ETA) to enable a PRMS to be CE Marked in accordance with the performance requirements of this Specification.

Until such time as a PRMS has been CE marked through the ETA process, the requirements of this Specification and DN-PAV-03075 shall apply.

PRMS shall not be permitted for use in trench reinstatements.

## **8.4.1 Constituent Materials**

### **8.4.1.1 Aggregates**

#### **Aggregates - General**

All aggregates shall comply with the requirements of Table 26a.

#### **Coarse Aggregates for Surface Courses**

Aggregates for use in surface courses are the point of contact between the vehicle tyre and road surface, accordingly they shall be of a single rock type and source. In addition, they shall comply with the PSV and AAV requirements of Table 26a.

### **8.4.1.2 Filler**

Filler shall comply with the requirements of Table 26a. Reclaimed filler shall not be used.

### **8.4.1.3 Reclaimed Asphalt**

Reclaimed Asphalt shall not be used.

## **8.4.2 Product Composition**

The requirements under this Clause relate to the composition of the product. Separate and additional requirements for the placement of products are contained in Clause 10.3.3 of this Specification.

### **8.4.2.1 Conditioning of Samples**

All samples of PRMS shall be pre-conditioned in accordance with the manufacturer's requirements.

### **8.4.2.2 Void Content**

Void content of the PRMS shall comply with the requirements of the Vmax and Vmin categories of Table 26b.

### **8.4.2.3 Water Sensitivity**

Water sensitivity provides an indication of mixture durability using the ratio of the indirect tensile strength of wet (water conditioned) specimens to that of dry specimens, expressed as a percentage. The water sensitivity of the PRMS shall comply with the requirements of Table 26b.

### **8.4.2.4 Resistance to Permanent Deformation**

The resistance to permanent deformation of the PRMS shall comply with the requirements of Table 26b.

### **8.4.3 Performance Requirements**

The proposed PRMS shall be subject to a provisional Type Approval Installation Trial (prTAIT) in accordance with Clause 1.6 and the requirements of DN-PAV-03075. The PRMS shall be deemed suitable after the performance requirements of Clause 10.3.3.9 are achieved.

### **8.4.4 Temporary Repair Works**

PRMS may be used in temporary repair works. Full-scale rectification in accordance with CC-SPW-00700 and replacement with an approved surface course (in accordance with DN-PAV-03023 Surfacing Materials for New and Maintenance Construction, for Use in Ireland) shall be required to replace temporary repair works as soon as practicably possible after installation.

Temporary repair works shall not be deemed to be a repair suitable to be part of the prTAIT process at time of opening to traffic.

## **8.5 Localised Surface Repair Systems**

Localised Surface Repair Systems (LSRS) shall comply with the requirements of this Specification. LSRS utilise an infra-red process that reconstitutes the surfacing material in situ to provide a permanent repair.

LSRS may be proprietary systems.

As LSRS are currently not covered by a harmonised European standard, Contractors may provide a European Technical Assessment (ETA) to enable a LSRS to be CE Marked in accordance with the performance requirements of this Specification.

Until such time as a LSRS has been CE marked through the ETA process, the requirements of this Specification and DN-PAV-03075 shall apply.

LSRS shall not be permitted for use in trench reinstatements.

### **8.5.1 Product Composition**

#### **8.5.1.1 General**

The requirements under this Clause relate to the composition of the product. Separate and additional requirements for the placement of products are contained in Clause 10.3.4 of this Specification.

#### **8.5.1.2 Additional Materials**

Additional materials for LSRS works may include: Permanent Repair Material Systems, bitumen emulsion rejuvenator, bitumen preservative and surfacing material.

The properties and benefits of such additives to the LSRS shall be detailed by the Contractor in the prTAIT.

If specified by the Contractor, Permanent Repair Material Systems in accordance with Clause 8.4 may be used in LSRS works to supplement the in situ material such that the repair complies with the requirements of this Specification.

Where supplementary materials are used the visual consistency of the existing surface course shall be maintained.

## **8.5.2 Performance Requirements**

The proposed LSRS shall be subject to a provisional Type Approval Installation Trial (prTAIT) in accordance with Clause 1.6 and the requirements of DN-PAV-03075. The LSRS shall be deemed suitable after the performance requirements of Clause 10.3.4.6 are achieved.

## **8.5.3 Temporary Repair Works**

LSRS may be used in temporary repair works. Full-scale rectification in accordance with CC-SPW-00700 and replacement with an approved surface course (in accordance with DN-PAV-03023) shall be required to replace temporary repair works as soon as practicably possible after installation.

Temporary repair works shall not be deemed to be a repair suitable to be part of the prTAIT process at time of opening to traffic.

## **8.6 Emergency Repair Materials Systems**

Emergency Repair Material Systems (ERMS) shall comply with the requirements of this Specification. ERMS utilise a cold-lay bituminous material which shall be used for the emergency/temporary patching and repair of surface defects, filling of road stud cavities, filling around ironworks, and utility cuttings/openings. Patching shall be defined as replacement of surface course, binder course and base where the materials are installed in small areas.

Full-scale rectification in accordance with CC-SPW-00700, and replacement with an approved surface course (in accordance with DN-PAV-03023) shall be required to replace emergency/temporary repair works as soon as practicably possible after installation.

ERMS shall be produced in plants that are independently accredited to IS EN ISO 9001 or an equivalent quality management system.

ERMS may be proprietary products.

### **8.6.1 Constituent Materials**

#### **8.6.1.1 Aggregates**

##### **Aggregates - General**

All aggregates shall comply with the requirements of Table 28a.

##### **Coarse Aggregates for Surface Courses**

Aggregates for use in surface courses are the point of contact between the vehicle tyre and road surface, accordingly they shall be of a single rock type and source. In addition, they shall comply with the PSV and AAV requirements of Table 28a.

#### **8.6.1.2 Filler**

Filler shall comply with the requirements of Table 28a. Reclaimed filler may be used.

#### **8.6.1.3 Reclaimed Asphalt**

Reclaimed Asphalt shall not be used.

## **8.6.2 Product Composition**

### **8.6.2.1 General**

The requirements under this Clause relate to the composition of the product. Separate and additional requirements for the placement of products are contained in Clause 10.3.5 of this Specification.

The ERMS shall have the following characteristics:

- i. It shall cure to a strength such that it is capable of being trafficked by heavy vehicles without damage within 30 minutes of installation when installed at surface temperatures between 30°C and 40°C.
- ii. It shall have a minimum shelf life of 12 months.

### **8.6.2.2 Conditioning of Samples**

All samples of ERMS shall be pre-conditioned in accordance with the product manufacturer's requirements.

### **8.6.2.3 Void Content**

Void content of the ERMS shall comply with the requirements of the V<sub>max</sub> and V<sub>min</sub> categories of Table 28b.

### **8.6.2.4 Water Sensitivity**

Water sensitivity provides an indication of mixture durability using the ratio of the indirect tensile strength of wet (water conditioned) specimens to that of dry specimens, expressed as a percentage. The water sensitivity of the ERMS shall comply with the requirements of Table 28b.

### **8.6.2.5 Resistance to Permanent Deformation**

The resistance to permanent deformation of the ERMS shall comply with the requirements of Table 28b.

## **8.7 Surface Course Preservation Systems**

Preservation systems that are intended to extend the life of an existing surface course, by the application of a preservation agent, and satisfy the following requirements:

- i. The surface texture of the existing pavement shall not be reduced by more than 0.5 mm and shall not fall below the minimum texture specified for the original surface course.
- ii. The softening point of the bitumen recovered from cores taken 1 month post treatment, shall not have decreased by more than 3 °C.
- iii. The penetration value of the bitumen recovered from cores taken 1 month post treatment, shall not have increased by more than 10 dmm.
- iv. prTAIT in accordance with the requirements of DN-PAV-03075 Approval of Specific
- v. Products shall be undertaken.

## 9. Reclaimed Asphalt

Reclaimed Asphalt shall comply with this Specification, which is derived from IS EN 13108-8.

### 9.1 Source

The source asphalt shall be site-won asphalt comprising of mineral aggregate, filler and paving grade bitumen or polymer modified bitumen. Source asphalt containing tar shall not be permitted.

Reclaimed Asphalt to be incorporated within a bituminous mixture shall meet the requirements related to the reuse or recycling of materials respectively defined by Article 27 (by product) and Article 28 (end of waste) as defined in European Union (Waste Management) Regulations, 2011 – 2020 (transposing EU law).

### 9.2 Classification, Description and Requirements

Reclaimed Asphalt shall be tested in accordance with Table 13a and shall meet the requirements detailed in Table 13b to ensure that the material is suitable for use. Any unsuitable material shall be discarded and the remaining compliant Reclaimed Asphalt shall be classified as the feedstock of Reclaimed Asphalt.

### 9.3 Storage

Reclaimed Asphalt Pavement and Reclaimed Asphalt feedstock protection and handling has a significant impact on the quality of the Reclaimed Asphalt and the resulting bituminous mixture. Guidance on the management of Reclaimed Asphalt Pavement and the Reclaimed Asphalt feedstock is provided in CC-GSW-00900 Notes for Guidance – Road Pavements – Bituminous Bound Materials.

Feedstock shall have a data sheet available providing the Reclaimed Asphalt properties detailed in Table 13a. The average, maximum and minimum values of the following Reclaimed Asphalt properties within the feedstock shall be reported on the data sheet:

- i. Data collection start and end date
- ii. Recovered binder Softening Point
- iii. Recovered binder Penetration
- iv. Grading of the aggregate content (% by mass):
  - < 0.063mm
  - 0.063mm to 2mm
  - ≥ 2mm
- v. Recovered Binder content (% by mass)
- vi. Maximum size of RA particles ( $U_{RA}$ )
- vii. Cohesion Test results

Feedstock data sheet(s) shall be included in a mixture Type Test report where feedstock is a constituent of the mixture. A data sheet template is provided in CC-GSW-00900 Notes for Guidance – Road Pavements – Bituminous Bound Materials.



## 9.4 Mixture Design

Reclaimed Asphalt shall only be added to a bituminous mixture production process where it is demonstrated that the production plant has the capability to add the Reclaimed Asphalt accurately and procedures are in place to record the quantity being added. The production process shall also provide sufficient time and heating of the mixture constituents to ensure a homogeneous blending of the Reclaimed Asphalt binder and the added Virgin Binder.

The constituent and composition requirements of the bituminous mixture contained in Table 1 and Table 2 are suitable for mixtures with Reclaimed Asphalt as a constituent up to 70% by mass of the mixture. Where more than 20% by mass of the mixture is Reclaimed Asphalt, additional requirements for the mixture detailed in Table 13c shall be adhered to. As stated in Table 2, RA with a recovered binder penetration which is not categorised as P<sub>15</sub> shall not be used as a bituminous mixture constituent.

The penetration of the combined virgin and recovered binder shall be calculated as detailed below and shall fall within the permitted range for the mixture designation.

### 9.4.1 Mixture Binder Penetration Grade

Where Reclaimed Asphalt constitutes greater than 20% by mass of the mixture, the grade of the combined Reclaimed Asphalt and Virgin Binder added to the mixture shall be calculated using the formula below and as detailed in EN 13108-1 Annex A:

$$a \log_{10}(\text{pen}_1) + b \log_{10}(\text{pen}_2) = (a + b) \log_{10}(\text{pen}_{\text{mix}})$$

where:

pen<sub>mix</sub> is the calculated penetration of the binder in the mixture containing Reclaimed Asphalt;

pen<sub>1</sub> is the penetration of the binder recovered from the Reclaimed Asphalt;

pen<sub>2</sub> is the penetration of the added Virgin Binder;

a and b are the portions by mass of the binder from the Reclaimed Asphalt (a) and from the added binder (b) in the mixture; a + b = 1.

The Virgin Binder added to the mixture shall be a single designated paving grade and shall not be greater than 70/100 in accordance with IS EN 12591; combinations of grades shall not be permitted.

Changes in the properties of the Reclaimed Asphalt may affect the composition of the final mixture; these effects will be greater with increasing amounts of Reclaimed Asphalt in the mixture. The content and grade of Virgin Binder required in the mixture shall be recalculated, and a new Type Test report created, if the Reclaimed Asphalt feedstock binder content and/or recovered binder penetration changes in excess of the amounts in Table 13e when compared .

If the grade of Virgin Binder must be changed, the mixture design shall be repeated and a new Type Test Report created.

## 9.5 Type Test Report

The requirements under this Clause relate to the composition of the product and shall be detailed in the Type Testing documentation accompanying the DoP and CE Mark for the mixture.

Individual Type Test reports shall be produced for each mixture, according to the quantity of Reclaimed Asphalt used.

The following shall be declared on Type Test report where Reclaimed Asphalt is a constituent of the mixture:

- i. The percentage of Reclaimed Asphalt in the mixture.
- ii. The Reclaimed Asphalt binder content
- iii. The grade of the binder recovered from the Reclaimed Asphalt
- iv. The Virgin Binder content added to the mixture.
- v. The grade of Virgin Binder added to the mixture.

Where Reclaimed Asphalt is a constituent of a mixture, the Reclaimed Asphalt feedstock data sheet(s) described in Clause 9.3 shall be provided with Type Test report.

## **9.6 Works Requirements**

Where Reclaimed Asphalt constitutes greater than 20% by mass of a bituminous mixture, additional works requirements shall be adhered to as detailed in Table 13d.

## **9.7 Traceability**

As with all bituminous mixture constituents, Reclaimed Asphalt shall be traceable from its source through its processing and the mixture production process. This shall include documentation relating to waste management requirements detailed in Clause 9 and the data sheets detailed under Clause 9.3.

## 10. Works

This Clause provides the requirements for the placement of products within the Works. Where there is a conflict between this Specification and other referenced specifications, the specific requirements of this document shall take precedence.

It is important to recognise that the IS EN 13108 series contains requirements for loose bituminous mixtures, i.e. to the point in the 'back of the truck' and the CE Marking of the products is also restricted to this point. The placing and compaction requirements of the mixtures are covered by the following Clauses.

### 10.1 Bituminous Mixtures

#### 10.1.1 General

These requirements for the placement and compaction of bituminous mixtures are complimentary and additional to the requirements of CC-SPW-00700. Certain references are made to BS 594987; where there is a conflict between this Specification and BS 594987, this Specification shall take precedence.

##### 10.1.1.1 Preparation

Any repair works to the existing road surface and structure, verges and road drainage shall be completed prior to the commencement of works. Any packed mud or other deposits on the road surface shall be thoroughly removed and the road surface shall be swept free of all loose and deleterious materials.

When specified in Appendix 7/9, prior to cold-milling the Contractor shall carry out a sweep of the area(s) to locate any buried metalwork within the layer to be cold-milled. The sweep shall be carried out with electronic detection equipment suitable for the purpose. The surface shall be clearly marked above all objects to show their detected extent. The objects shall be referenced and their location and depth reported to the Employer's Representative within 6 hours of discovery. Surfacing in the vicinity of such objects shall be excavated using pneumatic tools or other suitable methods.

#### 10.1.2 Works Proposals

Before work commences, the Contractor shall submit a works proposal to the Employer's Representative that includes:

- i. Laying and compaction procedures for each layer – including size, type and number of rollers; the number of roller passes or other method employed to ensure compaction e.g. by continuous monitoring of density with a non-destructive gauge.
- ii. Measures to ensure the rate of delivery of material to the paver is regulated to enable the paver to operate continuously.
- iii. Measures to address working in different climatic conditions.
- iv. The joint formation procedures for each layer – including paving width, the location of longitudinal and transverse joint(s); and the method(s) of treating upstanding edges.
- v. How traceability of the material in the Works will be addressed.

#### 10.1.3 Transport

Loading of asphalt shall be carried out such that segregation is minimised.

Asphalt shall be transported to the laying site in insulated vehicles with tight fitting covers to prevent an excessive drop in temperature and to ensure its protection against adverse weather conditions.

The floor of the vehicle shall be free from adherent bituminous materials or other contaminants. To facilitate the discharge of asphalt, the floor of the vehicle shall be coated with water, a liquid soap solution or proprietary release agent. The amount used shall be kept to a minimum. In the case where a coating is used the vehicle body shall be tipped to its fullest extent prior to loading, with the tailboard open, to ensure drainage of any excess coating.

Asphalt shall remain covered whilst awaiting tipping.

#### **10.1.4 Bond Coat**

A bond coat shall be sprayed onto all surfaces including HBM layers prior to laying all bituminous products to improve the adhesion between layers and increase the impermeability of the underlying layer. Bond coat shall comply with this Clause, Appendix 7/4 and Table 14 for hot applied binders or column 1 of Table 15 for emulsions.

The specified rate of spread for bond coats shall be a minimum of 0,30kg/m<sup>2</sup> of residual binder. Residual binder is the amount of binder left after evaporation of the water content of the emulsion.

Application shall be carried out with a calibrated mechanical binder distributor. For small areas application may be carried out with a hand held sprayer with the agreement of the Employer's Representative.

The Contractor shall ensure a quality management system in accordance with IS EN ISO 9001 is implemented for the application of bond coats. This shall include documented procedures for carrying out rate of spread and accuracy of spread tests in accordance with IS EN 12272-1. The Quality Plan shall detail methods to check the spraying equipment and to reconcile volume or mass used with areas treated and to visually assess accuracy of spread.

Binder distributors shall have controlled metering and be capable of uniform distribution. The accuracy of spread of binder (also known as transverse distribution of binder), when tested in accordance IS EN 12272-1, shall not exceed 15%. This test shall be carried out every six months.

The tolerance for the specified rate of spread of binder, when tested in accordance with IS EN 12272-1, shall not exceed  $\pm 15\%$ . During the Works the Contractor shall repeat the specified rate of spread of binder at a minimum frequency of one test for every 20,000m<sup>2</sup>, or once per month, whichever is the most frequent.

Tests shall also be carried out whenever there is a change in binder source or the spraying system has been altered. The Contractor shall provide the Employer's Representative with the test results when requested.

Before spraying is commenced, the surface shall be free of all loose material, the surface as a whole shall be dry and any damp areas shall be completely free of standing water. When using an emulsion, after application it shall be allowed to break fully (i.e. turn from brown to black) before the asphalt is laid, unless it is applied by a paver with an integral spraybar. Additives may be used to improve the break time of the emulsion and to prevent the bond coat being picked up on the wheels of construction equipment.

Hot applied bond coats may be overlaid immediately, but care is needed to obtain adhesion to the substrate when damp. Over-application or ponding shall be avoided as this could result in slippage or instability of the overlying layer.

There shall be no bare strips or areas having less than the minimum permitted rate of spread. Transverse joints shall have an overlap not wider than 300mm.

Longitudinal joints shall have an overlap not wider than 100mm to ensure that the minimum permitted rate of spread is achieved across the joint.

Tack coat shall only be used when small quantities of asphalt are being laid on footways and driveways.

All loose material on the sprayed surface shall be removed before any further layer of the pavement is laid.

### 10.1.5 Weather Conditions

The Contractor shall take account of the weather conditions when planning his working methods. The working methods shall comply with all weather-related requirements of this Clause.

Laying of road pavement products shall not proceed if any of the following conditions are present:

- i. The temperature of the surface to be covered is less than 2°C.
- ii. The air temperature is less than 0°C.
- iii. The surface to be covered is frozen or frost, ice, snow, salt or grit is present on the surface.
- iv. During heavy or persistent rain.
- v. When standing water is present.

In addition, hot bituminous materials laid less than 50mm thick, other than Porous Asphalt and Polymer Modified Stone Mastic Asphalt, shall be laid within the wind speed and temperature constraints of Figure 10.1.5.a.

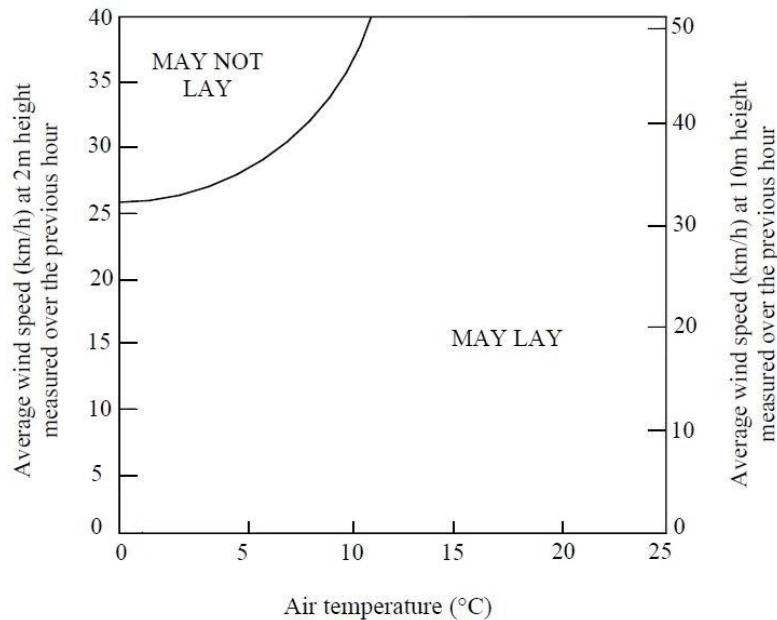


Figure 10.1.5.a

### 10.1.5.1 Weather Conditions Specific to Laying Porous Asphalt and Polymer Modified Stone Mastic Asphalt Mixtures

In addition to Clause 10.1.5, Porous Asphalt and Polymer Modified Stone Mastic Asphalt Mixtures shall be laid within the limits of air temperature and wind speed stated in Figure 10.1.5.b, together with the associated Quality Plan and works proposals.

