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Specification for Road Works Series 900 - Road Pavements - Bituminous Materials

CC-SPW-00900
November 2015

CC Construction & Commissioning

Standards

About TII

Transport Infrastructure Ireland (TII) is responsible for managing and improving the country's national road and light rail networks.

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Each document within TII Publications has a range of attributes associated with it, which allows for efficient access and retrieval of the document from the website. These attributes are also contained on the inside cover of each current document, for reference. For migration of documents from the NRA and RPA to the new system, each current document was assigned with new outer front and rear covers. Apart from the covers, and inside cover pages, the documents contain the same information as previously within the NRA or RPA systems, including historical references such as those contained within NRA DMRB and NRA MCDRW.

Document Attributes

TII Publication Title	*Specification for Road Works Series 900 - Road Pavements - Bituminous Materials*
TII Publication Number	*CC-SPW-00900*

Activity	*Construction & Commissioning (CC)*	**Document Set**	*Standards*
Stream	*Specification for Works (SPW)*	**Publication Date**	*November 2015*
Document Number	*00900*	**Historical Reference**	*Series 900*

NRA DMRB and MCDRW References

For all documents that existed within the NRA DMRB or the NRA MCDRW prior to the launch of TII Publications, the NRA document reference used previously is listed above under 'historical reference'. The TII Publication Number also shown above now supersedes this historical reference. All historical references within this document are deemed to be replaced by the TII Publication Number. For the equivalent TII Publication Number for all other historical references contained within this document, please refer to the TII Publications website.

ROAD PAVEMENTS – BITUMINOUS MATERIALS

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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 NRA HD 300 for reference during the design process.

1.2 Construction Products Regulation

For general details regarding the Construction Products Regulation, refer to NRA Specification for Road Works Series 000. 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 hEN's 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 hEN's refer to Construction Product Directive 8106/EEC the provisions of Construction Product Regulation (EU) No. 305/2011 prevail over any conflicting provisions of the hEN's. To assist in understanding the different terminology that exists between the Directive and the Regulation, NRA Series 000 contains the equivalent terms.

1.4 Assessment and Verification of Constancy of Performance (AVCP)

Further to the detail provided in Series 000 Clause 006, the two AVCP systems relevant to Series 900 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 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 hEN's detail the FPC requirements including minimum inspection / test frequencies.

Annex C of the hEN's 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 NRA HD 300 and NRA HD 301.

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 Definitions, Symbols and Abbreviations

AC	General designation for Asphalt Concrete. Asphalt Concrete is a continuously graded or gap-graded bituminous mixture in which the aggregates form an interlocking structure. The designation of AC is followed by an indication of *D*, 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.
Base	Main structural element of a pavement. The base may be laid in one or more courses, described as "upper" base, "lower" base.
Binder course	Part of the pavement between the surface course and the base.
Bond Coat	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.
Course	Structural element of a pavement constructed with a single material. A course may be laid in one or more layers.
Contractor	Installer of the Works.
Design Working Life	The period for which a product/system is to be used for its intended purpose without repair being necessary.
Employer	As defined in the Public Works Contract.
Employer's Representative	As defined in the Public Works Contract.

HRA	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. The designation of HRA is followed by an indication of the coarse aggregate content, in percent, an indication of *D*, the upper sieve size of the aggregate in the mixture, in millimetres (mm), the fine aggregate type and binder designation. 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.
Layer	Element of a pavement laid in a single operation
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.
Minimum binder content	The binder content applicable to design mixtures, it is the lowest binder