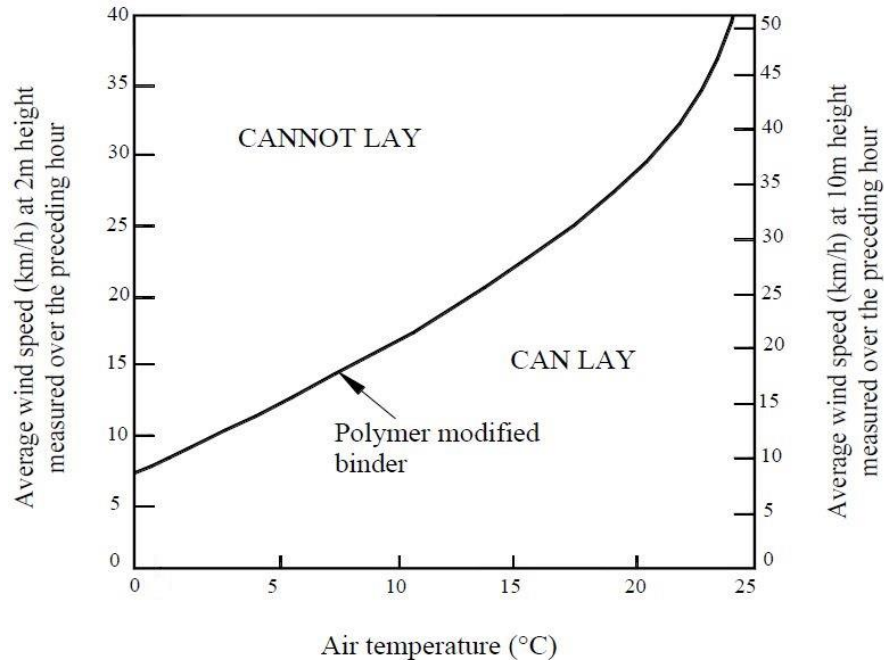


Figure 10.1.5.b

### 10.1.6 Temperatures

The temperature of the mixture, when measured in accordance with IS EN 12697-13, shall be within the limits for the particular mixture as detailed in Table 3, Table 6, Table 9 and Table 12 and any additional requirements of this Clause.

### 10.1.7 Laying

All plant shall be maintained in accordance with the manufacturer's requirements and be suitable for the mixture being installed. Wherever practicable, mixtures shall be spread, levelled and tamped by a self-propelled paving machine. The rate of delivery of material to the paver shall be regulated to enable the paver to operate continuously.

Hand placing of hot bituminous mixtures shall be restricted to the following circumstances:

- i. For laying regulating courses of irregular shape and varying thickness.
- ii. In confined spaces where it is impracticable for a paver to operate.
- iii. For footways where it is impractical for a paver to operate.
- iv. At the approaches to expansion joints at bridges, viaducts or other structures.

Hand-raking of surface course material or the addition of such material by hand spreading to the paved area, for adjustment of level, shall be restricted to the following circumstances:

- i. At the edges of the layers of material and at gullies, manholes and other ironwork.
- ii. At the approaches to expansion joints at bridges, viaducts or other structures.
- iii. In confined spaces where it is impracticable for a paver to operate.

The method of laying shall be such that the finished surface is free from dragging, tearing, segregation, bleeding, and fattening up of the material.

When laying mixtures from more than one source, the mixtures shall have equivalent laying and compaction characteristics. The Contractor's works proposals and quality plan shall document how traceability of the different sources of material in the Works will be achieved.

When paving directly onto bridge deck waterproofing systems, any special requirements which apply to that system shall be complied with.

Nominal and minimum compacted layer thicknesses for the particular mixture shall be in accordance with Table 3, Table 6, Table 9 and Table 12 and any additional requirements of this Clause. The cumulative compacted thickness of all layers placed shall not result in a reduction from the nominal thickness of more than 20% up to a maximum reduction of 15mm nor a reduction in the thickness of the Surface Course by more than 5mm from the design. This could be demonstrated utilising the cores that are being extracted for void analysis.

#### **10.1.7.1 Laying Conditions Specific to Hot Rolled Asphalt Mixtures**

A trial strip of not less than 30 linear metres shall be constructed for every HRA mixture and coated chipping combination to be used. It shall be used to demonstrate that the requisite properties of the finished surface course are compliant with the requirements for macrotexture and in particular that this is evidently positive in accordance with the inherent characteristic of the product. This trial strip may form part of the permanent works.

The application of coated chippings to areas of surface course shall be by a mechanical spreader capable of distributing chippings to an even rate of spread. Addition of chippings by hand operation shall only be permitted in the following circumstances, and shall be carried out by trained and competent personnel:

- i. In confined spaces, where it is impracticable for a chipping spreader to operate.
- ii. As a temporary expedient, when adjustments have to be made to the spreader distribution mechanism.
- iii. When hand laying of the surface course is permitted to correct uneven distribution of chippings.

The Contractor shall ensure a uniform rate of spread of chippings so that they are rolled into the surface and they are effectively held to provide the initial positive macrotexture depth specified in Table 6.

The rate of spread of chippings for shoulder-to-shoulder cover shall be carried out in accordance with BS 598-1 Clause 4.2 in order to establish the rate of spread necessary to achieve the required level of texture depth. Measurements shall be carried out in the following circumstances:

- i. For each source of chippings;
- ii. If visual observation indicates a change in the size or shape of the chippings.

Monitoring of the performance of the mechanical chipping spreader shall be carried out in accordance with BS 598-1 Clause 4.3 to check the rate of spread of chippings being achieved for each half width of the chipping spreader. In order to achieve the required macrotexture it is essential that the rate of spread for each tray is consistent across the entire mat.

Measurements shall be repeated for every 50 linear metres laid, this may be reduced to every 100 linear metres laid once consistency is established. Measurements shall revert to every 50m in the following circumstances:

- i. If the source of the chippings changes;
- ii. If visual observation indicates a change in the size, shape or spread of the chippings;
- iii. If the chipping spreader is changed.

### 10.1.7.2 Laying Conditions Specific to Porous Asphalt Mixtures

Porous Asphalt shall be laid by machine and compacted within three hours of mixing. Where more than one lane is to be covered, and where possible, porous asphalt shall be laid by at least two pavers working in echelon, so that longitudinal joints can be effectively rolled together whilst hot. The stagger between paving machines shall not exceed 20m.

'Throwing back' of material and walking on uncompacted porous asphalt shall be avoided.

All construction plant must be kept off the surface before opening to traffic in order to prevent damage and clogging of the material.

Landscaping operations shall be carried out such that soil and other materials are not placed on the surface or cause any clogging of the porous asphalt.

### 10.1.8 Joints

A joint is a connection between two adjacent lanes of material. Longitudinal joints in all layers shall be situated outside wheel track zones. For the purpose of this Clause, the wheel track zone shall be taken to be between 0,4m and 1,0m, and between 2,45m and 3,05m from the centre of the nearside lane markings for each traffic lane (or in the absence of lane markings, lane edges).

All joints shall be offset by at least 150mm from parallel joints in the layer beneath.

Joints in the surface course shall coincide with either lane edge or the lane marking, whichever is appropriate.

Where the compacted thickness of the layer is 50mm or less, the unsupported edge of a longitudinal and transverse joints shall be cut back to a vertical face, by a width equal to or greater than the layer thickness, discarding any loose material, to expose the full thickness of the layer.

Where the compacted thickness of the layer is greater than 50mm, longitudinal joints shall be treated to ensure the void content requirements specified in Clause 10.1.9 are achieved by:

- i. Treating as per the above requirements for a compacted thickness of a layer 50mm or less;
- ii. Using an edge compressing tool fitted to the roller to form a 450 or 600 angle; or
- iii. Laying adjacent lanes with two or more pavers in echelon.

The paving width of each layer shall be calculated to take this requirement into account.

Where the compacted thickness of the layer is greater than 50mm, the transverse joint shall be cut back to a vertical joint.

The freestanding edge of all layers shall be finished by using an edge compressing tool fitted to the roller to form a 450 or 600 angle.

The faces of all cold upstanding edges of material, including previously laid asphalt, against which hot bituminous mixtures are to be laid to form joints shall be treated with one of the following:

- i. Hot bitumen binder with a penetration value not less than 40 pen.



- ii. Hot elastomeric polymer modified bituminous binder complying with IS EN 14023 with a penetration value not less than 40 pen.
- iii. Cold applied thixotropic bituminous compound of similar characteristics to (i) or (ii) above. This shall be applied at base and binder course layers only.

This operation shall be carried out so that the binder adheres evenly to the full area of both the cold and the warm upstanding edges when the asphalt is placed.

One of the above products shall also be applied to the entire area of any freestanding edge on the outside of the finished pavement on the high side of the camber and, when stated in Appendix 7/1, on the low side.

Within 24 hours of a joint being formed, a sealant shall be applied to the top surface of all base and binder course joints such that there is not less than 0,50kg/m<sup>2</sup> of residual bitumen extending to 75mm either side of the joint. The sealant, which may contain mineral filler to IS EN 13043, shall be one of the following:

- i. Hot elastomeric polymer modified bituminous binder complying with IS EN 14023 with a penetration of not less than 40 pen.
- ii. Bitumen emulsion with a cohesion of 1.0 J/cm<sup>2</sup> or above in accordance with IS EN 13808.
- iii. Microsurfacing in accordance with Clause 7.1.

When paving adjacent to an expansion joint of a structure, the joint or joint cavity shall be kept clear of material. When laying surface course, the paver shall be taken out of use whilst laying the remainder of the surface course up to the joint and the corresponding area beyond it.

#### **10.1.8.1 Joint Requirements Specific to Porous Asphalt Mixtures**

Where exposed longitudinal joints are unavoidable they may be cold butted, provided that the edge of the porous asphalt layer laid previously has not been damaged and is clean and vertical.

Where damage to edges has occurred, they shall be trimmed by a road saw with appropriate measures including suction extraction, to prevent clogging of the pores with detritus.

Bitumen coating shall not be applied to the longitudinal edges of joints.

Transverse joints shall be formed against a 200mm wide, 45mm thick hard timber stop end nailed to the road surface in advance of the paving operation.

The cutting of edges shall be avoided but where transverse edge cutting is essential it shall be undertaken using a road saw with appropriate measures including suction extraction, to prevent clogging of the pores with detritus.

Nothing shall be done, nor any articles positioned, such as to impede the run-off water freely entering the drainage channel or filter drain provided to remove the water from the pavement surface. Where an impermeable surface is to be laid downstream of the porous asphalt, the lane ends of the porous asphalt shall be staggered across the carriageway in the direction of the drainage path in order to prevent excess rainwater from welling up over the transverse joint.

#### **10.1.9 Compaction Control**

Compaction shall be controlled and monitored to comply with the requirements of Table 3, Table 6, Table 9 and Table 12 and the specific requirements of this Clause.

Compliance with the requirements of Tables 3, 6, 9 and 12 shall be demonstrated by one of the following methods:

1. Where cores are required by the Employers Representative or 'to be recorded' is specified in the Tables, a pair of cores shall be taken for every 1,000 linear metres laid per running lane or as otherwise specified in Appendix 7/1. Unless otherwise specified in Appendix 7/1, cores are not required in the hard shoulder. For schemes less than 1,000m in length, a minimum of one pair of cores shall be taken unless otherwise specified in Appendix 7/1. The mean air void content shall be determined in accordance with the test methods in Table 20 for each core pair. For surface course materials, cores of 100mm diameter are acceptable. The cores shall be extracted outside of the wheel tracks for all layers. The core log shall note if the site is confined; or
2. At the discretion of the Employer's Representative and where the Contractor can demonstrate by means of verifiable records that on previous contracts of similar characteristics that the proposed specific mixture has been installed consistently within specification for the air void requirements, in this scenario coring is not required and the compaction assessment shall continue using an indirect density gauge.

Where an indirect density gauge is used, for each 20m interval, the in-situ void content shall be determined in accordance with the test methods in Table 20 using the bulk density from the gauge reading and the maximum density of the material. The maximum density shall initially be taken as that provided in the mixture Type Testing report; it is the responsibility of the contractor to ensure the gauge remains calibrated to the mixture.

The frequency of coring shall be resumed to comply with 1 above where compliance cannot be demonstrated, or doubt exists on the part of the Employer's Representative. In the event that the measured air void content does not comply with the requirements of Tables 3, 6, 9 and 12, then further air void content testing shall be carried out to establish the extent of the non-conformity. If it is necessary to remove and replace any material to restore conformity, this shall be in length not less than 15 metres.

The compaction and compaction control for method compaction shall be as specified below unless otherwise specified in Appendix 7/1.

Rollers shall be one or more of the following types:

- i. Deadweight - with smooth steel wheels, a rear roll width of not less than 450mm and a weight of not less than 8 tonnes.
- ii. Vibratory - of at least the equivalent compaction capacity of the deadweight roller above. It is important to ensure that the frequency and amplitude of vibration and speed of travel are correctly matched to layer thickness and mixture composition. Vibratory rollers shall not be used in vibrating mode on bridge decks.
- iii. Pneumatic tyred - of at least the equivalent compaction capacity of the deadweight roller referenced above.

Smaller rollers may be permitted for sites with restricted access, limited working area, restricted width or where the underlying construction will not support a heavier roller.

A method of assessing the performance of rollers is given in BS 598.

Finishing rolling shall be carried out with a smooth steel wheel roller which may be a tandem vibratory roller in non-vibratory mode.

The number of rollers shall be such that while travelling at a slow, steady speed sufficient passes can be made in order to compact the material to achieve the required void content and/or surface macrotexture.

Where compaction is to be determined in accordance with the requirements for  $V_{max}$  and  $V_{min}$  the Contractor may use any plant to achieve the specified level of compaction and shall finish compaction at temperatures above the minimum specified rolling temperature.

#### **10.1.9.1 Compaction Control Specific to Asphalt Concrete Mixtures - Base and Binder Course**

The compaction of asphalt concrete base and binder course mixtures shall be assessed by indirect density gauge readings or cores or a combination of both.

Compaction shall be continuously assessed using an indirect density gauge with readings taken at 20m intervals in alternate wheel tracks. Each gauge shall be individually calibrated on each mixture from each mixing plant and the calibrations shall be continually checked and updated based on correlations between gauge readings and core densities. At the locations where cores are specified to be taken, gauge readings shall be taken at the exact same location to facilitate this correlation.

For each 20m interval, the in-situ void content shall be determined in accordance with the test methods in Table 20 using the bulk density from the gauge reading and the maximum density of the material. The maximum density shall initially be taken as that provided in the mixture Type Testing report; it is the responsibility of the contractor to ensure the gauge remains calibrated to the mixture.

The average in situ void content calculated from any six consecutive indirect gauge readings shall not exceed the value stated in Table 3.

If the value in Table 3 is exceeded, a pair of cores shall be taken at each location, from outside the wheel track zone of the finished road pavement. Cores shall be cut and the void content determined in accordance with test methods in Table 20. The evaluation of the extent of any non-conformity shall be based on results obtained from the cores.

Each core extracted shall be visually examined for evidence of excessive voids below the depth to which the indirect density gauge penetrates. If excessive voids are observed, further cores shall be taken to determine its extent.

A copy of the final indirect density test results obtained and, their correlation with in-situ air void contents shall be passed to the Employer's Representative within 72 hours.

For the material from each mixing plant, compliance with the requirements of Table 3, for air void content of the laid material, shall be demonstrated by one of the following methods:

1. Where cores are required by the Employers Representative or 'to be recorded' is specified in the Tables, a pair of cores shall be taken from outside the wheel tracks of each running lane for every 1,000 linear metres laid or as otherwise specified in Appendix 7/1. Unless otherwise specified in Appendix 7/1, these cores are not required in the hard shoulder. For schemes less than 1,000m in length, a minimum of one pair of cores shall be taken unless otherwise specified in Appendix 7/1. The void content shall be determined in accordance with the test methods in Table 20 for each core pair. The average in situ void content for each of these pairs shall not exceed the value specified in Table 3. The core log shall note if the site is confined; or
2. At the discretion of the Employers Representative and where the Contractor can demonstrate by means of verifiable records that on previous Contracts of similar characteristics that the proposed specific mixture has been installed consistently within specification for the air void requirements, in this scenario coring is not required and the compaction assessment shall continue using an indirect density gauge, in accordance with 10.1.9.

The frequency of coring shall be resumed to comply with 1 above where compliance cannot be demonstrated, or doubt exists on the part of the Employer's Representative. In the event that the measured air void content does not comply with the requirements of Table 3, then further air void content testing shall be carried out to establish the extent of the non-conformity. If it is necessary to remove and replace any material to restore conformity, this shall be in length not less than 15 metres.

For the material from each mixing plant, compliance with the requirements of Table 3, for air void content within 100mm of the joints, shall be demonstrated by one of the following methods:

1. Where cores are required by the Employers Representative or 'to be recorded' is specified in the Tables, a pair of cores shall be taken within every 500 linear metres laid, or as otherwise specified in Appendix 7/1. The cores shall be centred 100mm from the final joint position at any unsupported edge that will form a joint with an adjacent running lane. Unless otherwise specified in Appendix 7/1, these cores are not required along the hard shoulder. The void content shall be determined in accordance with the test methods in Table 20 for each core pair. The average in situ void content for each of these pairs shall not exceed the value stated in Table 3; or
2. At the discretion of the Employer's Representative and where the Contractor can demonstrate by means of verifiable records that on previous Contracts of similar characteristics that the proposed specific mixture has been installed consistently within specification for the air void requirements, in this scenario coring is not required and the compaction assessment shall continue using an indirect density gauge, in accordance with 10.1.9.

The frequency of coring shall be resumed to comply with 1 above where compliance cannot be demonstrated, or doubt exists on the part of the Employer's Representative. In the event that the measured air void content does not comply with the requirements of Table 3, then further air void content testing shall be carried out to establish the extent of the non-conformity. If it is necessary to remove and replace any material to restore conformity, this shall be in length not less than 15 metres.

The volumetric properties of base and binder course design mixtures shall be monitored by determining the void content of cores compacted to refusal.

For the material from each mixing plant, compliance with the requirements of Table 3, for air void content at refusal, shall be demonstrated by one of the following methods:

1. Where cores are required by the Employers Representative or 'to be recorded' is specified in the Tables, a pair of cores shall be taken from outside the wheel tracks of each running lane for every 1,000 linear metres laid or as otherwise specified by the Employers Representative. Unless otherwise specified in Appendix 7/1, these cores are not required in the hard shoulder. The mean air void content at refusal shall be determined in accordance with the test methods in Table 20. The core log shall note if the site is confined; or
2. At the discretion of the Employer's Representative and where the Contractor can demonstrate by means of verifiable records that on previous contracts of similar characteristics that the proposed specific mixture has been installed consistently within specification for the air void requirements, in this scenario coring will not be required and the compaction assessment shall continue using an indirect density gauge, in accordance with 10.1.9.

If the mean air void content at refusal of any three consecutive pairs of cores falls below the level in Table 3, the mixture target composition shall be reviewed and the Type Test revalidated.

### 10.1.9.2 Compaction Control Specific to Hot Rolled Asphalt Mixtures

For the material from each mixing plant, compliance with the requirements of Table 6 be demonstrated by one of the following methods:

1. Where cores are required by the Employers Representative or 'to be recorded' is specified in the Tables, a pair of cores shall be taken from outside the wheel tracks of each running lane for every 1,000 linear metres laid or as otherwise specified in Appendix 7/1. Unless otherwise specified in Appendix 7/1, these cores are not required in the hard shoulder. For schemes less than 1,000m in length, a minimum of one pair of cores shall be taken unless otherwise specified in Appendix 7/1. The void content shall be determined in accordance with the test methods in Table 20 for each core pair. The average in situ void content for each of these pairs shall not exceed the value specified in Table 3. The core log shall note if the site is confined; or
2. At the discretion of the Employer's Representative and where the Contractor can demonstrate by means of verifiable records that on previous contracts of similar characteristics that the proposed specific mixture has been installed consistently within specification for the air void requirements, in this scenario coring will not be required, in accordance with 10.1.9.

The frequency of coring shall be resumed to comply with 1 above where compliance cannot be demonstrated, or doubt exists on the part of the Employer's Representative. In the event that the measured air void content does not comply with the requirements of Table 6, then further air void content testing shall be carried out to establish the extent of the non-conformity. If it is necessary to remove and replace any material to restore conformity, this shall be in length not less than 15 metres.

Three-point static deadweight rollers with a minimum weight of 10 tonnes shall be used as lead rollers to trap coated chippings in the HRA surface. Tandem vibratory rollers shall only be used as finishing rollers in non-vibratory mode.

### 10.1.9.3 Compaction Control Specific to Stone Mastic Asphalt Binder Course Mixtures

For the material from each mixing plant, compliance with the requirements of Table 9 be demonstrated by one of the following methods:

1. Where cores are required by the Employers Representative or 'to be recorded' is specified in the Tables, a pair of cores shall be taken from each running lane from outside the wheel tracks for every 1,000 linear metres laid or as otherwise specified in Appendix 7/1. Unless otherwise specified in Appendix 7/1, these cores are not required in the hard shoulder. For schemes less than 1,000m in length, a minimum of one pair of cores shall be taken unless otherwise specified in Appendix 7/1. The void content shall be determined in accordance with the test methods in Table 20 for each core pair. The average in situ void content for each of these pairs shall not exceed the value stated in Table 9. The core log shall note if the site is confined; or
2. At the discretion of the Employer's Representative and where the Contractor can demonstrate by means of verifiable records that on previous contracts of similar characteristics that the proposed specific mixture has been installed consistently within specification for the air void requirements, in this scenario coring will not be required and the compaction assessment shall continue using an indirect density gauge, in accordance with 10.1.9.

The frequency of coring shall be resumed to comply with 1 above where compliance cannot be demonstrated, or doubt exists on the part of the Employer's Representative.

In the event that the measured air void content does not comply with the requirements of Table 9, then further air void content testing shall be carried out to establish the extent of the non-conformity. If it is necessary to remove and replace any material to restore conformity, this shall be in length not less than 15 metres.

#### **10.1.9.4 Compaction Control Specific to Porous Asphalt Mixtures**

Porous asphalt shall be compacted using a minimum of two 6 to 8 tonne, non-vibrating, steel wheel tandem rollers for each paving machine. If a vibratory type roller is used it shall be operated in a non-vibrating mode. To avoid 'pick-up', the roller drum surfaces shall be initially clean and completely wetted prior to and during rolling.

Pneumatic tyred rollers and three wheeled rollers shall not be used.

Rolling shall commence at the highest temperature consistent with no shoving and shall be substantially completed within the temperature range given in Table 12.

The first roller pass shall be on the low edge of the paved material, followed by the high edge. Rolling of the rest of the surface shall then proceed from low to high side and shall continue until all roller marks have been removed.

For the material from each mixing plant, a pair of cores shall be taken from each running lane for every 1,000 linear metres laid. Unless otherwise specified in Appendix 7/1, these cores are not required in the hard shoulder. For schemes less than 1,000m in length, a minimum of one pair of cores shall be taken unless otherwise specified in Appendix 7/1. The void content shall be determined in accordance with Table 20 for each core pair. The average in situ void content for each of these pairs shall not exceed the value stated in Table 12. The cores shall be extracted from outside of the wheel tracks for the surface course layer. The core log shall note if the site is confined.

#### **10.1.10 Performance Requirements**

##### **10.1.10.1 Performance Requirements Specific to Asphalt Concrete Base and Binder Course Mixtures**

For the Material from each mixing plant, compliance with the requirements of Table 3, for resistance to permanent deformation of material laid in the Works shall be monitored and demonstrated by:

1. Where cores are required by the Employers Representative, two cores shall be taken from the first kilometre length of material and thereafter one further core from each subsequent lane kilometre. The cores shall be extracted from outside the wheel tracks; or
2. At the discretion of the Employers Representative and where the Contractor can demonstrate by means of verifiable records that on previous contracts of similar characteristics that the proposed specific mixture has been installed consistently within specification for the resistance to permanent deformation requirements, in this scenario coring will not be required.

Testing shall be carried out in accordance with the test methods in Table 20.

Where Reclaimed Asphalt is a constituent of the mixture, additional performance testing of the Works shall be required as specified in Table 13d.

### **10.1.10.2 Performance Requirements Specific to Hot Rolled Asphalt Surface Course Mixtures**

For the Material from each mixing plant, compliance with the requirements of Table 6, for resistance to permanent deformation of material laid in the Works shall be monitored and demonstrated by

1. Where cores are required by the Employers Representative, six cores shall be taken from the works. The cores shall be extracted from outside the wheel tracks;  
or
2. At the discretion of the Employers Representative and where the Contractor can demonstrate by means of verifiable records that on previous Contracts of similar characteristics that the proposed specific mixture has been installed consistently within specification for the resistance to permanent deformation requirements, in this scenario coring will not be required.

Testing shall be carried out in accordance with the test methods in Table 20.

### **10.1.10.3 Performance Requirements Specific to Stone Mastic Asphalt Mixtures**

For the Material from each mixing plant compliance with the requirements of Table 9, for resistance to permanent deformation of material laid in the Works shall be monitored and demonstrated by

1. Where cores are required by the Employers Representative, two cores shall be taken from the Works. The cores shall be extracted from outside the wheel tracks;  
or
2. At the discretion of the Employer's Representative and where the Contractor has demonstrated by means of verifiable records that on previous contracts of similar characteristics that the proposed specific mixture has been installed consistently within specification for the resistance to permanent deformation requirements, in this scenario coring will not be required.

Testing shall be carried out in accordance with the test methods in Table 20.

### **10.1.10.4 Performance Requirements Specific to Porous Asphalt**

Hydraulic Conductivity

After the porous asphalt has cooled to ambient temperature, and before trafficking, the relative hydraulic conductivity of the material shall be measured in accordance with IS EN 12697-40 and performance levels stated in Table 12.

### **10.1.11 Surface Macrotexture**

The macrotexture of bituminous surface courses shall be controlled and monitored in accordance with the requirements of Table 3, Table 6 and Table 9 and the specific requirements of this Clause.

The initial surface macrotexture after compaction and before opening to traffic shall be measured using the volumetric patch method described in IS EN 13036-1.

For all carriageways these measurements shall be carried out for each individual carriageway lane width as soon as possible after laying and before opening to traffic. Measurements shall be made on 50m lane lengths evenly spaced along the section and covering not less than one third of the section tested. On each 50m lane length, 10 individual measurements of the texture depth shall be taken at approximately 5m spacings along a diagonal line across the carriageway lane width. Measurements shall not be taken within 300mm of the longitudinal edge of the carriageway.

To reduce the variability, the determination of the average texture depth may be based on a test section of not less than six sets of ten individual measurements. For schemes less than 1,000m in length it may be practicable to:

- i. Carry out measurements over the entire surface course; or
- ii. Over alternate 50m lengths covering 50% of the work.

Where this cannot reasonably be achieved the test measurements should be regularly spaced over 50m lengths of the carriageway lane, covering not less than one third of the surfacing laid in one lane.

On larger schemes, exceeding a kilometre in length, select test sections of carriageway 1000m long in the same way.

For surface courses the surface texture may be measured using a Laser system to the Specification necessary to enable the Mean Profile Depth (MPD) to be calculated at one metre intervals in accordance with ISO 13473-1 e.g. RSP or equivalent.

Whilst measurement of macrotexture for compliance purposes is by the volumetric patch technique specified in IS EN 13036-1 only, the measurement using MPD may be used as a screening procedure. In the event of dispute or discrepancy between the two methods, only results obtained using the volumetric patch technique will be considered for compliance purposes.

#### **10.1.11.1 Surface Macrotexture Specific to Hot Rolled Asphalt**

The macrotexture of HRA surface courses shall be controlled and monitored in accordance with the requirements of Table 6 and the specific requirements of this Clause.

For all carriageways, these measurements shall be carried out for each individual lane width as soon as possible after laying and before opening to traffic. To reduce the variability, the determination of the average texture depth shall be based on a test section of not less than four sets of ten individual measurements, with the texture depth determined for each lane as follows.

For shorter schemes (less than 400m in length), measurements for every 50m lane length over the entire surface course shall be carried out.

For longer schemes, the overall scheme length shall be sub-divided into 400m sections. Measurements shall be carried out over alternate 50m lane lengths in every 400m section covering not less than 50% of the work.

To further reduce the variability, limits have been set for the individual values within each 50m lane length as shown in Table 6.

In addition to the assessment of macrotexture by the volumetric patch and/or laser techniques, a visual assessment shall be carried out to assess that a positive macrotexture has been achieved. The visual assessment shall be carried out along the same 50m lane lengths assessed for macrotexture. A format to undertake the visual assessment is contained in NGA 10.1.11 of Annex A of CC-GSW-00900.

In the event that the visual assessment does not result in agreement between the Contractor and Employer's Representative that positive macrotexture has been achieved, a 3D photogrammetry survey shall be undertaken.

The 3D Photogrammetry survey shall be undertaken at similar locations to the macrotexture and visual assessment. The location and testing frequency of the data collection procedure for the 3D Photogrammetry survey shall follow the same procedure as for the volumetric patch test outlined above.



The determination of the average Count50 parameter shall be based on a test length of 50m. The surface in the 50m length shall be considered as exhibiting a positive macrotexture if the average 3D Photogrammetry parameter, Count50, is greater than 4.

The result of the 3D photogrammetry shall be deemed the definitive assessment of positive macrotexture.

A format to undertake the 3D photogrammetry assessment can be found in CC-PAV-04010 The Use of Close Range Photogrammetry to Characterise Texture in a Pavement Surfacing Material.

Further information relating to the visual assessment and 3D Photogrammetry methods is contained in section NG 10.1.11.1 of CC-GSW-00900.

### **10.1.12 Trafficking**

Construction plant used on pavements under construction shall be suitable in relation to material, condition, and thickness of the course over which it traverses so that damage is not caused to the subgrade or the pavement courses already constructed. The wheels or rubber tracks of plant moving over the various pavement courses shall be kept free from deleterious materials. No steel tracked vehicles shall be permitted to run on bituminous pavement layers.

In order to exclude moisture from interfaces and ensure full interlayer bonding, the surface of all bituminous material shall be kept clean and uncontaminated. The only traffic permitted to run on the surface of bituminous material to be overlaid shall be that engaged in laying and compacting the next course or, where a binder course is to be blinded or surface dressed, that is engaged on surface treatment. If any surface becomes contaminated, it shall be made good by cleaning and, if this proves impracticable, by rectification in compliance with CC-SPW-00700.

## **Use of Surfaces by Traffic**

Where a material other than a surface course is open to live traffic, appropriate measures shall be implemented to ensure that drivers are adequately alerted to the unfinished nature of the Works where appropriate. These measures shall include:

- i. Appropriate signage and lining in accordance with Chapter 8 of the Traffic Signs Manual.
- ii. The use of Cautionary Speed Plates or Statutory Road Works Speed Limits as appropriate.
- iii. Distinctive orange coloured road marking paint or tape shall be used as temporary centre line and edge markings to further emphasise the unfinished nature of the road.

The measures outlined above shall remain in place until the Works are complete.

### **Use of Surfaces by Traffic - Requirements Specific to Porous Asphalt Mixtures**

To avoid damage and to prevent detritus being spread over the surface, traffic and construction plant shall be kept off the surface until opening of the road or until issue of the Certificate of Completion for the relevant Section of the Works, whichever is the later, unless otherwise agreed by the Employer's Representative.

### **10.1.13 Aftercare**

The Contractor shall ensure the pavement material has adequately cooled and hardened before the road is opened to traffic.

Unless otherwise agreed by the Employer's Representative, the road shall not be opened to traffic if its surface temperature exceeds 25oC unless the maximum temperature within the laid material has fallen below 35oC.

### **10.1.14 Reinstatement of Core Holes**

Reinstatement of core holes shall be carried out as follows:

- i. The walls and base of all holes from which core samples have been cut shall be dried and painted with hot 40/60 or 70/100 paving grade bitumen or cold-applied polymer modified bitumen emulsion immediately prior to being back-filled.
- ii. Hot binder course or base material similar to that in the existing pavement shall be used for the back-filling of layers more than 50mm below the surface.
- iii. Surface course reinstatement material shall comply with the requirements of this Specification and be the same as the existing surface.
- iv. Core holes shall be back-filled and then compacted to refusal with a circular-headed vibrating hammer or equivalent device in layers not exceeding 75mm thick.

## **10.2 Surface Treatments**

### **10.2.1 General**

The Producer shall use constituents which comply with harmonised European Standards (hENs) and are CE marked. Where a hEN does not exist for a constituent, the manufacturer of the constituent shall have employed a quality management system in accordance with IS EN 9001, or equivalent, as part of their factory production control.

#### **10.2.1.1 Preparation**

Existing road markings, ironwork and road studs shall be suitably masked. Street furniture shall be masked using self-adhesive masking material; oil, sand or similar materials shall not be used.

The surface shall be vigorously brushed to remove dust, laitance and other loose matter. Any oil visible on the surface shall be removed by washing and scrubbing with detergent solution followed by flushing with clean water. Where the product is a proprietary material, preparation as per the manufacturer's needs shall be provided in addition to these requirements.

For high friction surfacing, the surface shall be allowed to dry before application of the binder.

### **10.2.2 Microsurfacing**

#### **10.2.2.1 Works Proposals and Approval Process**

The Producer shall be responsible for meeting the requirements set out in Appendix 7/10.

Before work commences, the Producer shall submit a works proposal to the Employer's Representative detailing the proposed method of executing the Works. This shall include:

- i. The TAIT Certificate(s) for the proposed microsurfacing product(s).
- ii. CE Marking, DOP, FPC Certificate for the proposed microsurfacing product(s).
- iii. Any weather limitations.
- iv. Type Test report.

The TAIT shall have been carried out on a site with similar characteristics and traffic category to that to be treated in the Contract.

The Employer's Representative may wish to inspect all or any of the documentation forming part of the Producer's FPC system to be satisfied on the nature of the systems in place at the constituent material suppliers.

### **10.2.2.2 Performance Requirements**

The performance of the microsurfacing shall be maintained against defects and against failure to meet the specification for a period of five years, or the period specified in Appendix 7/10, from the date of completion of the Works. This period shall be known as the 'Design Working Life'.

The Producer shall be responsible for maintaining the performance requirements set out in Appendix 7/10 throughout the 'Design Working Life'.

With regard to surface macrotexture performance, the definitive test is the volumetric patch technique measured in accordance with IS EN 13036-1. Measurements shall be made on 50m lane lengths evenly spaced along the section and covering not less than one third of the section tested. On each 50m lane length, 10 individual measurements of the texture depth shall be taken at approximately 5m spacings along a diagonal line across the carriageway lane width. Measurements shall not be taken within 300mm of the longitudinal edge of the carriageway.

To reduce the variability, base the determination of the average texture depth of a test section on not less than six sets of ten individual measurements. For small schemes it may be practicable to carry out measurements over the entire surface course or over alternate 50m lengths covering 50% of the work. Where this cannot reasonably be done test measurements shall be made over regularly spaced 50m lengths of carriageway lane, covering not less than one third of the surfacing laid in one lane. On larger schemes, exceeding a kilometre in length, select test sections of carriageway 1000m long in the same way.

The average macrotexture depth of each lane kilometre, or the complete carriageway lane where this is less than 1,000 linear metres, shall be as specified in Appendix 7/10.

### **10.2.3 Surface Dressing**

#### **10.2.3.1 Recipe Surface Dressing (RSD)**

##### **10.2.3.1.1 Works Proposals**

The Producer shall be responsible for meeting the requirements set out in Appendix 7/21.

Before work commences, the Producer shall submit a works proposal to the Employer's Representative detailing the proposed method of executing the Works. This shall include:

- i. Handling and storage of constituent materials.
- ii. Application of binder.
- iii. Application of chippings.
- iv. Rollers and sweepers.
- v. Site preparation.
- vi. Any weather limitations.
- vii. Trafficking and aftercare.

The Producer shall also provide the Employer's Representative with the DoP and CE Marking for the binder and chippings proposed to comply with the requirements of in Appendix 7/21, Table 15, Table 17 and Table 18.

### **10.2.3.1.2 Handling and Storage**

Chippings shall be stockpiled to ensure continuity of supply once work commences.

Stockpiles shall be managed and maintained so as to avoid the risk of cross contamination and degradation of the various sizes from the declared performance.

### **10.2.3.1.3 Application of Binder**

Before a binder sprayer is used in the Works, the Producer shall provide the Employer's Representative with a calibration certificate to confirm compliance with the category specified in Appendix 7/21.

The binder sprayer shall be checked on site for accuracy of transverse distribution in accordance with IS EN 12272-1. The category for accuracy of spread of binder and the category for tolerance on the rate of spread of binder shall be as specified in Appendix 7/21, as selected from Table 22a. Testing shall be conducted at a frequency according to the traffic volume as detailed in Table 22b.

Binder shall be applied to the road surface at the rates specified in Appendix 7/21. Areas where an adjusted binder rate is needed because of localised conditions shall be noted and such changes recorded in the As Constructed documentation. Restrictions in the event of adverse weather together with any additional limitations are set out in Appendix 7/21.

### **10.2.3.1.4 Application of Chippings**

Before a chipping spreader is used in the Works, the Producer shall provide the Employer's Representative with a calibration certificate to confirm compliance with the category specified in Appendix 7/21 for each chipping size and source.

The chipping spreader shall be checked on site for accuracy of transverse distribution in accordance with IS EN 12272-1.

The category for accuracy of spread of chippings and the category for tolerance on the rate of spread of chippings shall be as specified in Appendix 7/21, as selected from Table 22a. Testing shall be conducted at a frequency according to the traffic volume as detailed in Table 22b.

Chipping spreaders shall have controlled metering and be capable of variable or fixed width application to match the binder sprayer. During application, the chipping spreader shall not fall more than 30 metres behind the binder sprayer.

### **10.2.3.1.5 Rollers**

Rolling shall be performed by pneumatic tyred rollers, rubber coated vibratory steel rollers or other types where road profile and chipping quality allow. The rolling shall not cause damage to the chippings. The rollers shall have fully operating sprinkler systems, spraying water or other release agent onto the drum or tyres. Each layer of chippings shall receive a minimum number of four passes operating at a speed of 15km/hr to 20km/hr.

### **10.2.3.1.6 Sweepers**

Where double or multi-layered surface dressings are to be installed, at least one suction sweeper shall be available on site to keep the lane to be treated clear of loose chippings and to remove any accidental spillage or excess applied.

### **10.2.3.1.7 Joints**

Transverse joints shall be formed with spraying starting and finishing on a protective strip not less than one metre wide at each end of the lane length being treated. Transverse joints shall be of binder overlap only and not wider than 150mm. There shall be no ridges or bare strips.

Longitudinal joints shall coincide with centre of lane markings. Longitudinal joints shall be of binder overlap only and, while ensuring that the proposed rate of spread is achieved across the joint, shall not be wider than 150mm. There shall be no ridges or bare strips.

The overlap areas of binder for both transverse and longitudinal joints shall not be chipped during the surface dressing of the first strip. In multiple surface dressings, joints shall be staggered to provide a uniform finish. At intermediate stops in the gritting process, the chippings spreader shall stop 150mm to 300mm short of the sprayed area. At ends of sections, chippings shall be applied right up to the end of the strip of sprayed binder.

#### **10.2.3.1.8 Weather Conditions**

The Producer's works proposals shall cover weather limitations; any specific weather requirements shall be stated in Appendix 7/21. The works proposal shall state the Works can be constructed within the Contract Period such that the Works will not be interrupted by the weather conditions.

Application restrictions to be observed in the event of adverse weather shall be as specified below together with any additional limitations set out in Appendix 7/21 and shall also be covered in the Producer's works proposals.

- i. Works shall be carried out between April and August, unless otherwise specified in Appendix 7/21.
- ii. When there is precipitation or if heavy precipitation is forecast.
- iii. When there is free water on the surface.
- iv. When the road temperature is at or below 15°C.

#### **10.2.3.1.9 Testing**

To ensure quality control of the specified components during the Works, the Producer shall obtain samples. Samples shall be taken at the frequency specified in Appendix 1/5.

Sampling of binder shall be carried out in accordance with IS EN 58. Each sample shall consist of 5 litres of binder and sampled at the point of delivery that shall be retained for use by the Purchaser, and which may also be used by the Market Surveillance Authority or the Competent National Authority.

Bulk sampling of chippings shall be carried out in accordance with IS EN 932-1.

To ensure quality control of equipment during the Works, the Producer shall carry out the tests for rates of spread and accuracy of application of binder and chippings as stated in Table 22b.

The Producer shall supply and deliver samples of material to the Employer's Representative in accordance with Appendix 1/5.

#### **10.2.3.1.10 Trafficking and Aftercare**

Masking shall be removed after the surface dressing has been applied and before opening the road to restricted traffic.

In accordance with Chapter 8 - Temporary Traffic Measures and Signs for Road Works, aftercare signage and traffic control shall be installed to regulate traffic behaviour after the road is opened.

The Producer shall monitor the surface dressing closely for a minimum period of 2 hours, or as specified in Appendix 7/21, after the road is opened to restricted traffic.

The minimum time period before unrestricted traffic may use the surface dressing shall be specified in Appendix 7/21. All aftercare signage shall be removed once unrestricted traffic is permitted to use the surface dressing.

The Producer shall remove surplus chippings from the road by suction sweeping before it is opened to unrestricted traffic. This operation shall not dislodge chippings or disturb the chipping mosaic.

Further operations to remove subsequently loosened chippings shall be carried out over the next 48 hours. This shall not dislodge chippings or disturb the chipping mosaic. The road, and adjacent side roads, footways and paved areas shall be kept substantially free of loose chippings for a maximum period of 30 days after completion of the Works.

Any defects arising from deficiencies in the materials, workmanship and aftercare manifest during or at the end of the Defects Period shall be rectified by the Producer at his own expense.

#### **10.2.3.1.11 As-Built Records**

Not more than 30 days after completion of the Works, the Producer shall provide a record of the progress of the work in accordance with Preparation and Delivery Requirements for As-Built Records (CC-CMG-04001). Such records shall incorporate all relevant information, including:

1. Design requirements;
2. Site location;
3. Road assessment;
4. Variations to the design and those necessitated by localised site conditions;
5. Test results;
6. Plant details;
7. Traffic control carried out;
8. Weather information;
9. Site photographs taken at each stage of the Works;
10. Unforeseen problems;
11. A list of complaints, if any, from the general public or road users; and
12. Any other information that the Employer's Representative may reasonably require to have included.

#### **10.2.3.2 Surface Dressing Product (End Performance)**

##### **10.2.3.2.1 Works Proposals and Approval Process**

The Producer shall be responsible for meeting the requirements set out in Appendix 7/3.

Before work commences, the Producer shall submit a works proposal to the Employer's Representative detailing the proposed method of executing the Works. This shall include:

- i. The TAIT Certificate(s) for the proposed surface dressing product(s).
- ii. CE Marking, DOP, FPC Cert for the proposed surface dressing product(s).
- iii. Any weather limitations.
- iv. Trafficking and Aftercare.
- v. Type Test report.

The TAIT shall have been carried out on a site with similar characteristics and traffic category to that to be treated in the Contract.

The Employer's Representative may wish to inspect all or any of the documentation forming part of the Producer's FPC assessment system to be satisfied on the nature of the systems in place at the constituent material suppliers.

#### **10.2.3.2.2 Trafficking and Aftercare**

The Producer shall have responsibility for methods of trafficking and aftercare of the surface dressing product. All procedures undertaken shall be documented.

#### **10.2.3.2.3 Performance Requirements**

The performance of the surface dressing product shall be maintained against defects and against failure to meet the specification for a period of five years, or the period specified in Appendix 7/3, from the date of completion of the Works. This period shall be known as the 'Design Working Life'.

The Producer shall be responsible for maintaining the performance requirements set out in Appendix 7/3 throughout the 'Design Working Life'.

With regard to surface macrotexture performance, the definitive test is the volumetric patch technique measured in accordance with IS EN 13036-1. Measurements shall be made on 50m lane lengths evenly spaced along the section and covering not less than one third of the section tested. On each 50m lane length, 10 individual measurements of the texture depth shall be taken at approximately 5m spacings along a diagonal line across the carriageway lane width. Measurements shall not be taken within 300mm of the longitudinal edge of the carriageway.

To reduce the variability, base the determination of the average texture depth of a test section on not less than six sets of ten individual measurements. For small schemes it may be practicable to carry out measurements over the entire surface course or over alternate 50m lengths covering 50% of the work. Where this cannot reasonably be done test measurements shall be made over regularly spaced 50m lengths of carriageway lane, covering not less than one third of the surfacing laid in one lane. On larger schemes, exceeding a kilometre in length, select test sections of carriageway 1000m long in the same way.

The average macrotexture depth of each lane kilometre, or the complete carriageway lane where this is less than 1,000 linear metres, shall be as specified in Appendix 7/3.

### **10.2.4 High Friction Surfacing**

#### **10.2.4.1 Works Proposals and Approval Process**

The Contractor shall be responsible for meeting the requirements set out in Appendix 7/11.

Before work commences, the Contractor shall submit a works proposal to the Employer's Representative detailing the proposed method of executing the Works. This shall include:

- i. Mixing and laying procedures – including substrate preparation, pull-off test procedures, process of binder mixing and laying processes (mechanically or manually), size and type of sprayer/applicator, aggregate broadcasting process (mechanically or manually), and method employed to ensure acceptable rate of spread of binder.
- ii. Measures to address working in different climatic conditions.
- iii. How traceability of the material in the Works will be addressed.

The prTAIT shall have been carried out on a site with similar characteristics and traffic category to that to be treated in the Contract.

The Employer's Representative may wish to inspect all or any of the documentation forming part of the Producer's FPC assessment system to be satisfied on the nature of the systems in place at the constituent suppliers.

#### **10.2.4.2 Existing Surface**

The macrotexture of the existing surface shall be between 0,50mm to 2,0mm unless otherwise verified by the prTAIT in accordance with DN-PAV-03075.

High friction surfacing shall not be installed on concrete substrate unless otherwise verified by the prTAIT in accordance with DN-PAV-03075.

The Contractor shall be satisfied that the existing surface is suitable to achieve the performance requirements of this Clause.

#### **10.2.4.3 Transport**

Storage and transportation to site shall comply with the requirements of the prTAIT.

#### **10.2.4.4 Weather Conditions**

High friction surfacing shall be installed when the surface temperature of the substrate is between 5°C and 35°C unless otherwise verified by the prTAIT in accordance with DN-PAV-03075.

High friction surfacing shall be installed within the weather conditions specified in the prTAIT.

The Contractor shall take account of the weather conditions when planning his working methods.

#### **10.2.4.5 Laying**

The performance of the product's bond to the substrate shall be carried out by conducting the pull-off test in accordance with ASTM C1583 and the requirements of Table 23e. For broadcast systems, the test shall be carried out on site at the time of installation prior to application of the aggregate. For screeded systems, the test shall be carried out on site on the system.

Testing shall be carried out at two locations within the Works area, at least one of these to be in the wheel track zone, with locations to be spaced at least 20m apart. The test shall be carried out by the Contractor and witnessed by the Employer's Representative. In the event of the Employer's Representative not being present, the Contractor shall propose a method of verification in the works proposal.

The method of installation shall be such that the finished surface is free from dragging, tearing and segregation of the material.

Installation of the product/system shall be in accordance with the requirements of the prTAIT, as defined in DN-PAV-03075.

On freshly laid asphalt, high friction surfacing shall be applied within the time interval specified in Table 23d.

#### **10.2.4.6 Trafficking and Aftercare**

Trafficking of high friction surfacing shall be carried out as directed by the Contractor in the prTAIT. The time period between completion of works and opening to live traffic shall be in accordance with the manufacturer's requirements, as demonstrated in the prTAIT.

Prior to trafficking, all masking material shall be removed. During the curing period no disturbance or trafficking of the treated surface shall be permitted.



Prior to opening to unrestricted traffic, excess aggregate shall be removed by vacuum sweeper. Rolling of the aggregate shall not be permitted. This operation shall not dislodge aggregate.

All aftercare signage shall be removed once unrestricted traffic is permitted to use the high friction surfacing.

#### **10.2.4.7 Performance Requirements**

The performance of the high friction surfacing shall be maintained against defects and against failure to meet the specification for a period of five years, or the period specified in Appendix 7/11, from the date of completion of the Works. This period shall be known as the 'Design Working Life'.

The Producer shall be responsible for maintaining the performance requirements set out in Appendix 7/11 throughout the 'Design Working Life'.

With regard to surface macrotexture performance, the definitive test is the volumetric patch technique measured in accordance with IS EN 13036-1. Measurements shall be made on 50m lane lengths evenly spaced along the section and covering not less than one third of the section tested. On each 50m lane length, 10 individual measurements shall be taken of the texture depth at approximately 5m spacings along a diagonal line across the carriageway lane width. Measurements shall not be taken within 300mm of the longitudinal edge of the carriageway.

To reduce the variability, base the determination of the average texture depth of a test section on not less than six sets of ten individual measurements. For small schemes it may be practicable to carry out measurements over the entire surface course or over alternate 50m lengths covering 50% of the work. Where this cannot reasonably be done test measurements shall be made over regularly spaced 50m lengths of carriageway lane, covering not less than one third of the surfacing laid in one lane. On larger schemes, exceeding a kilometre in length, select test sections of carriageway 1000m long in the same way.

The average macrotexture depth of each lane kilometre, or the complete carriageway lane where this is less than 1,000 linear metres, shall be as specified in Appendix 7/11.

### **10.3 Miscellaneous Products and Processes**

#### **10.3.1 Low Energy Bound Mixtures**

##### **10.3.1.1 General**

Low Energy Bound Mixtures (LEBM) shall be subject to a Type Test in accordance with the requirements of DN-PAV-03075 and shall demonstrate compliance with the performance requirements of Table 24g.

##### **10.3.1.2 Preparation**

Pre-milling of asphalt, where required, shall be undertaken using a milling machine.

##### **10.3.1.3 Works Proposals**

The Producer shall be responsible for meeting the requirements set out in Appendix 7/12.

Before work commences, the Contractor shall submit a works proposal to the Employer's Representative detailing the proposed method of executing the Works. This shall include:

- i. Method to be employed for installation and to ensure compaction.
- ii. Measures to deal with hard edges and obstructions.

- iii. Measures to avoid problems caused by weather.
- iv. The joint formation procedures for each layer – including width, location of longitudinal and transverse joint(s), and method(s) of treating upstanding edges.
- v. How traceability of the material in the Works will be addressed.
- vi. Contingency plan to correct any damage or defects to the LEBM.

#### **10.3.1.4 Transport**

Ex situ materials shall be covered by an impervious sheet (tarpaulin) to minimise moisture loss.

#### **10.3.1.5 Weather Conditions**

The Producer shall take account of the weather conditions when planning the working methods. The working methods shall comply with all weather related requirements of this Clause.

Laying of LEBM shall not proceed if any of the following conditions are present:

- i. The temperature of the surface to be covered is less than 2°C.
- ii. The air temperature is less than 0°C.
- iii. The surface to be covered is frozen or frost, ice, snow, salt or grit is present on the surface.
- iv. During heavy or persistent rain.
- v. When standing water is present.

LEBM construction works shall not be carried out in weather conditions (heat, wind, rain, etc.) which may adversely affect the optimum moisture content and the workability (breaking of the emulsion) of the LEBM. If weather conditions do affect the optimum moisture content, the Producer shall take corrective action to ensure the LEBM is laid to maintain the optimum moisture content.

#### **10.3.1.6 Laying**

##### **10.3.1.6.1 General**

The method of installation shall be such that the finished surface is free from dragging, tearing and segregation of the material.

Nominal and minimum compacted layer thicknesses for the particular mixture shall be in accordance with Table 24f and any additional requirements of this Clause.

The pavement thickness design shall be monitored at 100m intervals during construction and recorded.

All plant shall be maintained in accordance with the manufacturer's requirements and be suitable for the mixture being installed.

##### **10.3.1.6.2 Plant Mixed (Ex Situ) Mixtures**

Ex situ LEBM shall be laid and compacted within two hours after the mixture has left the mixing plant. The moisture content shall be within  $\pm 2\%$  of the optimum moisture content stated in the works proposals.

To the maximum extent practical, ex situ LEBM shall be spread, levelled and tamped by a self-propelled paving machine. The rate of delivery of material to the paver shall be regulated to enable the paver to operate continuously.

The plant used for placing, grading and shaping the ex situ LEBM shall be capable of laying the material evenly and to the required thickness across at least one lane width.

#### **10.3.1.6.3 In Situ Produced Mixtures**

In situ LEBM shall be laid and compacted within two hours of the final pass of the stabilising plant, unless a curing or 'maturing' period of aeration is required.

The plant used for pulverisation shall be capable of uniformly pulverising the existing road structure in a single pass, to the design depth. The plant shall be equipped with a means of controlling the depth of processing to  $\pm 15$ mm of the required depth.

The plant used for grading and shaping the in situ LEBM shall be capable of laying the material evenly and to the required thickness across at least one lane width.

Any open or segregated surface area shall be blinded using dry crushed rock fines.

#### **10.3.1.7 Joints**

All longitudinal and transverse joints shall be trimmed to a vertical edge immediately prior to forming the joint.

Longitudinal joints in all layers shall be situated outside wheel track zones. For the purpose of this Clause, the wheel track zone shall be taken to be between 0,4m and 1,0m, and between 2,45m and 3,05m from the centre of the nearside lane markings for each traffic lane (or in the absence of lane markings, lane edges).

#### **10.3.1.8 Compaction Control**

The compaction of each layer shall be carried until the required in situ density is achieved and the layer provides a stable and dense tight surface.

The in situ bulk density shall be measured after shaping, trimming and final compaction at intervals of 50m in all lanes (including hard shoulder). The in situ bulk density values obtained shall comply with Table 24g.

The stability of the layer after compaction shall be deemed adequate as demonstrated by the Stability Test in Clause 10.3.1.10. Open edges shall be protected from traffic.

#### **10.3.1.9 Sealing**

When specified in Appendix 7/12, the surface shall be sealed on completion of compaction using a sprayed membrane of cationic bitumen emulsion. The bitumen emulsion shall be sprayed at a rate of at least 0.2kg/m<sup>2</sup> of residual bitumen, or as otherwise specified in Appendix 7/12, to achieve a uniform and continuous seal to the surface of the layer.

#### **10.3.1.10 Stability Test**

The stability of the layer under compaction shall be deemed adequate if the finished surface does not shove, rut or exhibit transverse cracking under the load of subsequent construction traffic. A stability test shall be conducted to assess the stability of a layer in any area. The stability tests shall be carried out on the lane(s) to be trafficked. The test shall be undertaken as follows:

- i. After a curing period of at least 24 hours, the area shall be subjected to channelled trafficking using a rigid three-axle tipper truck loaded to a gross mass of 24 tonnes (assumed equivalent to three standard axles).

- ii. The vertical deformation shall be measured in all wheel tracks at monitoring points on each of 5 transverse sections set one metre apart after 5, 15, 30 and 40 passes of the truck.
- iii. The mean vertical deformations at the above trafficking increments shall be plotted against the respective number of truck passes and the mean vertical deformation corresponding to 100 standard axles shall be interpolated.
- iv. The LEBM layer shall be deemed acceptable if the mean vertical deformation corresponding to 100 standard axles is less than 10mm.

#### **10.3.1.11 Performance Requirements**

The end-product testing of the LEBM shall be assessed on the basis of representative in situ specimens. Unless otherwise specified in Appendix 7/12, these specimens shall consist of pairs of 150mm diameter cores taken every 250 linear metres laid, with minimum 50% of cores taken from wheel track zone, one year after opening to traffic. The results shall not be less than the values specified in Table 24g.

The performance of the LEBM shall meet the requirement of one of the performance classes in Table 24h.

#### **10.3.1.12 Trafficking**

Construction plant used on LEBM under construction shall be suitable in relation to material, condition, and thickness of the course over which it traverses so that damage is not caused to the subgrade or the LEBM already constructed. The wheels or rubber tracks of plant moving over the various pavement courses shall be kept free from deleterious materials. No steel tracked vehicles shall be permitted to run on LEBM.

In order to exclude moisture from interfaces and ensure full interlayer bonding, the surface of all LEBM shall be kept clean and uncontaminated. The only traffic permitted to run on the surface of LEBM to be overlaid shall be that engaged in laying and compacting the next course. If any surface becomes contaminated, it shall be made good by cleaning and if this proves impracticable, be removed from the Works.

#### **Use of Surfaces by Traffic**

Where a material other than a surface course is being trafficked, appropriate measures shall be implemented to ensure that drivers are adequately alerted to the unfinished nature of the Works where appropriate. These measures shall include:

- i. Appropriate signage and lining in accordance with Chapter 8 of the Traffic Signs Manual.
- ii. The use of Cautionary Speed Plates or Statutory Road Works Speed Limits as appropriate.
- iii. Distinctive orange coloured road marking paint or tape shall be used as temporary centre line and edge markings to further emphasise the unfinished nature of the road.

The measures outlined above shall remain in place until the Works are complete.

### **10.3.2 Geotextiles and Geotextile-related Products**

#### **10.3.2.1 General**

The installation shall be in accordance with the requirements of DN-PAV-03074.

### **10.3.2.2 Surface Pre-Treatment**

Geotextiles and geotextile-related products shall be laid on smooth, even surfaces. Preparation of the surface shall be in accordance with Clause 10.2.1.1. The profile of the surface to be treated, both longitudinally and transversely, shall allow the product to achieve full contact with the surface.

Where a product requires a regulating course, such works shall be installed in accordance with the requirements of Clause 2.2.

### **10.3.2.3 Installation**

The installation of geotextiles and geotextile-related products shall be carried out by a purpose built mechanical applicator. The applicator shall be capable of laying the fabric under tension without wrinkles or creases, and brushing and/or rolling it firmly into the bond coat (if required), shall be used. Rolling out the fabric by hand shall only be permitted in areas where the applicator cannot access.

Overlaps on geogrids and geocomposites shall be laid in accordance with the manufacturer's requirements, however as a minimum laps shall be 50mm in the longitudinal direction and 150mm in the transverse direction.

Direct trafficking of geotextiles and geotextile-related products shall be restricted to the paving machine and delivery vehicles only. Steel drum rollers shall not run directly over the geosynthetic.

For installation of steel mesh, the material should be unrolled with the outside of the roll facing upwards to keep the concave curvature downwards.

Overlaps on steel meshes shall be laid in accordance with the manufacturer's requirements, however as a minimum laps shall be 300mm in the longitudinal direction and 150mm in the transverse direction.

Once the rolls are in their final position, the steel mesh shall be rolled a minimum of two passes using a pneumatic tyred roller. The roller shall cover the entire width of the steel mesh roll ensuring that the steel mesh conforms to the prepared road surface. The mesh shall be initially secured and stretched to remove any curvature in accordance with the manufacturer's requirements.

### **10.3.2.4 Aftercare**

Masking shall be removed after geotextiles and geotextile-related products have been installed and before the surfacing operation commences. The product shall be overlaid in the same shift as installation.

## **10.3.3 Permanent Repair Material Systems**

### **10.3.3.1 Works Proposals**

Before work commences, the Contractor shall submit a works proposal to the Employer's Representative detailing the proposed method of executing the Works, which shall also be subject to the approval of Transport Infrastructure Ireland. This shall include:

- i. Installation and compaction procedures – including size, type and number of rollers; the number of roller passes or other method employed to ensure compaction e.g., by continuous monitoring of density with a non-destructive gauge.
- ii. Measures to address working in different climatic conditions
- iii. The joint formation procedures for each layer – including width of repair area, the location of longitudinal and transverse joint(s); and the method(s) of treating upstanding edges.
- iv. How traceability of the material in the Works will be addressed.

### **10.3.3.2 Transport**

Loading of PRMS into the Contractor's selected distribution container shall be carried out such that segregation is minimised. Storage and transportation to site shall comply with the requirements of the prTAIT.

### **10.3.3.3 Bonding Layer**

A spray-applied bonding material as specified by the product/system manufacturer shall be used to seal the base and vertical edges of the repair area. The applicator to be used, the rate of spread of the material and the allowed curing time shall be specified by the product/system manufacturer.

Before spraying is commenced, the surface shall be free of all loose material, the surface as a whole shall be dry and any damp areas shall be completely free of standing water. After application the bonding material shall be allowed to break fully before the product/system is installed. If the bonding material is a bond coat, it shall comply with the requirements of Clause 10.1.4. Over-application or ponding shall be avoided to mitigate slippage or instability of the overlying layer.

All loose material on the sprayed surface shall be removed before any further layer of the pavement is installed.

### **10.3.3.4 Weather Conditions**

The Contractor shall take account of the weather conditions when planning his working methods. The working methods shall comply with all weather related requirements of this Clause.

PRMS shall be installed within the weather conditions requirements of Clause 10.1.5 and any parameter guidelines outlined by the manufacturer and/or Contractor and shall comply with the requirements of the prTAIT.

### **10.3.3.5 Laying**

All plant shall be maintained in accordance with the manufacturer's requirements and be suitable for the system being installed.

The method of installation shall be such that the finished surface is free from dragging, tearing and segregation of the material.

All construction layers shall be installed such that on completion each layer shall be at the same level as the adjacent course.

In accordance with the product/system manufacturer's requirements and the requirements of the prTAIT, material shall be installed in uniform lifts allowing for surcharge per lift such that compaction can be achieved.

Diamond patches shall be the preferred repair shape for heavily trafficked roads.

PRMS shall be installed solely by competent personnel.

When paving directly onto bridge deck waterproofing systems, any special requirements which apply to that system shall be complied with.

### **10.3.3.6 Reinstatement of Core Holes**

Reinstatement of core holes using PRMS shall be carried out as follows:

- i. The walls and base of all holes from which core samples have been cut shall be dried and painted with hot 40/60 or 70/100 paving grade bitumen or cold-applied polymer modified bitumen emulsion immediately prior to being back-filled.
- ii. PRMS shall be used for the back-filling of layers more than 50mm below the surface, unless there are other site-specific requirements.
- iii. Surface course reinstatement material shall comply with the requirements of this Specification and be as similar as possible to the existing surface.
- iv. Core holes shall be back-filled and then compacted to refusal with a circular-headed vibrating hammer or equivalent device in layers not exceeding 75mm thick.

#### **10.3.3.7 Joints**

Longitudinal joints in all layers shall be situated outside wheel track zones. For the purpose of this Clause, the wheel track zone shall be taken to be between 0,4m and 1,0m, and between 2,45m and 3,05m from the centre of the nearside lane markings for each traffic lane (or in the absence of lane markings, lane edges).

All joints shall be offset by at least 150mm from parallel joints in the layer beneath.

Joints in the surface course shall coincide with either lane edge marking or the lane marking, whichever is appropriate. This requirement may be amended for PRMS works as demonstrated in the prTAIT.

The faces of all cold upstanding edges of material, including previously installed asphalt, against which PRMS are to be installed to form joints shall be treated as specified by the manufacturer and/or Contractor when undertaking PRMS works.

#### **10.3.3.8 Compaction Control**

Compaction shall be controlled and monitored in accordance with the specific requirements of this Clause.

The compaction and compaction control for method compaction shall be as specified in Clause 10.1.9 of this Specification.

In the event that installation takes place in two or more lifts, the compaction for each lift shall take into account material surcharge and the manufacturer's and/or Contractor's requirements.

Once the final lift is placed, compaction shall commence in accordance with the manufacturer's and/or Contractor's requirements.

Compaction shall cease before migration of binder to the surface or crushing of aggregates is observed.

Once installed and compacted the finished surface shall be planar with the adjoining surface and be in accordance with the requirements of Table 26c.

Upon completion of works compacted materials shall be capable of being wet flush cored.

#### **10.3.3.9 Performance Requirements**

The prTAIT shall have been carried out on the same or higher traffic category to that to be treated in the Contract. The traffic category shall be defined in Table 26d. The Contractor shall provide test certificates giving details of the properties of each system proposed, including the data specified in this Clause.

### **10.3.3.10 Surface Macrotexture**

The macrotexture of bituminous surface courses shall be controlled and monitored in accordance with the requirements of Table 26c.

The initial surface macrotexture after compaction and before opening to traffic shall be measured using the methodology described in IS EN 13036-1.

### **10.3.3.11 Trafficking**

#### **Use of Surfaces by Traffic**

The time period between completion of works and opening to live traffic shall be determined by the manufacturer's and/or Contractor's requirements, as demonstrated in the prTAIT.

## **10.3.4 Localised Surface Repair Systems**

### **10.3.4.1 Works Proposals**

Before work commences, the Contractor shall submit a works proposal to the Employer's Representative detailing the proposed method of executing the Works, which shall also be subject to the approval of Transport Infrastructure Ireland. This shall include:

- i. Installation and compaction procedures – including size, type and number of rollers; the number of roller passes or other method employed to ensure compaction e.g., by continuous monitoring of density with a non-destructive gauge.
- ii. Measures to address working in different climatic conditions.
- iii. The joint formation procedures for each layer – including width of repair area, the location of longitudinal and transverse joint(s); and the method(s) of treating upstanding edges.
- iv. How traceability of the material in the Works will be addressed.

### **10.3.4.2 Weather Conditions**

The Contractor shall take account of the weather conditions when planning his working methods. The working methods shall comply with all weather related requirements of this Clause.

LSRS shall be installed within the weather conditions requirements of Clause 10.1.5 and any parameter guidelines outlined by the Contractor and shall comply with the requirements of the prTAIT.

### **10.3.4.3 Laying**

All plant shall be maintained in accordance with the manufacturer's requirements and be suitable for the system being installed.

The method of installation shall be such that the finished surface is free from dragging, tearing and segregation of the material.

The existing surface to be treated shall be heated using infra-red equipment to a temperature specified by the Contractor. The heat shall penetrate to a depth within the existing pavement structure as specified by the Contractor.

A joint 100mm inside the perimeter of the heated area shall be cut into the surface.

After heating using infra-red equipment, the surface shall then be raked thoroughly to maximise the surface area of the exposed material.



PRMS, in accordance with the requirements of Clause 8.4, shall be added to the repair area if so required.

Diamond patches shall be the preferred repair shape for heavily trafficked roads.

LSRS shall be installed solely by competent personnel.

When paving directly onto bridge deck waterproofing systems, any special requirements which apply to that system shall be complied with.

When compaction in accordance with Clause 10.3.4.5 is complete, additional materials in accordance with the requirements of this Clause and the prTAIT shall be applied to the compacted surface. While the requirement and specifications for these products shall be specified by the Contractor, the surfacing material shall also comply with the PSV and surface macrotexture requirements of this Specification.

#### **10.3.4.4 Joints**

Longitudinal joints in all layers shall be situated outside wheel track zones. For the purpose of this Clause, the wheel track zone shall be taken to be between 0,4m and 1,0m, and between 2,45m and 3,05m from the centre of the nearside lane markings for each traffic lane (or in the absence of lane markings, lane edges).

All joints shall be offset by at least 150mm from parallel joints in the layer beneath.

Joints in the surface course shall coincide with either lane edge marking or the lane marking, whichever is appropriate. This requirement may be amended for LSRS works as demonstrated in the prTAIT.

The faces of all cold upstanding edges of material, including previously installed asphalt, against which LSRS are to be installed to form joints shall be treated as specified by the Contractor when undertaking LSRS works.

#### **10.3.4.5 Compaction Control**

Compaction shall be controlled and monitored in accordance with the specific requirements of this Clause.

The compaction and compaction control for method compaction shall be as specified in Clause 10.1.9 of this Specification.

Compaction shall cease before migration of binder to the surface or crushing of aggregates is observed.

Once installed and compacted the finished surface shall be planar with the adjoining surface and be in accordance with the requirements of Table 27a.

Upon completion of works compacted materials shall be capable of being wet flush cored.

#### **10.3.4.6 Performance Requirements**

The prTAIT shall have been carried out on the same or higher traffic category to that to be treated in the Contract. The traffic category shall be defined in Table 27b. The Contractor shall provide test certificates giving details of the properties of each system proposed, including the data specified in this Clause.

### **10.3.4.7 Surface Macrotexture**

The macrotexture of bituminous surface courses shall be controlled and monitored in accordance with the requirements of Table 27a.

The initial surface macrotexture after compaction and before opening to traffic shall be measured using the methodology described in IS EN 13036-1.

### **10.3.4.8 Trafficking**

#### **Use of Surfaces by Traffic**

The time period between completion of works and opening to live traffic shall be determined by the Contractor's requirements, as demonstrated in the prTAIT.

## **10.3.5 Emergency Repair Material Systems**

### **10.3.5.1 Transport**

Loading of ERMS into the Contractor's selected distribution container shall be carried out such that segregation is minimised.

### **10.3.5.2 Bonding Layer**

A spray-applied bonding material as specified by the product/system manufacturer shall be used to seal the base and vertical edges of the repair area. The applicator to be used, the rate of spread of the material and the allowed curing time shall be specified by the product/system manufacturer.

Before spraying is commenced, the surface shall be free of all loose material, the surface as a whole shall be dry and any damp areas shall be completely free of standing water. After application the bonding material shall be allowed to break fully before the product/system is installed.

If the bonding material is a bond coat, it shall comply with the requirements of Clause 10.1.4. Over-application or ponding shall be avoided to mitigate slippage or instability of the overlying layer.

All loose material on the sprayed surface shall be removed before any further layer of the pavement is installed.

### **10.3.5.3 Weather Conditions**

The Contractor shall take account of the weather conditions when planning his working methods. The working methods shall comply with all weather related requirements of this Clause.

ERMS shall be installed within the weather conditions requirements of Clause 10.1.5 and or as outlined by the manufacturer and/or Contractor.

Installation shall not be undertaken unless weather conditions are such that the repair material will have at least 30 minutes in which to cure and harden.

### **10.3.5.4 Laying**

The method of installation shall be such that the finished surface is free from dragging, tearing and segregation of the material.

All construction layers shall be installed such that on completion each layer shall be at the same level as the adjacent course.

In accordance with the product/system manufacturer's requirements, material shall be installed in uniform lifts allowing for surcharge per lift such that compaction can be achieved.

### **10.3.5.5 Joints**

The faces of all cold upstanding edges of material, including previously installed asphalt, against which ERMS are to be installed to form joints shall be treated as specified by the manufacturer and/or Contractor when undertaking ERMS works.

### **10.3.5.6 Compaction Control**

Compaction shall be controlled and monitored in accordance with the specific requirements of this Clause.

The compaction and compaction control for method compaction shall be as specified in Clause 10.1.9 of this Specification.

In the event that installation takes place in two or more lifts, the compaction for each lift shall take into account material surcharge and the manufacturer's and/or Contractor's requirements.

Once the final lift is placed, compaction shall commence in accordance with the manufacturer's and/or Contractor's requirements.

Compaction shall cease before migration of binder to the surface or crushing of aggregates is observed.

Once installed and compacted the finished surface shall be planar with the adjoining surface and be in accordance with the requirements of Table 28c.

### **10.3.5.7 Performance Requirements**

None of the material shall debond or delaminate from the existing surface of the road for a period of at least 7 days from installation. Any subsequent delaminated material shall not be of sufficient size as to cause a hazard to traffic.

### **10.3.5.8 Surface Macrotexture**

The macrotexture of bituminous surface courses shall be controlled and monitored in accordance with the requirements of Table 28c and the specific requirements of this Clause.

The initial surface macrotexture after compaction and before opening to traffic shall be measured using the methodology described in IS EN 13036-1.

### **10.3.5.9 Replacement of ERMS works**

Full-scale rectification in accordance with CC-SPW-00700, and replacement with an approved surface course (in accordance with DN-PAV-03023) shall be required to replace the ERMS works as soon as practicably possible after installation.

## 11. Tables

**Table 1 Asphalt Concrete – Requirements for Constituent Materials**

Test	Asphalt Concrete		Test Method
	Base & Binder	Surface Course	
Coarse Aggregate			
Aggregate of a single type and source	na	✓	EN 932-3
Type - Crushed Rock	✓	✓	na
Type - Crushed Gravel	C <sub>100/0</sub>	C <sub>100/0</sub>	EN 933-5
Fines Content	f <sub>4</sub>	f <sub>4</sub>	EN 933-1
Shape - Flakiness Index	na	FI <sub>30</sub>	EN 933-3
Resistance to Fragmentation - Los Angeles	LA <sub>30</sub>	LA <sub>30</sub>	EN 1097-2
Resistance to Freezing & Thawing - Soundness	MS <sub>25</sub>	MS <sub>25</sub>	EN 1367-2
Resistance to Freezing & Thawing - Water Absorption	WA <sub>242</sub> <sup>1</sup>	WA <sub>242</sub> <sup>1</sup>	EN 1097-6
Resistance to Polishing - PSV	na	see Appendix 7/1 <sup>2</sup>	EN 1097-8
Resistance to Surface Abrasion - AAV	na	see Appendix 7/1 <sup>2</sup>	EN 1097-8
Reclaimed Asphalt			
Maximum allowed	70%	0%	
Fine Aggregate			
Grading	0/2 or 0/4	0/2 or 0/4	EN 933-1
Fines Content	f <sub>22</sub>	f <sub>22</sub>	EN 933-1
Type	crushed rock fines, sand or mixture of both	crushed rock fines, sand or mixture of both	na
Added Filler			
Reclaimed filler	yes	yes	
Grading	EN 13043 table 24	EN 13043 table 24	EN 933-10
Type	crushed rock, crushed slag, hydrated lime, cement CEM I or CEM II	crushed rock, crushed slag, hydrated lime, cement CEM I or CEM II	na
Loose bulk density in kerosene (except hydrated lime)	na	EN 13043 Clause 5.5.5	EN 1097-3, annex B

**Notes**

<sup>1</sup> If the water absorption value is greater than WA<sub>242</sub>, the aggregate shall be deemed acceptable if the Soundness meets the MS<sub>25</sub> requirement

<sup>2</sup> Not applicable for footways. For Accommodation Works, PSV<sub>55</sub> declared and AAV<sub>16</sub> declared may be used.

**Table 2 Asphalt Concrete – Product Composition and Properties**

hEN reference	EN13108 – 1 Asphalt Concrete													
Table column reference	1		2		3		4		5		6		7	
Layer	Base		Binder		Surface		Surface		Surface		Surface		Surface	
Mixture designation	AC 32 dense/HDM <sup>1</sup> base des		AC 20 dense/HDM <sup>1</sup> bin des		AC 14 close surf des		AC 10 close surf des		AC 14 open surf des		AC 10 open surf des		AC 6 dense surf des	
Sieve Size	% by mass passing													
40	100													
31,5	90 to 100		100											
20	71 to 95		95 to 100		100				100					
14					95 to 100		100		90 to 100		100			
10			52 to 72		70 to 90		95 to 100		55 to 75		85 to 100		100	
6,3	44 to 60		38 to 56		45 to 65		55 to 75		25 to 45		30 to 60		90 to 100	
2	20 to 40		20 to 40		19 to 33		19 to 33		10 to 18		10 to 18		36 to 52	
1					15 to 30		15 to 30						20 to 50	
0,250	6 to 20		6 to 20										7 to 23	
	dense	HDM	dense	HDM										
0,063	2 to 9	7 to 11	2 to 9	7 to 11	3 to 8		3 to 8		2 to 7		2 to 7		2 to 10	
	Binder content B <sub>min</sub> <sup>2</sup>													
Limestone	4,0		4,8		5,0		5,2		4,6		5,0		6,0	
Other crushed rock	4,0		4,8		5,2		5,4		4,8		5,2		6,4	
Crushed Gravel	4,6		5,0		5,4 to 6,6 <sup>3</sup>		5,4 to 6,6 <sup>3</sup>		5,4 to 6,6 <sup>3</sup>		5,4 to 6,6 <sup>3</sup>		5,4 to 6,6 <sup>3</sup>	
<b>Binder grade</b>	<b>dense</b>	<b>HDM</b>	<b>dense</b>	<b>HDM</b>										
40/60	✓	✓	✓	✓										
70/100	✓		✓		✓		✓		✓		✓		✓	
160/220 <sup>4</sup>					✓		✓		✓		✓		✓	
	Properties													
Void content – Minimum <sup>5</sup>	V <sub>min</sub> 4,0		V <sub>min</sub> 4,0		V <sub>min</sub> 3,0		V <sub>min</sub> 3,0		V <sub>min</sub> 4,0		V <sub>min</sub> 4,0		V <sub>min</sub> 3,0	
Void content – Maximum <sup>5</sup>	V <sub>max</sub> 10,0		V <sub>max</sub> 7,0		V <sub>max</sub> 7,0		V <sub>max</sub> 7,0		V <sub>max</sub> NR		V <sub>max</sub> NR		V <sub>max</sub> 7,0	
Resistance to permanent deformation <sup>5</sup>	WTS <sub>AIR</sub> 1,0 PRD <sub>AIR</sub> 9,0		WTS <sub>AIR</sub> 1,0 PRD <sub>AIR</sub> 9,0											
Water sensitivity <sup>5</sup>	ITSR <sub>70</sub>		ITSR <sub>70</sub>		ITSR <sub>80</sub>		ITSR <sub>80</sub>		ITSR <sub>80</sub>		ITSR <sub>80</sub>		ITSR <sub>80</sub>	
Stiffness <sup>5</sup>	To be recorded		To be recorded											
	Temperature of the mixture – maximum													
	Hot	Warm <sup>6</sup>	Hot	Warm <sup>6</sup>	Hot	Warm <sup>6</sup>	Hot	Warm <sup>6</sup>	Hot	Warm <sup>6</sup>	Hot	Warm <sup>6</sup>	Hot	Warm <sup>6</sup>
40/60	190	150	190	150										
70/100	180	150	180	150	180	150	180	150	180	150	180	150	180	150
160/220					170		170		170		170		170	

Notes

<sup>1</sup> Delete as appropriate

<sup>2</sup> The minimum binder content, expressed as B<sub>min</sub>, is corrected for FPC purposes to B, in accordance with CC-GSW-00900, Clause 3.3.3.

<sup>3</sup> The information on the bitumen contents required for these mixtures made with gravel is not sufficient for a single value to be specified. The bitumen content to be used should be chosen from within the range given.

<sup>4</sup> The use of 160/220 paving grade binder shall only be permitted for accommodation works.

<sup>5</sup> Test methods and test conditions contained in Table 19.

<sup>6</sup> Refer to CC-GSW-00900 for guidance on plant heating and cold starting of the manufacturing process.

**Table 3 Asphalt Concrete – Requirements of the Works**

hEN reference	EN 13108 – 1 Asphalt Concrete																					
Table column reference	1		2		3		4		5		6		7									
Layer	Base		Binder		Surface		Surface		Surface		Surface		Surface									
Mixture designation	AC 32 dense/HDM <sup>1</sup> base des		AC 20 dense/HDM <sup>1</sup> bin des		AC 14 close surf des		AC 10 close surf des		AC 14 open surf des		AC 10 open surf des		AC 6 dense surf des									
<b>Alignment, levels, tolerances, thickness &amp; regularity (mm)</b>																						
Horizontal alignment	See Clause 702																					
Levels	See Clause 702																					
Tolerances	± 15		± 6		± 6		± 6		± 6		± 6		± 6									
Adjacent to a surface water or linear drainage channel					+ 10 - 0		+ 10 - 0		+ 10 - 0		+ 10 - 0		+ 10 - 0									
Layer thickness - nominal	70 to 150		50 to 100		40 to 55		30 to 40		35 to 55		30 to 35		20 to 30									
Layer thickness - minimum	55		40		35		25		30		25		15									
Surface regularity	see Clause 702																					
Temperature of the mixture – minimum	Delivery	Rolling		Delivery	Rolling		Delivery	Rolling		Delivery	Rolling		Delivery	Rolling		Delivery	Rolling		Delivery	Rolling		
		Hot	Warm		Hot	Warm		Hot	Warm		Hot	Warm		Hot	Warm		Hot	Warm		Hot	Warm	Hot
40/60 pen		105	90		105	90																
70/100 pen		90	85		90	85	130	110	100	85	130	110	100	85	115	90	115	90	130	110	100	85
160/220 pen							110		85		110		85	95	75	95	75	110		85		
<b>Properties</b>																						
Air Void content in situ in laid material <sup>2</sup>	V <sub>max 7,0</sub>		V <sub>max 7,0</sub>		To be recorded		To be recorded		To be recorded		To be recorded		To be recorded									
Air Void content in situ within 100mm of joint <sup>2</sup>	V <sub>max 9,0</sub>		V <sub>max 9,0</sub>																			
Air Void content in situ at refusal <sup>2</sup>	V <sub>min 0,5</sub>		V <sub>min 0,5</sub>																			
Resistance to permanent deformation <sup>2</sup>	WTS <sub>AIR 1,3</sub> PRD <sub>AIR 14,0</sub>		WTS <sub>AIR 1,3</sub> PRD <sub>AIR 14,0</sub>																			
Water sensitivity <sup>2</sup>	ITSR <sub>70</sub>		ITSR <sub>70</sub>		To be recorded		To be recorded		To be recorded		To be recorded		To be recorded									
<b>Surface Macrotexture (mm)<sup>3</sup></b>																						
Mandatory speed of traffic > 60km/hr	Not applicable		Not applicable		Not permitted		Not permitted		Not permitted		Not permitted		Not permitted									
Average per 1000m - minimum																						
Average per 1000m - maximum																						
Average for a set of 10 measurements - minimum																						
Mandatory speed of traffic ≤ 60km/hr and roundabouts	Not applicable		Not applicable										Not permitted									
Average per 1000m - minimum					1,2 <sup>3</sup>		1,2 <sup>3</sup>		1,2 <sup>3</sup>		1,2 <sup>3</sup>											
Average per 1000m - maximum					1,7 <sup>3</sup>		1,7 <sup>3</sup>															
Average for a set of 10 measurements - minimum					1,0 <sup>3</sup>		1,0 <sup>3</sup>		1,0 <sup>3</sup>		1,0 <sup>3</sup>											

**Notes**

<sup>1</sup> Delete as appropriate

<sup>2</sup> Applicable to trafficked surfaces, not accommodation works. Test methods and test conditions contained in Table 20. Cored specimens to be taken from the constructed pavement layer.

<sup>3</sup> Restricted conditions apply, refer to DN-PAV-03023. Not applicable for Accommodation Works or footways.

**Table 4 Hot Rolled Asphalt – Requirements for Constituent Materials**

Test	Hot Rolled Asphalt		Test Method
	Surface Course	Pre Coated Chippings	
<b>Coarse Aggregate</b>			
Aggregate of a single type and source	✓	✓	EN 932-3
Type - Crushed Rock	✓	✓	na
Type - Crushed Gravel	$C_{100/0}$	$C_{100/0}$	EN 933-5
Fines Content	$f_4$	$f_2$	EN 933-1
Shape - Flakiness and size	$F_{35}$	$F_{10} 14/20^2$	EN 933-3
Resistance to Fragmentation - Los Angeles	$LA_{30}$	$LA_{30}$	EN 1097-2
Resistance to Freezing & Thawing - Soundness	$MS_{25}$	$MS_{25}$	EN 1367-2
Resistance to Freezing & Thawing - Water Absorption	$WA_{242}^1$	$WA_{242}^1$	EN 1097-6
Resistance to Polishing - PSV (general use mixtures)	PSV <sub>44</sub>	see Appendix 7/1	EN 1097-8
Resistance to Polishing - PSV (mixtures for roundabouts)	PSV <sub>60</sub>	see Appendix 7/1	EN 1097-8
Resistance to Surface Abrasion - AAV	na	see Appendix 7/1	EN 1097-8
<b>Reclaimed Asphalt</b>			
Maximum allowed	0%	0%	
<b>Fine Aggregate</b>			
Grading	0/2 or 0/4	na	EN 933-1
Fines Content	$f_{10}$ sand $f_{10}$ CRF	na	EN 933-1
Type	crushed rock fines (CRF), sand or mixture of both	na	na
<b>Added Filler</b>			
Reclaimed filler	Not permitted	na	
Grading	EN 13043 table 24	na	EN 933-10
Type	limestone, hydrated lime, cement CEM I or CEM II	na	na
Loose bulk density in kerosene (except hydrated lime)	Clause 5.5.5 of EN 13043	na	EN 1097-7

**Notes**

<sup>1</sup> If the water absorption value is greater than  $WA_{242}$ , the aggregate shall be deemed acceptable if the Soundness meets the  $MS_{25}$  requirement

<sup>2</sup> Refer to chipping after coating

**Table 5 Hot Rolled Asphalt – Product Composition and Properties**

hEN reference	EN 13108 – 4 Hot Rolled Asphalt					
Table column reference	1	2	3	4	5	6
Layer	Surface	Surface	Surface	Surface	Specialist <sup>2</sup>	Surface
Mixture designation	HRA 35/14F surf des	HRA 35/14C surf des <sup>1</sup>	HRA 30/14F surf des	HRA 30/14C surf des <sup>1</sup>	HRA 0/2F surf	Pre Coated Chippings
Sieve Size	% by mass passing					
31,5						100
20	100	100	100	100		80 to 100
16	-	-	-	-		0 to 30
14	95 to 100	95 to 100	93 to 100	93 to 100		0 to 10
10	62 to 81	62 to 81	67 to 83	67 to 83		0 to 2
6,3					100	
2	61	59	65	66	98 to 100	
0,500	44 to 63	24 to 41	49 to 68	29 to 41	80 to 90	
0,250	16 to 46	16 to 26	19 to 51	19 to 36	40 to 65	
0,063	8,0	8,0	9,0	9,0	14,0	0 to 1.5
% aggregate passing 2 retained 0,500 - maximum	13		14			
Binder content B <sup>3</sup>	minimum	minimum	minimum	minimum	minimum	Range
Paving Grade	7,2	7,2	7,4	7,4	9,6	1,2 to 1,8
Binder grade						
40/60	✓	✓	✓	✓	✓	✓
Polymer Modified Binder <sup>4</sup>	✓	✓	✓	✓		
Properties						
Binder volume <sup>5</sup>	B <sub>vol</sub> 15,5	B <sub>vol</sub> 15,5	B <sub>vol</sub> 15,5	B <sub>vol</sub> 15,5		
Air Void content <sup>5</sup>	V <sub>max</sub> 7,0	V <sub>max</sub> 7,0	V <sub>max</sub> 7,0	V <sub>max</sub> 7,0		
Resistance to permanent deformation <sup>5</sup>	WTR <sub>AIR</sub> 15,0 RD <sub>AIR</sub> 9,0	WTR <sub>AIR</sub> 15,0 RD <sub>AIR</sub> 9,0	WTR <sub>AIR</sub> 15,0 RD <sub>AIR</sub> 9,0	WTR <sub>AIR</sub> 15,0 RD <sub>AIR</sub> 9,0		
Water sensitivity <sup>5</sup>	ITSR <sub>80</sub>	ITSR <sub>80</sub>	ITSR <sub>80</sub>	ITSR <sub>80</sub>		
Temperature of the mixture – maximum						
40/60	190	190	190	190	190	
PMB 65/105-60	6	6	6	6		

Notes

<sup>1</sup> Attention is drawn to the limited experience with Type C fine aggregate designed mixtures. Problems may occur with obtaining durable material with low permeability because the harshness of this type of mixture makes compaction more difficult.

<sup>2</sup> Refer to CC-SPW-02000 for HRA 0/2F use

<sup>3</sup> The optimum binder content for HRA shall be determined through a design procedure, in accordance with Annex G of S.R. 28:2018. Where the optimum binder content is less than that given in this table, the value in this table shall be used. For CE Marking and DoP purposes only, the 'B' value is required to be converted to indicate the 'B<sub>min</sub>' value in accordance with CC-GSW-00900, Clause 4.3.3.

<sup>4</sup> with approval of Transport Infrastructure Ireland

<sup>5</sup> Test methods and test conditions contained in Table 19

<sup>6</sup> Supplier Declared Value



**Table 6 Hot Rolled Asphalt – Requirements of the Works**

hEN reference	EN 13108 – 4 Hot Rolled Asphalt											
Table column reference	1		2		3		4		5		6	
Layer	Surface		Surface		Surface		Surface		Specialist <sup>3</sup>		Surface	
Mixture designation	HRA 35/14F surf des		HRA 35/14C surf des		HRA 30/14F surf des		HRA 30/14C surf des		HRA 0/2F surf		Pre coated chippings	
<b>Alignment, levels, tolerances, thickness and regularity (mm)</b>												
Horizontal alignment	See Clause 702											
Levels	See Clause 702											
Tolerances	± 6		± 6		± 6		± 6		± 6			
Adjacent to a surface water or linear drainage channel	+ 10 - 0		+ 10 - 0		+ 10 - 0		+ 10 - 0		+ 10 - 0			
Layer thickness - nominal	45		45		40		40		25		na	
Layer thickness - minimum	40		40		35		35		20		na	
Surface regularity	See Clause 702											
<b>Temperature of the mixture – minimum</b>	<b>Delivery</b>	<b>Rolling</b>	<b>Delivery</b>	<b>Rolling</b>	<b>Delivery</b>	<b>Rolling</b>	<b>Delivery</b>	<b>Rolling</b>	<b>Delivery</b>	<b>Rolling</b>	<b>Delivery</b>	<b>Rolling</b>
40/60	155	110	155	110	155	110	155	110	140	110	na	
PMB 65/105-60	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>				
<b>Properties</b>												
Air Void content <sup>1</sup>	V <sub>max 11,0</sub>		V <sub>max 11,0</sub>		V <sub>max 11,0</sub>		V <sub>max 11,0</sub>					
Resistance to permanent deformation <sup>1</sup>	WTR <sub>AIR 23,0</sub> RD <sub>AIR 12,0</sub>		WTR <sub>AIR 23,0</sub> RD <sub>AIR 12,0</sub>		WTR <sub>AIR 23,0</sub> RD <sub>AIR 12,0</sub>		WTR <sub>AIR 23,0</sub> RD <sub>AIR 12,0</sub>					
Water sensitivity <sup>1</sup>	ITSR <sub>80</sub>		ITSR <sub>80</sub>		ITSR <sub>80</sub>		ITSR <sub>80</sub>					
<b>Surface Macrotexture (mm)<sup>4</sup></b>												
<b>Mandatory speed of traffic &gt; 60km/hr</b>												
Average per 400m – minimum	1,5		1,5		1,5		1,5					
Average per 400m – maximum	2,0		2,0		2,0		2,0					
Average per set of 10 measurements – minimum	1,2		1,2		1,2		1,2					
Minimum individual value per set of 10 measurements	1,0		1,0		1,0		1,0					
Maximum individual value per set of 10 measurements	2,3		2,3		2,3		2,3					
Number of individual values <1,2mm per set of 10 measurements	no more than three individual values < 1,2		no more than three individual values < 1,2		no more than three individual values < 1,2		no more than three individual values < 1,2					
<b>Mandatory speed of traffic ≤ 60km/hr and all roundabouts</b>												
Average per 400m – minimum	1,2		1,2		1,2		1,2					
Average per 400m – maximum	1,7		1,7		1,7		1,7					
Average per set of 10 measurements – minimum	1,0		1,0		1,0		1,0					
Minimum individual value per set of 10 measurements	0,8		0,8		0,8		0,8					
Maximum individual value per set of 10 measurements	2,0		2,0		2,0		2,0					
Number of individual values < 1,0mm per set of 10 measurements	no more than three individual values < 1,0		no more than three individual values < 1,0		no more than three individual values < 1,0		no more than three individual values < 1,0					

**Notes**

<sup>1</sup> Test methods and test conditions contained in Table 20. Cored specimens to be taken from the constructed pavement layer.

<sup>2</sup> Supplier Declared Value

<sup>3</sup> Refer to CC-SPW-02000 for HRA 0/2F use

<sup>4</sup> Restricted conditions apply, refer to DN-PAV-03023

**Table 7 Stone Mastic Asphalt – Requirements for Constituent Materials**

Test	Stone Mastic Asphalt		Test Method
	Binder	Surface Course	
<b>Coarse Aggregate</b>			
Aggregate of a single type and source	na	✓	EN 932-3
Type - Crushed Rock	✓	✓	na
Type - Crushed Gravel	C <sub>100/0</sub>	C <sub>100/0</sub>	EN 933-5
Fines Content	f <sub>4</sub>	f <sub>4</sub>	EN 933-1
Shape - Flakiness and size	F <sub>I35</sub>	F <sub>I15</sub>	EN 933-3
Resistance to Fragmentation - Los Angeles	LA <sub>30</sub>	LA <sub>25</sub>	EN 1097-2
Resistance to Freezing & Thawing - Soundness	MS <sub>25</sub>	MS <sub>25</sub>	EN 1367-2
Resistance to Freezing & Thawing - Water Absorption	WA <sub>242</sub> <sup>1</sup>	WA <sub>242</sub> <sup>1</sup>	EN 1097-6
Resistance to Polishing - PSV	na	see Appendix 7/1	EN 1097-8
Resistance to Surface Abrasion - AAV	na	see Appendix 7/1	EN 1097-8
Reclaimed Asphalt			
Maximum allowed	0%	0%	
<b>Fine Aggregate</b>			
Grading	0/2 or 0/4	0/2 or 0/4	EN 933-1
Fines Content	f <sub>22</sub>	f <sub>22</sub>	EN 933-1
Type	crushed rock fines, sand or mixture with max 50% sand	Crushed rock fines of PSV <sub>55</sub> minimum	na
<b>Added Filler</b>			
Reclaimed filler	yes	Not permitted	
Grading	EN 13043 table 24	EN 13043 table 24	EN 933-10
Type	crushed rock, crushed slag, hydrated lime, cement CEM I or CEM II	limestone, hydrated lime, cement CEM I or CEM II	na
Loose bulk density in kerosene (except hydrated lime)	Clause 5.5.5 of EN 13043	Clause 5.5.5 of EN 13043	EN 1097-7

**Notes**

<sup>1</sup> If the water absorption value is greater than WA<sub>242</sub>, the aggregate shall be deemed acceptable if the Soundness meets the MS<sub>25</sub> requirement

**Table 8 Stone Mastic Asphalt – Product Composition and Properties**

hEN reference	EN 13108 – 5 Stone Mastic Asphalt													
Table column reference	1		2		3		4		5		6		7	
Layer	Binder		Binder		Binder		Surface		Surface		Surface		Surface	
Mixture designation	SMA 14 bin des		SMA 10 bin des		SMA 6 bin des		SMA 14 surf des		SMA 10 surf des		SMA 14 surf des		SMA 10 surf des	
Sieve Size	% by mass passing													
20	100						100				100			
14	90 to 100		100				90 to 100		100		90 to 100		100	
10	35 to 60		90 to 100		100		35 to 60		90 to 100		35 to 60		90 to 100	
6,3	20 to 45		30 to 55		90 to 100		20 to 45		30 to 55		20 to 45		30 to 55	
4					22 to 45									
2	15 to 30		20 to 35		20 to 34		15 to 30		20 to 35		15 to 30		20 to 35	
0,063	6 to 12		6 to 12		8 to 14		6 to 12		6 to 12		6 to 12		6 to 12	
<b>Binder content <math>B_{min}</math><sup>1</sup></b>														
Paving grade	5,6		5,8		6,0						5,6		5,8	
PMB 65/105-60	5,4		5,6		5,8		5,6		5,8					
<b>Binder grade</b>														
40/60	✓		✓		✓						✓		✓	
70/100	✓		✓		✓									
PMB 65/105-60	✓		✓		✓		✓		✓					
<b>Additives</b>														
Stabilising additives (fibres) % by mass	0,3 to 1,5		0,3 to 1,5		0,3 to 1,5						0,3 to 1,5		0,3 to 1,5	
<b>Properties</b>														
Binder drainage <sup>2</sup>	D <sub>0,3</sub>		D <sub>0,3</sub>		D <sub>0,3</sub>		D <sub>0,3</sub>		D <sub>0,3</sub>		D <sub>0,3</sub>		D <sub>0,3</sub>	
Air Void content minimum <sup>2</sup>	V <sub>min 2,0</sub>		V <sub>min 2,0</sub>		V <sub>min 2,0</sub>		V <sub>min 2,0</sub>		V <sub>min 2,0</sub>		V <sub>min 2,0</sub>		V <sub>min 2,0</sub>	
Air Void content maximum <sup>2</sup>	V <sub>max 8,0</sub>		V <sub>max 8,0</sub>		V <sub>max 8,0</sub>		V <sub>max 5,0</sub>		V <sub>max 5,0</sub>		V <sub>max 5,0</sub>		V <sub>max 5,0</sub>	
Water sensitivity <sup>2</sup>	ITSR <sub>80</sub>		ITSR <sub>80</sub>		ITSR <sub>80</sub>		ITSR <sub>80</sub>		ITSR <sub>80</sub>		ITSR <sub>80</sub>		ITSR <sub>80</sub>	
Resistance to permanent deformation <sup>2</sup>	WTS <sub>AIR 1,0</sub> PRD <sub>AIR 9,0</sub>		WTS <sub>AIR 1,0</sub> PRD <sub>AIR 9,0</sub>		WTS <sub>AIR 1,0</sub> PRD <sub>AIR 9,0</sub>		WTS <sub>AIR 1,0</sub> PRD <sub>AIR 9,0</sub>		WTS <sub>AIR 1,0</sub> PRD <sub>AIR 9,0</sub>		WTS <sub>AIR 1,0</sub> PRD <sub>AIR 9,0</sub>		WTS <sub>AIR 1,0</sub> PRD <sub>AIR 9,0</sub>	
<b>Temperature of the mixture – maximum<sup>3</sup></b>														
	Hot	Warm <sup>4</sup>	Hot	Warm <sup>4</sup>	Hot	Warm <sup>4</sup>	Hot	Warm <sup>4</sup>	Hot	Warm <sup>4</sup>	Hot	Warm <sup>4</sup>	Hot	Warm <sup>4</sup>
40/60	190	150	190	150	190	150					190	150	190	150
70/100	180	150	180	150	180	150								
PMB 65/105-60	<sup>3</sup>	155	<sup>3</sup>	155	<sup>3</sup>	155	<sup>3</sup>	155	<sup>3</sup>	155	<sup>3</sup>	155		

**Notes**

<sup>1</sup> The minimum binder content, expressed as  $B_{min}$ , is corrected for FPC purposes to  $B$ , in accordance with CC-GSW-00900, Clause 5.3.3.

<sup>2</sup> Test methods and test conditions contained in Table 19

<sup>3</sup> Supplier Declared Value

<sup>4</sup> Refer to CC-GSW-00900 for guidance on plant heating and cold starting of the manufacturing process.

**Table 9 Stone Mastic Asphalt – Requirements of the Works**

hEN reference	EN 13108 – 5 Stone Mastic Asphalt																																													
Table column reference	1				2				3				4				5				6				7																					
Layer	Binder				Binder				Binder				Surface				Surface				Surface				Surface																					
Mixture designation	SMA 14 bin des				SMA 10 bin des				SMA 6 bin des				SMA 14 surf des				SMA 10 surf des				SMA 14 surf des <sup>2</sup>				SMA 10 surf des <sup>2</sup>																					
Alignment, levels, tolerances, thickness & regularity (mm)																																														
Horizontal alignment														See Clause 702																																
Levels														See Clause 702																																
Tolerances														± 6				± 6				± 6				± 6				± 6				± 6												
Adjacent to surface water or linear drainage channel														+ 10 - 0				+ 10 - 0				+ 10 - 0				+ 10 - 0				+ 10 - 0				+ 10 - 0												
Layer thickness - nominal														30 to 60				20 to 50				15 to 40				35 to 50				25 to 50				35 to 50				25 to 50								
Layer thickness - minimum														25				15				10				30				20				30				20								
Surface regularity														see Clause 702																																
Temperature of the mixture – minimum														Delivery		Rolling		Delivery		Rolling		Delivery		Rolling		Delivery		Rolling		Delivery		Rolling		Delivery		Rolling		Delivery		Rolling		Delivery		Rolling		
														Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	Hot	Warm	
40/60														130	110	100	90	130	110	100	90	130	110	100	90																					
70/100														125	100	90	85	125	100	90	85	125	100	90	85																					
PMB 65/105-60														145	125	115	95	145	125	115	95	145	125	115	95	145	125	115	95	145	125	115	95													
Properties																																														
Air voids minimum <sup>1</sup>														V <sub>min 2,0</sub>				V <sub>min 2,0</sub>				V <sub>min 2,0</sub>																								
Air voids maximum <sup>1</sup>														V <sub>max 8,0</sub>				V <sub>max 8,0</sub>				V <sub>max 8,0</sub>																								
Water sensitivity <sup>1</sup>														ITSR <sub>80</sub>				ITSR <sub>80</sub>				ITSR <sub>80</sub>				ITSR <sub>80</sub>				ITSR <sub>80</sub>				ITSR <sub>80</sub>												
Resistance to permanent deformation <sup>1</sup>														WTS <sub>AIR 1,3</sub>		PRD <sub>AIR 14,0</sub>		WTS <sub>AIR 1,3</sub>		PRD <sub>AIR 14,0</sub>		WTS <sub>AIR 1,3</sub>		PRD <sub>AIR 14,0</sub>		WTS <sub>AIR 1,3</sub>		PRD <sub>AIR 14,0</sub>		WTS <sub>AIR 1,3</sub>		PRD <sub>AIR 14,0</sub>		WTS <sub>AIR 1,3</sub>		PRD <sub>AIR 14,0</sub>		WTS <sub>AIR 1,3</sub>		PRD <sub>AIR 14,0</sub>		WTS <sub>AIR 1,3</sub>		PRD <sub>AIR 14,0</sub>		
Surface Macrotexture (mm) <sup>3</sup>																																														
Mandatory speed of traffic > 60km/hr																																														
Average per 1000m - minimum														na				na				na				1,3				1,1				1,3				1,1								
Average per 1000m - maximum														na				na				na				1,8				1,6				1,8				1,6								
Average for a set of 10 measurements - minimum														na				na				na				1,0				0,9				1,0				0,9								
Mandatory speed of traffic ≤ 60km/hr and roundabouts																																														
Average per 1000m - minimum														na				na				na				1,0 <sup>3</sup>				1,0				1,0 <sup>3</sup>				1,0								
Average per 1000m - maximum														na				na				na				1,8 <sup>3</sup>				1,6				1,8 <sup>3</sup>				1,6								
Average for a set of 10 measurements - minimum														na				na				na				0,9 <sup>3</sup>				0,9				0,9 <sup>3</sup>				0,9								

**Notes**

<sup>1</sup> Test methods and test conditions contained in Table 20. Cored specimens to be taken from the constructed pavement layer.

<sup>2</sup> These mixture designations shall not be permitted for use on roads carrying greater than 100 cv/lane/day

<sup>3</sup> Restricted conditions apply, refer to DN-PAV-03023

**Table 10 Porous Asphalt – Requirements for Constituent Materials**

Test	Porous Asphalt	Test Method
	Surface Course	
<b>Coarse Aggregate</b>		
Aggregate of a single type and source	✓	EN 932-3
Type - Crushed Rock	✓	na
Type - Crushed Gravel	$C_{100/0}$	EN 933-5
Fines Content	$f_4$	EN 933-1
Shape - Flakiness and size	$Fl_{15} 8/14$ $Fl_{20} 6,3/10$	EN 933-3
Resistance to Fragmentation - Los Angeles	$LA_{25}$	EN 1097-2
Resistance to Freezing & Thawing - Soundness	$MS_{25}$	EN 1367-2
Resistance to Freezing & Thawing - Water Absorption	$WA_{24}2^1$	EN 1097-6
Resistance to Polishing - PSV	see Appendix 7/1	EN 1097-8
Resistance to Surface Abrasion - AAV	$AAV_{10}$	EN 1097-8
<b>Reclaimed Asphalt</b>		
Maximum allowed	0%	
<b>Fine Aggregate</b>		
Grading	0/2 or 0/4	EN 933-1
Fines Content	$f_{22}$	EN 933-1
Type	crushed rock fines	na
<b>Added Filler</b>		
Reclaimed filler	Not permitted	
Grading	EN 13043 table 24	EN 933-10
Type	Minimum 2% by mass of aggregate to be hydrated lime	
Loose bulk density in kerosene (except hydrated lime)	Clause 5.5.5 of EN 13043	EN 1097-7

**Notes**

<sup>1</sup> If the water absorption value is greater than  $WA_{24}2$ , the aggregate shall be deemed acceptable if the Soundness meets the  $MS_{25}$  requirement

**Table 11 Porous Asphalt – Product Composition and Properties**

<b>hEN reference</b>	<b>EN 13108 – 7 Porous Asphalt</b>
Table column reference	1
Layer	Surface
Mixture designation	PA 14 Surf des
<b>Sieve Size</b>	<b>% by mass passing</b>
20	100
14	90 to 100
10	55 to 75
6,3	15 to 25
4	
2	10 to 17
0,063	4,0 to 5,5 <sup>1</sup>
<b>Binder content B<sub>min</sub><sup>2</sup></b>	
PMB 65/105-70	6,0
<b>Properties</b>	
Binder drainage <sup>3</sup>	D <sub>0,3</sub>
Air Void content minimum expected <sup>3</sup>	V <sub>min 20</sub>
Air Void content maximum expected <sup>3</sup>	V <sub>max 28</sub>
Water sensitivity <sup>3</sup>	ITSR <sub>80</sub>
Particle Loss (Cantabro Wear Test) <sup>3</sup>	PL <sub>20</sub>
<b>Binder grade</b>	
PMB 65/105-70	✓
<b>Temperature of the mixture - maximum</b>	
PMB 65/105-70	4

**Notes**

<sup>1</sup> Includes 2% hydrated lime by weight of total aggregate

<sup>2</sup> The minimum binder content, expressed as B<sub>min</sub>, is corrected for FPC purposes to B, in accordance with CC-GSW-00900, Clause 6.3.3.

<sup>3</sup> Test methods and test conditions contained in Table 19

<sup>4</sup> Supplier Declared Value

**Table 12 Porous Asphalt – Requirements of the Works**

hEN reference	EN 13108 – 7 Porous Asphalt	
Table column reference	1	
Layer	Surface	
Mixture designation	PA 14 surf des	
<b>Alignment, levels, tolerances, thickness &amp; regularity (mm)</b>		
Horizontal alignment	See Clause 702	
Levels	See Clause 702	
Tolerances	± 6	
Adjacent to a surface water or linear drainage channel	+ 10 - 0	
Layer thickness - nominal	40 to 50	
Layer thickness - minimum	35	
<b>Bond and joints</b>		
Joint location	No joints permitted - shall be laid in echelon	
Longitudinal & transverse joint treatment	No treatment	
<b>Temperature of the mixture – minimum</b>	<b>Delivery</b>	<b>Rolling</b>
PMB 65/105-70	145	115
<b>Properties</b>		
Air voids minimum <sup>1</sup>	V <sub>min 20</sub>	
Air voids maximum <sup>1</sup>	V <sub>max 28</sub>	
Water sensitivity <sup>1</sup>	To be recorded	
Hydraulic Conductivity <sup>1</sup>	Average 0,12 seconds (min. value 0,8s)	

**Notes**

<sup>1</sup> Test methods and test conditions contained in Table 20. Cored specimens to be taken from the constructed layer.

**Table 13a Assessment of the Reclaimed Asphalt Feedstock**

Test	Reference in EN 13108-8	Test frequency by RA content by mass of the mixture			Test Method
		≤20%	>20% and ≤50%	>50% and ≤70%	
Source – mix group(s)	5.1	Declared	Declared	Declared	-
Foreign Matter	4.1	1 per 2000t	1 per 1000t	1 per 500t	EN 12697-42
Binder type	4.2.1	Declared	Declared	Declared	-
Binder recovered penetration <sup>1</sup>	4.2.2	1 per 2000t	1 per 1000t	1 per 500t	EN 12697-3 plus EN 1426
Binder recovered Softening Point	4.2.2	1 per 2000t	1 per 1000t	1 per 500t	EN 12697-3 plus EN 1427
Grading of the aggregate content	4.3	1 per 2000t	1 per 1000t	1 per 500t	EN 12697-2, Cl. 3.2.2
Binder content	4.4	1 per 2000t	1 per 1000t	1 per 500t	EN 12697-1 or 39
Maximum size of RA particles U <sub>RA</sub>	4.5	1 per 2000t	1 per 1000t	1 per 500t	EN 933-1
Cohesion test	-	1 per 2000t	1 per 1000t	1 per 500t	Refer to CC-GSW-00900



**Table 13b Requirements of the Reclaimed Asphalt Feedstock**

Characteristic	RA content by mass of the mixture		
	≤20%	>20% and ≤50%	>50% and ≤70%
Source – mix group(s)	declared declared		
Foreign Matter	F <sub>1</sub>		
Binder type	Paving Grade or Polymer Modified	Paving Grade only	
Recovered Binder:			
Penetration	P <sub>15</sub>		
Penetration range <sup>1</sup>	Declared	<15	<10
Softening Point	Declared		
Grading of the Reclaimed Aggregate content	Declared declared		
Grading range <sup>1</sup> % by mass of material:			
< 0.063mm	Declared	≤6	≤4
0.063mm to 2mm	Declared	≤16	≤12
≥ 2mm	Declared	≤16	≤12
Binder Content	Declared		
Binder Content range (% by mass)	Declared	≤1	≤0.8
Maximum size of RA particles U <sub>RA</sub>	Declared		
Cohesion Test	Declared		

**Notes**

<sup>1</sup>Range is defined as the difference between the maximum and minimum value from the set of values, as defined in EN13108-20, collected for a particular RA characteristic

**Table 13c Mixture Design Evaluation when Reclaimed Asphalt is a Constituent**

Characteristic	RA content by mass of the mixture			Test Method
	≤20%	>20% and ≤50%	>50% and ≤70%	
Recovered Penetration of mixture	n/a	To be reported		EN 12697-3 plus EN 1426
Recovered Softening Point of mixture	n/a	To be reported		EN 12697-3 plus EN 1427
Binder drainage	n/a	Maximum 0,3%		EN 12697-27
Stiffness <sup>1</sup>	n/a	To be reported		EN 12697-26:2018 Annex C IT-CY 20°C, 124ms
Fatigue <sup>1</sup>	n/a		To be reported	EN 12697-24:2018 Annex E, IT-CY at 20°C, 0.1Hz

**Notes:**

The above requirements are in addition to the product composition and properties requirements of Table 2.

<sup>1</sup> Refer to CC-GSW-00900 for further guidance on performance testing.

**Table 13d Additional Works Requirements when Reclaimed Asphalt is a Constituent**

Characteristic	RA content by mass of the mixture			Test Frequency	Test Method
	≤20%	>20% and ≤50%	>50% and ≤70%		
Stiffness <sup>1,2</sup>	nr	to be reported		1 pair of 150mm diameter cores per 1000m laid	EN 12697-26:2018 Annex C, IT-CY 20°C, 124ms
Fatigue <sup>1,2</sup>	nr		to be reported	16 cores per project	EN 12697-24:2018 Annex E, IT-CY at 20°C, 0.1Hz
ITS Ratio with Moisture Induced Sensitivity Test (MIST) conditioning <sup>1</sup>	nr	to be reported		3 pairs of 100mm diameter cores per 1000m laid Minimum 3 pairs of cores per project less than 1000m in length	EN 12697-23 ASTM D7870/D7870M
Dynamic Shear Rheometer (DSR) <sup>1,2</sup>	nr	Complex shear modulus ( $G^*$ ) and phase angle ( $\delta$ ) to be reported		1 per project	EN 12697-3 plus EN 14770
Falling Weight Deflectometer <sup>1</sup>	nr		to be reported	At 50m station intervals in the left wheel path of each lane	AM-PAV-06050 CC-SPW-04008

**Notes**

The above requirements are in addition to the requirements of the works testing contained in Table 3

<sup>1</sup>These tests form part of on-going research sponsored by Transport Infrastructure Ireland, the requirement is to make test results available to the Employer's Representative and the TII network management inspectorate

<sup>2</sup> Refer to CC-GSW-00900 for further guidance on performance testing

**Table 13e Reclaimed Asphalt – Requirements for Recalculation of Mixture Design**

Reclaimed Asphalt in Mix	≤20%	>20% and ≤50%	>50% and ≤70%
Trigger level of change in Reclaimed Asphalt – mean binder content – for recalculation of design	2%	0.5%	0,3%
Trigger level of change in Reclaimed Asphalt – mean recovered penetration – for recalculation of design	20 pen	5 pen	3,33 pen

**Table 14 Binder Properties – Paving Grade and Polymer Modified Bitumens**

hEN reference		EN 12591			EN 14023	
Table column reference		1	2	3	4	5
Type		Paving grade	Paving grade	Paving grade	PMB	PMB
Use		General	General	General	SMA	Porous
Grade		40/60	70/100	160/220	PMB 65-105/60	PMB 65-105/70
Test	Test Method	Unit				
<b>Initial Binder Characteristics</b>						
Penetration at 25°C	EN 1426	0,1mm	40 to 60	70 to 100	160 to 220	65 to 105 (Class 6)
Softening point	EN 1427	°C	48 to 56	43 to 51	35 to 43	≥ 60 (Class 6)
Storage Stability Difference in softening point	EN 13399 EN 1427	°C				≤ 5 (Class 2)
Fraass Breaking point, max	EN 12593	°C				≤ -12 (Class 6)
Cohesion Force Ductility (50mm/min traction)	EN 13589 EN 13703	J/cm <sup>2</sup>				≥ 1 (Class 4)
Elastic Recovery @ 25°C	EN 13398	%				TBR (Class 1)
Flash Point minimum	EN ISO 2592	°C	≥ 230	≥ 230	≥ 220	≥ 220 (Class 4)
Solubility, minimum	EN 12592	%(m/m)	≥ 99,0	≥ 99,0	≥ 99,0	
<b>Binder Characteristics, after short term ageing to EN 12607-1 (RTFOT)</b>						
Change of Mass, Max	EN 12607-1	%	≤ 0,5	≤ 0,8	≤ 1,0	≤ 1,0 (Class 5)
Retained pen 25°C, min	EN 1426	%	≥ 50	≥ 46	≥ 37	≥ 60 (Class 7)
Increase in softening point, maximum	EN 1427	°C	≤ 9	≤ 9	≤ 11	≤ 8 (Class 2)
Decrease in softening point, maximum	EN 1427	°C				≤ 2 (Class 2)

**Notes**

Tests must be carried out within 10 days of sampling; Sampling should be taken at point of delivery only in accordance with EN 58 & EN 12594

**Table 15 Binder Properties – Cationic Bituminous Emulsions**

hEN reference		EN 13808					
Table column reference		1	2	3	4	5	6
Use		Bond Coat	Tack Coat	Surface Dressing	Surface Dressing	Surface Dressing	Surface Dressing
Grade		C65BP 3	C40B 4	C69B3	C69BP 3	C72BP 3	C72BP 3
Test	Test Method	Unit					
Properties of the Emulsion							
Binder content	EN 1428	% by mass	63 to 67 (Class 7)	38 to 42 (Class 3)	67 to 71 (Class 9)	67 to 71 (Class 9)	≥ 71 (Class 11)
Residual binder after distillation	EN 1431	% by mass	≥ 63 (Class 7)	≥ 38 (Class 3)	≥ 67 (Class 9)	≥ 67 (Class 9)	
Breaking Value (Forshammer filler)	EN 13075-1		< 110 & 110-195 (Class 2 & 4)	< 110 & 110-195 (Class 2 & 4)	< 110 & 70-155 (Class 2 & 3)	< 110 & 70-155 (Class 2 & 3)	< 110 & 70-155 (Class 2 & 3)
Residue on Sieving, 500µm	EN 1429	% by mass	NR (Class 0)	NR (Class 0)	≤ 0,2 (Class 3)	≤ 0,2 (Class 3)	≤ 0,2 (Class 3)
Redwood #2 Viscosity @ 85°C	EN 16345	seconds	NR (Class 0)	NR (Class 0)	20-100 (Class 3)	20-100 (Class 3)	20-100 (Class 3)
Properties of the Binder							
Sample for test			Bituminous Phase of the emulsion		Residual Binder by Distillation	Bituminous Phase of the emulsion	Bituminous Phase of the emulsion
Penetration at 25°C	EN 1426	0,1mm			≤ 270 (Class 6)	≤ 270 (Class 6)	≤ 270 (Class 6)
Softening point	EN 1427	°C			DV (Class 1)	DV (Class 1)	≥ 39 (Class 7)
Cohesion (pendulum test)	EN 13588	J/cm <sup>2</sup>	≥ 1,0		-	≥ 1,0	≥ 1,2

**Notes**

Performance classes in accordance with IS EN 13808 Tables 2, 3 and 4

Tests must be carried out within 10 days of sampling; Sampling should be taken at point of delivery only in accordance with EN 58 & EN 12594

Binder contents carried out in accordance with IS EN 1428 exceeding the upper limit are permitted once the viscosity requirement is met

The binder content when determined by IS EN 1428 shall be defined as, 100 - (minus) Water Content

Abbreviations: DV: Declared Value; NR: Not Required

**Table 16 Regulating**

	CC-SPW-00900 Reference		Layer thickness – nominal <sup>1</sup>	Layer thickness - minimum	Horizontal alignment	Levels <sup>3</sup>	Bond coat rate of spread
Mixture designation	table	column					
Material							
AC 32 dense/HDM <sup>2</sup> base	2	1	70 to 150	55	See Clause 702	See Clause 702	0,30kg/m <sup>2</sup> of residual binder
AC 20 dense/HDM <sup>2</sup> bin	2	2	50 to 100	40			
SMA 14 bin	8	1	30 to 60 <sup>2</sup>	25			
SMA 10 bin	8	2	20 to 50 <sup>2</sup>	15			
SMA 6 bin	8	3	15 to 40 <sup>2</sup>	10			

**Notes**

<sup>1</sup> Where the total depth of a regulating course exceeds 100mm then the course shall be laid so that each regulating layer has a compacted thickness of between 50mm and 100mm.

<sup>2</sup> Thicknesses in excess of those given can provide better compaction if adequate equipment is used but could lead to problems with surface regularity and level control.

<sup>3</sup> Regulating shall be constructed so as to ensure that the designed nominal thickness and regularity of the subsequent layer is achieved

**Table 17 Surface Treatments – Requirements for Constituent Materials**

Material		Surface Dressing		Test Method
Test				
<b>Coarse Aggregate</b>				
Type - Crushed Rock		✓		EN 932-3
Type - Crushed Gravel		C <sub>100/0</sub>		EN 933-5
Shape - Flakiness and size		F <sub>l20</sub> <sup>1</sup> , F <sub>l25</sub> <sup>4</sup>		EN 933-3
Resistance to Fragmentation - Los Angeles		According to traffic:		
National Roads with Surface Dressing on concrete or other hard surfaces with AADT greater than 1000		LA <sub>20</sub>		EN 1097-2
National Roads with AADT greater than 200 or where steel wheeled rollers are used for compaction		LA <sub>25</sub>		EN 1097-2
Other lightly trafficked National Roads where local experience has demonstrated satisfactory performance of material from that source		LA <sub>30</sub>		EN 1097-2
Resistance to Freezing & Thawing - Soundness		MS <sub>25</sub>		EN 1367-2
Resistance to Freezing & Thawing - Water Absorption		WA <sub>24</sub> <sup>2</sup>		EN 1097-6
Resistance to Polishing - PSV		see Appendix 7/3 <sup>3</sup> or Appendix 7/21 <sup>3</sup>		EN 1097-8
Resistance to Surface Abrasion - AAV		see Appendix 7/3 <sup>3</sup> or Appendix 7/21 <sup>3</sup>		EN 1097-8
Average Least Dimension - ALD	Chip Size	Min (mm)	Max (mm)	South Africa test standard TMH1 Method B18(b)T (Dumas Method) <sup>5</sup>
	14/20	11	14	
	10/14	8	10	
	6/10	5	7	
	2/6	2.5	4	

**Notes**

<sup>1</sup> Applies to 14/20, 10/14, 6/10 chipping. See Note 4 for 2/6 chipping Not required for 2/4 chipping

<sup>2</sup> If the water absorption value is greater than WA242, the aggregate shall be deemed acceptable if the Soundness meets the MS25 requirement

<sup>3</sup> The PSV and AAV shall be specified in Appendix 7/3 for Surface Dressing Products and Appendix 7/21 for Recipe Surface Dressing

<sup>4</sup> Fl25 Applies to 2/6 chipping only.

<sup>5</sup> See DN-PAV-03074 Chapter 4 for further details of ALD measurement.

**Table 18 Surface Treatments – Product Composition and Properties**

hEN reference or product	Surface Dressing				
Table column reference	1	2	3	4	5
Designation	14/20 chipping	10/14 chipping	6/10 chipping	2/6 chipping	2/4 chipping
EN 13043 grading category	14/20 G <sub>c</sub> 85/20	10/14 G <sub>c</sub> 85/20	6,3/10 G <sub>c</sub> 85/20	2,8/6,3 G <sub>c</sub> 85/20	2/4 G <sub>c</sub> 85/20
<b>Sieve Size</b>	% by mass passing				
40	100				
31,5	98 to 100	100			
20	85 to 99	98 to 100	100		
16	Record value <sup>1</sup>				
14	0 to 20	85 to 99	98 to 100		
12,5		Record value <sup>1</sup>		100	
10		0 to 20	85 to 99		
8			Record value <sup>1</sup>	98 to 100	100
6,3	0 to 5		0 to 20	85 to 99	98 to 100
4		0 to 5	0 to 5	Record value <sup>1</sup>	85 to 99
2				0 to 20	0 to 20
1				0 to 5	0 to 5
0,250					
0,063					
Fines Content	$f_{0,5}$	$f_{0,5}$	$f_{0,5}$	$f_{1,0}$	$f_{1,0}$

**Notes**

<sup>1</sup> Record value for information purposes

**Table 19 Test Methods and Conditions – Products**

Property	Test method	Sample Preparation
		Note <sup>1,2</sup>
Grading	EN 12697-2	EN 12697-28
Binder content	EN 12697-1 or 39	EN 12697-28
Binder Volume	EN 12697-8 Using bulk density to EN 12697-6 procedure B SSD and maximum density to EN 12697-5 procedure A in water	EN 12697-30 Impact compaction or EN 12697-31 gyratory compaction
Binder drainage SMA	EN 12697-18 Schellenberg Method	EN 12697-27
Binder drainage PA	EN 12697-18 Basket Method	EN 12697-27
Void content	EN 12697-8 Using bulk density to EN 12697-6 procedure B SSD <sup>3</sup> and maximum density to EN 12697-5 procedure A in water	EN 12697-30 Impact compaction or EN 12697-31 gyratory compaction

Property	Test method	Sample Preparation
Void content at refusal	EN 12697-8 Using bulk density to EN 12697-6 procedure B SSD <sup>3</sup> (same specimens as used for void content) and maximum density to EN 12697-5 procedure A in water	EN 12697-32
Particle Loss (Cantabro Wear Test)	EN 12697-17 at 25°C	EN 12697-30 Impact compaction or EN 12697-31 gyratory compaction  The specimen compaction shall achieve maximum air voids up to 28% without causing significant crushing of the coarse aggregate
Water sensitivity	EN 12697-12 method A	EN 12697-31 gyratory compaction
Resistance to permanent deformation	EN 12697-22 procedure B 45°C small device	EN 12697-33 305mm square slabs compacted by a laboratory roller compactor <sup>5</sup>
Resistance to permanent deformation HRA	EN 12697-22 procedure A 45°C small device	EN 12697-33 305mm square slabs compacted by a laboratory roller compactor <sup>5</sup>
Stiffness	EN 12697-26 IT-CY 20°C	150mm diameter cores extracted from slabs compacted by a laboratory roller compactor or EN 12697-31 gyratory compaction
Stiffness LEBM	EN 12697-26 IT-CY 20°C	150mm cylindrical specimens, thickness 75 mm
Hot Rolled Asphalt Design Binder content	BS 594987 Annex H <sup>4</sup>	BS 594987 Annex H

**Notes**

<sup>1</sup> Unless otherwise stated, tests shall be carried out on specimens at the target composition manufactured by laboratory mixing in accordance with EN 12697-35

<sup>2</sup> Where sample preparation requires compaction, the method of compaction shall ensure the resultant Air Void content of the specimens is within the range specified for the mixture, the energy level used, in terms of the number of blows, number of gyrations or number of passes, shall be stated on the Type Test Report

<sup>3</sup> For Porous Asphalt and other materials with a void content greater than 10%, procedure D by dimensions shall be used

<sup>4</sup> The addition factors in BS 594987 Table H.5 shall be zero in all cases

<sup>5</sup> Guidance on test specimen thickness for resistance to permanent deformation is given in EN 12697-22



**Table 20 Test Methods and Conditions – Works**

Property	Test method	Sample Preparation
Grading	EN 12697-2	EN 12697-28
Binder content	EN 12697-1 or 39	EN 12697-28
Void content in situ in laid material & Void content in situ within 100mm of joint	EN 12697-8	
	Using bulk density to EN 12697-6 procedure B SSD	EN 12697-27 CI 4.7 cores 150mm diameter
	maximum density to EN 12697-5 procedure A in water	EN 12697-27 CI 4.3 sample from augers <sup>1</sup> or cores used for bulk density
Void content at refusal	EN 12697-32	
	Using bulk density to EN 12697-6 procedure B SSD	EN 12697-27 CI 4.7 cores 150mm diameter
	maximum density to EN 12697-5 procedure A in water	(using same cores extracted for void content)
Water sensitivity	EN 12697-12 method A	EN 12697-27 CI 4.3 sample from augers <sup>1</sup>
Resistance to permanent deformation	EN 12697-22 procedure B 45°C Small device	EN 12697-27 CI 4.7 cores 200mm min diameter or CI 4.8 saw cut slabs 320mm x 260mm
Resistance to permanent deformation HRA	EN 12697-22 procedure A 45°C Small device	EN 12697-27 CI 4.7 cores 200mm min diameter <sup>2</sup>
Stiffness	EN 12697-26 IT-CY 20°C	EN 12697-27 CI 4.7 cores 150mm diameter
Stiffness LEBM	EN 12697-26 IT-CY 20°C	150mm cylindrical specimens, thickness 75 mm
Hydraulic Conductivity	EN 12697-40	
Macrotexture	EN 13036-1	

**Notes**

<sup>1</sup> Preferably from the same location as where the cores will be taken

<sup>2</sup> Specimen thickness for resistance to permanent deformation shall be that at which the mixture was laid on the road, less material trimmed as part of sample preparation. HRA cores with pre coated chippings can be trimmed to achieve a flat and chippings-free surface or alternatively, turned and tested on the underside.

**Table 21 Not Used**

**Table 22a Surface Dressing – Categories of Binder and Chipping Application from IS EN 12271**

Parameter <sup>1</sup>	Traffic (Commercial Vehicles per Lane per Day)				
	0-25	26-50	51-250	251-500	Above 501
Rate of spread of binder - tolerance	±15% (Category 1)	±15% (Category 1)	±10% (Category 2)	±10% (Category 2)	±5% (Category 3)
Accuracy of spread of binder	≤15% (Category 1)	≤15% (Category 1)	≤15% (Category 1)	≤10% (Category 2)	≤10% (Category 2 <sup>2</sup> )
Rate of spread of chippings - tolerance	±15% (Category 1)	±15% (Category 1)	±10% (Category 2)	±10% (Category 2)	±5% (Category 3)
Accuracy of spread of chippings	≤15% (Category 1)	≤15% (Category 1)	≤15% (Category 1)	≤10% (Category 2)	≤10% (Category 2)

**Notes**

<sup>1</sup> Test method for performance categories are defined in EN 12272-1.

<sup>2</sup> Where the existing surface is very even there is a case for recommending that Category 3 is used for accuracy of spread of binders. However, only a limited number of spray-bars are capable of this accuracy.

**Table 22b Surface Dressing – Frequencies of Test for Binder and Chipping Application from IS EN 12271**

Parameter	Traffic (Commercial Vehicles per Lane per Day)				
	0-25	26-50	51-250	251-500	Above 500
Rate of spread of binder - tolerance	Reconciliation of binder used to area of surface dressing for each job site (Category F <sub>1</sub> )	Reconciliation of binder used to area of surface dressing for each job site (Category F <sub>1</sub> )	Every 100,000m <sup>2</sup> and at change of binder type or source (Category F <sub>2</sub> )	Every 25,000m <sup>2</sup> and at change of binder type or source (Category F <sub>3</sub> )	Every 10,000m <sup>2</sup> and at change of binder type or source (Category F <sub>4</sub> )
Accuracy of spread of binder	As set out in the quality plan (Category F <sub>0</sub> )	As set out in the quality plan (Category F <sub>0</sub> )	Every 100,000m <sup>2</sup> and at change of binder type or source (Category F <sub>1</sub> )	Every 100,000m <sup>2</sup> and at change of binder type or source (Category F <sub>1</sub> )	Every 100,000m <sup>2</sup> and at change of binder type or source (Category F <sub>1</sub> )
Rate of spread of chippings - tolerance	Reconciliation of chippings used to area of surface dressing for each job site (Category F <sub>1</sub> )	Reconciliation of chippings used to area of surface dressing for each job site (Category F <sub>1</sub> )	Every 100,000m <sup>2</sup> and at change of binder type or source (Category F <sub>2</sub> )	Every 25,000m <sup>2</sup> and at change of binder type or source (Category F <sub>3</sub> )	Every 25,000m <sup>2</sup> and at change of binder type or source (Category F <sub>3</sub> )

Parameter	Traffic (Commercial Vehicles per Lane per Day)				
	0-25	26-50	51-250	251-500	Above 500
Accuracy of spread of chippings	As set out in the quality plan (Category F <sub>0</sub> )	As set out in the quality plan (Category F <sub>0</sub> )	Every 100,000m <sup>2</sup> and at change of binder type or source (Category F <sub>1</sub> )	Every 100,000m <sup>2</sup> and at change of binder type or source (Category F <sub>1</sub> )	Every 100,000m <sup>2</sup> and at change of binder type or source (Category F <sub>1</sub> )

**Notes**

The tests for accuracy of spread automatically provide the measure of tolerance.

Where a Producer changes from one road type to another, necessitating a change of test frequency, the area surfaced should be checked since the last appropriate test (on any road type) and if it is in excess of the value given for the new road type then a test should be conducted in the early stages of the work on the new road type. The frequency does not have to be separated by road type. If, for instance, a Producer is moving between heavily trafficked sites and lightly trafficked sites, most of the tests should be carried out on the more heavily trafficked roads.

Categories F<sub>2</sub>, F<sub>3</sub> and F<sub>4</sub> shall include the requirement of category F<sub>1</sub> in addition to the requirements by area.

**Table 23a High Friction Surfacing – Requirements for Binders**

Physical Property		Test Method
Adhesive strength <sup>1</sup>	≥ 1,7 MPa	EN 1542
Elongation at break point for epoxy, methyl methacrylate, and polyurethane cold binders <sup>1</sup>	≥ 30%	EN ISO 527-1
Tensile strength of epoxy, methyl methacrylate, and polyurethane cold binders <sup>2</sup>	≥ 10,5 MPa	EN ISO 527-1
Tensile strength of hot binders	As declared	BS 6319-7
Softening point of hot binders	≥ 90 °C	BS 2000-58
Flow resistance of hot binders @ 60 °C	≤ 1 mm	BS 2499-3

**Notes**

<sup>1</sup> Test specimens to be cured for 7 days at 23±2 °C and tested immediately without delay

<sup>2</sup> Prepare samples per manufacturer's recommendation. Tests are carried at 23±2 °C

**Table 23b High Friction Surfacing – Requirements for Manufactured Aggregates**

Physical Property Calcined Bauxite		Test Method
Resistance to Polishing - PSV <sup>1</sup>	PSV <sub>70+</sub>	EN 1097-8
Resistance to Surface Abrasion - AAV <sup>2</sup>	AAV <sub>4</sub>	EN 1097-8 Annex A
Particle Density	ρ <sub>2,8</sub>	EN 1097-6
Resistance to Freezing & Thawing - Water Absorption	WA <sub>240,5</sub>	EN 1097-6
Particle Angularity	Blocked shape (not flakes)	Visual Assessment
<b>Sieve Size</b>	% by mass passing	
4	100	EN933-1
3,35	95 to 100	
1,18	0 to 5	
0,60	0 to 0,5	
<b>Mineralogy for Manufactured Aggregate</b>		
Diasporic or Gibbsite Corundum	60-85%	X-ray Diffraction

		Test Method
<b>Physical Property Calcined Bauxite</b>		
<b>Chemical Composition for Manufactured Aggregate</b>		
Al <sub>2</sub> O <sub>3</sub>	≥ 82,0%	EN 932-3
Fe <sub>2</sub> O <sub>3</sub>	≤ 4,5%	
SiO <sub>2</sub>	≤ 12,5%	
K <sub>2</sub> O+Na <sub>2</sub> O	≤ 0,5%	
TiO <sub>2</sub>	≤ 4,5%	

**Notes**

<sup>1</sup> The test is carried out on aggregate passing a 10mm sieve and retained on a 7,2mm grid sieve

<sup>2</sup> The test is carried out on aggregate passing a 14mm sieve and retained on a 10,2mm grid sieve

**Table 23c High Friction Surfacing – Requirements for Natural Aggregates**

		Test Method
<b>Physical Property Natural Aggregate</b>		
Resistance to Polishing - PSV <sup>1</sup>	PSV <sub>70+</sub>	EN 1097-8
Resistance to Surface Abrasion - AAV <sup>2</sup>	Declared	EN 1097-8 Annex A
Particle Density	Declared	EN 1097-6
Resistance to Freezing & Thawing -Water Absorption	WA <sub>24</sub> 1,0	EN 1097-6
Particle Angularity	Blocked shape (not flakes)	Visual Assessment
<b>Sieve Size</b>		
4	100	EN933-1
3,35	95 to 100	
1,18	0 to 5	
0,60	0 to 0,5	

**Notes**

<sup>1</sup> The test is carried out on aggregate passing a 10mm sieve and retained on a 7,2mm grid sieve

<sup>2</sup> The test is carried out on aggregate passing a 14mm sieve and retained on a 10,2mm grid sieve

**Table 23d High Friction Surfacing – Interval between Installing HFS Systems onto Freshly Laid Asphalt**

Asphalt type	Interval for Cold Applied HFS	Interval for Hot Applied HFS
Hot rolled asphalt	Between 7 and 28 days	Within 24 hours
Stone mastic asphalt	Between 14 and 28 days	Within 24 hours
Microsurfacing	Between 14 and 28 days	After 14 days of traffic
Surface dressing	After 6 months	After 14 days of traffic

**Notes**

Surface onto which HFS is to be applied shall be uniform and free from voids per CC-SPW-00700, Clause 702 for surface regularity.

**Table 23e High Friction Surfacing – Performance Requirements for Bond to Substrate**

Product Characteristics	Test Method	Requirement
Tensile adhesion /adhesive strength (Pull Off Test)	ASTM C1583	≥ 0.5 N/mm <sup>2</sup> (at 20±2°C)

**Table 24a Low Energy Bound Mixtures – Requirements for Virgin Aggregates and Virgin Filler**

Test		Test Method
<b>Coarse Aggregate</b>		
Resistance to Fragmentation - Los Angeles	LA <sub>30</sub>	EN 1097-2
Type - Crushed Rock	✓	na
Type - Crushed Gravel	C100/0	EN 933-5
Fines Content	f <sub>4</sub>	EN 933-1
Shape - Flakiness	na	na
Resistance to Freezing & Thawing - Soundness	MS <sub>25</sub>	EN 1367-2
Resistance to Freezing & Thawing - Water Absorption	WA <sub>242</sub> <sup>1</sup>	EN 1097-6
<b>Fine Aggregate</b>		
Type	crushed gravel fines, crushed rock fines, sand or mixture	na
<b>Filler</b>		
Grading	EN 13043 table 24	EN 933-10
Type	crushed gravel fines, crushed rock fines, sand	na

**Notes**

<sup>1</sup> If the water absorption value is greater than WA<sub>242</sub>, the aggregate shall be deemed acceptable if the Soundness meets the MS<sub>25</sub> requirement

**Table 24b Low Energy Bound Mixtures, Binder Properties – Cationic Bitumen Emulsions**

Table column reference			1	2
Use			Recycling	Recycling
Grade			C60B4	C60BP4 <sup>1</sup>
Test	Test Method	Unit		
Binder content	EN 1428	% by mass	58 to 62 (Class 6) <sup>2</sup>	58 to 62 (Class 6) <sup>2</sup>
Breaking Value	EN 13075-1		< 110 & 110-195 (Class 2 & 4)	< 110 & 110-195 (Class 2 & 4)
Mixing stability with cement	EN 12848	g	> 2 (Class 9)	> 2 (Class 9)
Settling tendency (7 days storage)	EN 12847	[%]	≤ 10 (Class 3)	≤ 10 (Class 3)
<b>Properties of the Binder</b>				
Elastic recovery	EN 13398	%	-	> 50
Penetration at 25°C	EN 1426	0,1mm	< 100 (Class 3)	< 100 (Class 3)
Softening point	EN 1427	°C	> 43 (Class 6)	> 50 (Class 4)

**Notes**

<sup>1</sup> Emulsion with polymer-modified bitumen is recommended for base and binder course

<sup>2</sup> Class 7 can be used as alternative

**Table 24c Low Energy Bound Mixtures – Product Composition and Properties (Binder Content)**

Table column reference	1	2	3	4
Minimum binder content (by % weight)	CTM <sup>1</sup>	CBTM / CAM <sup>2</sup>	BSM <sup>3</sup>	CAM <sup>4</sup>
Cement	2	1	1	1
Foamed Bitumen or Bituminous Emulsion	-	2	2	3

**Notes**

<sup>1</sup> CTM: Cement Treated Mixture

<sup>2</sup> CBTM: Cement-Bitumen Treated Material

<sup>3</sup> BSM: Bitumen Stabilised Mixture

<sup>4</sup> CAM: Cold Asphalt Mixture

**Table 24d Low Energy Bound Mixtures – Product Composition and Properties (Grading Envelope)**

Table column reference	1	2	3	4
Layer	Subbase / Base / Binder			
Grading Zone	A	B <sup>1</sup>	C <sup>2</sup>	D
Sieve Size	% by mass passing			
40	100	100	100	100
31,5	100	100	86 to 100	90 to 100
20	100	100	75 to 100	-
16	-	-	-	60 to 90
14	85 to 100	85 to 100	52 to 100	-
10	68 to 100	68 to 100	44 to 100	-
8	-	-	-	40 to 70
6,3	38 to 74	38 to 94	26 to 74	-
4	-	-	-	27 to 50
2	26 to 58	26 to 84	18 to 58	18 to 40
1	13 to 38	13 to 64	8 to 38	14 to 30
0,500	-	-	-	10 to 24
0,250	9 to 28	9 to 51	5 to 28	-
0,063 <sup>3</sup>	5 to 21	5 to 38	3 to 21	5 to 12

**Notes**

<sup>1</sup> Grading zone shall not be used with bitumen bound mixtures.

<sup>2</sup> Grading zone shall only be used in an in situ stabilisation process with a layer thickness greater than 100mm

<sup>3</sup> For bitumen bound mixtures the amount of fine material passing the 63 µm sieve shall be restricted to between 5 and 20%.

**Table 24e Low Energy Bound Mixtures – Testing Criteria of Product Composition**

Minimum Frequencies for Inspection and Testing			
Item	Inspection	Test	Test method
Aggregate and RA stockpiles <sup>1</sup>	Daily	Grading and moisture content Before production and weekly	EN 933-1 EN 1097-5
Combined grading of mixture <sup>2</sup>	Continual	Daily	EN 12967-2
Moisture content of mixture <sup>3</sup>	Continual	Daily	EN ISO 17892-1

Notes

<sup>1</sup> For in situ LEBM: only aggregate (virgin or reclaimed) added to meet the design gradation

<sup>2</sup> For in situ LEBM: sample has to be taken on site behind recycler pass before binder addition

<sup>3</sup> Moisture content of un-compacted stabilised material should be within the range 0 to 1,5 % below the Optimum Moisture Content. This should be checked on-site on a continuous basis and, at least, at a rate of one test be 500m of recycled lane section

**Table 24f Low Energy Bound Mixtures – Requirements of the Works**

Table column reference	1	2	3
Layer	Subbase	Base	Binder
Alignment, levels, tolerances, thickness & regularity (mm)			
Horizontal alignment	Clause 702	Clause 702	Clause 702
Levels	Clause 702	Clause 702	Clause 702
Tolerances	± 10 / -30	± 15	± 6
Layer thickness per pass <sup>1</sup>	100 – 300	100 – 300	100 – 300
Layer thickness tolerance (site measurement)	±25 of specified	±25 of specified	±25 of specified
Surface regularity	Clause 702	Clause 702	Clause 702

Notes

<sup>1</sup> Check depth at 50m intervals

**Table 24g Low Energy Bound Mixtures – Product Control Testing Criteria**

Requirements			
Material property or characteristic	Individual results	Mean from test set	Test method
In situ density relative to refusal density	93% minimum	95% minimum	EN 12697-6
Moisture content	Optimum ± 3%	Optimum ± 2%	EN ISO 17892-1
Indirect tensile stiffness modulus (ITSM)	As specified in Table 24h	-	EN 12697-26
Percentage air voids content	12% maximum	9% maximum	EN 12697-8

**Table 24h Low Energy Bound Mixtures – Product Requirements**

Performance class	Individual results
Class 1	≥1000 MPa
Class 2	≥1750 MPa
Class 3	≥2500 MPa

**Table 25a Retexturing – Maximum Permissible Noise Levels at the Facade of Nearby Dwellings**

Days & Times	LA <sub>eq</sub> (1hr) dB	LA <sub>max</sub> dB(A)
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60	65
Saturday 08:00 to 16:30hrs	65	75
Sundays and Bank Holidays 08:00 to 16:30hrs	60	65

**Table 25b Retexturing – Selection of Appropriate Retexturing Treatment**

Treatment	Chipped Rolled Asphalt	Surface Dressings	Stone Mastic Asphalts	Close Textured Asphalt Concrete
<b>Bush Hammering</b>				
Polished Aggregate Recovery of Skidding	Y	Y	Y	Y
Embedded Chippings Recovery of texture depth	O	X	X	X
Excessive noise/excessive texture	Y	X	X	X
Fatted-up recovery of texture depths	X	X	X	X
Removal of Binder Film	X	X	O	O
<b>Shot Blasting</b>				
Polished Aggregate Recovery of Skidding	Y	X	Y	Y
Embedded Chippings Recovery of texture depth	Y	X	X	X
Excessive noise/excessive texture	X	X	X	X
Fatted-up recovery of texture depths	X	X	X	X
Removal of Binder Film	X	X	O	O
<b>Grooving/Grinding</b>				
Polished Aggregate Recovery of Skidding	Y	X	Y	O
Embedded Chippings Recovery of texture depth	O	X	X	X
Excessive noise/excessive texture	O	X	X	X
Fatted-up recovery of texture depths	X	X	X	X
Removal of Binder Film	X	X	O	X
<b>Longitudinal Scabbling</b>				
Polished Aggregate Recovery of Skidding	Y	O	Y	Y
Embedded Chippings Recovery of texture depth	X	X	X	X
Excessive noise/excessive texture	Y	X	X	X
Fatted-up recovery of texture depths	X	X	X	X
Removal of Binder Film	X	X	X	Y
<b>Water Jetting</b>				
Polished Aggregate Recovery of Skidding	O	X	X	X
Embedded Chippings Recovery of texture depth	Y	X	X	X
Excessive noise/excessive texture	X	X	X	X
Fatted-up recovery of texture depths	X	Y	O	X
Removal of Binder Film	X	X	O	Y

**Notes**

Y – Appropriate Treatment

O – Treatment may be appropriate in some circumstances but effects will be limited and depend on surfacing conditions

X – Not Permitted



**Table 26a Permanent Repair Material Systems – Requirements for Constituent Materials**

Test	Permanent Repair Material	Test Method
<b>Coarse Aggregate</b>		
Aggregate of a single type and source	✓	EN 932-3
Type - Crushed Rock	✓	na
Type - Crushed Gravel	$C_{100/0}$	EN 933-5
Resistance to Fragmentation - Los Angeles	$LA_{30}$	EN 1097-2
Resistance to Polishing - PSV	$PSV_{60}$ or as amended by Appendix 7/1	EN 1097-8
Resistance to Surface Abrasion - AAV	$AAV_{10}$ or as amended by Appendix 7/1	EN 1097-8
<b>Reclaimed Asphalt</b>		
Maximum allowed	0%	
<b>Added Filler</b>		
Reclaimed filler	Not permitted	
Grading	EN 13043 table 24	EN 933-10
Type	crushed rock, crushed slag, hydrated lime, cement CEM I or CEM II	na

**Table 26b Permanent Repair Material Systems – Product Composition and Properties**

Reference	Permanent Repair Material	
Table column reference	1	2
Location	Carriageway	Footway
<b>Properties</b>		
Air Void content minimum <sup>1</sup>	$V_{\min 2,0}$	$V_{\min 2,0}$
Air Void content maximum <sup>1</sup>	$V_{\max 10,0}$	$V_{\max 13,0}$
Water sensitivity <sup>1</sup>	ITSR <sub>80</sub>	ITSR <sub>80</sub>
Resistance to permanent deformation <sup>1,2</sup>	$WTS_{Air1,0}$ PRD <sub>Air</sub>	$WTS_{Air1,0}$ PRD <sub>Air</sub>

**Notes**

<sup>1</sup>Test methods and test conditions contained in Table 19

<sup>2</sup>PRDAir values to be reported

**Table 26c Permanent Repair Material Systems – Requirements of the Works**

Reference	Permanent Repair Material Systems
Table column reference	1
Location	Carriageway
<b>Alignment, levels, tolerances &amp; regularity (mm)</b>	
Levels	Match existing pavement
Tolerances	0/+3
Adjacent to surface water or linear drainage channel	+ 10 - 0
<b>Surface Macrotexture (mm)</b>	
All locations including roundabouts	
Minimum	1,0

**Notes**

<sup>1</sup>Test methods and test conditions contained in Table 20

**Table 26d Permanent Repair Material Systems – Traffic Categories for Monitoring of PRMS**

Reference	Permanent Repair Material Systems
Table column reference	1
Traffic Category <sup>1</sup>	Commercial Vehicles per Lane per Day
	> 3000
	2001 - 3000
	1001 - 2000
	751 - 1000
	501 - 750
	251 - 500
	126 - 500
	51 - 125
	26 - 50
	0 - 25

**Notes**

<sup>1</sup>Traffic Category at time of repair works

**Table 27a Localised Surface Repair Systems – Requirements of the Works**

Reference	Localised Surface Repair Systems
Table column reference	1
Location	Carriageway
<b>Alignment, levels, tolerances &amp; regularity (mm)</b>	
Levels	Match existing pavement
Tolerances	0/+3
Adjacent to surface water or linear drainage channel	+ 10 - 0
<b>Surface Macrotexture (mm)</b>	
All locations including roundabouts	
Minimum	1,0

**Notes**

<sup>1</sup>Test methods and test conditions contained in Table 20

**Table 27b Localised Surface Repair Systems – Traffic Categories for Monitoring of LSRS**

Reference	Localised Surface Repair Systems
Table column reference	1
Traffic Category <sup>1</sup>	Commercial Vehicles per Lane per Day
	> 3000
	2001 - 3000
	1001 - 2000
	751 - 1000
	501 - 750
	251 - 500
	126 - 500
	51 - 125
	26 - 50
	0 - 25

**Notes**

<sup>1</sup>Traffic Category at time of repair works

**Table 28a Emergency Repair Material Systems – Requirements for Constituent Materials**

Test	Emergency Repair Material	Test Method
<b>Coarse Aggregate</b>		
Aggregate of a single type and source	✓	EN 932-3
Type - Crushed Rock	✓	na
Type - Crushed Gravel	$C_{100/0}$	EN 933-5
Resistance to Fragmentation - Los Angeles	$LA_{30}$	EN 1097-2
Resistance to Polishing - PSV	$PSV_{55}$ or as amended by Appendix 7/1	EN 1097-8
Resistance to Surface Abrasion - AAV	$AAV_{10}$ or as amended by Appendix 7/1	EN 1097-8
<b>Reclaimed Asphalt</b>		
Maximum allowed	0%	
<b>Added Filler</b>		
Reclaimed filler	yes	
Grading	EN 13043 table 24	EN 933-10
Type	crushed rock, crushed slag, hydrated lime, cement CEM I or CEM II	na

**Table 28b Emergency Repair Material Systems – Product Composition and Properties**

Reference	Emergency Repair Material	
Table column reference	1	2
Location	Carriageway	Footway
<b>Properties</b>		
Air Void content minimum <sup>1</sup>	$V_{\min 2,0}$	$V_{\min 2,0}$
Air Void content maximum <sup>1</sup>	$V_{\max 10,0}$	$V_{\max 13,0}$
Water sensitivity <sup>1</sup>	ITSR <sub>60</sub>	ITSR <sub>60</sub>
Resistance to permanent deformation <sup>1</sup>	$WTS_{Air1,0}$ PRD <sub>Air</sub>	$WTS_{Air1,0}$ PRD <sub>Air</sub>

**Notes**

<sup>1</sup>Test methods and test conditions contained in Table 19, PRDAir values to be reported

<sup>2</sup>Supplier Declared Value

**Table 28c Emergency Repair Material Systems – Requirements of the Works**


Reference	Emergency Repair Material Systems
Table column reference	1
Location	Carriageway
<b>Alignment, levels, tolerances &amp; regularity (mm)</b>	
Levels	Match existing pavement
Tolerances	0/+3
Adjacent to surface water or linear drainage channel	+ 10 - 0
<b>Surface Macrotexture (mm)</b>	
All locations including roundabouts	
Minimum	1,0

**Notes**

<sup>1</sup>Test methods and test conditions contained in Table 20





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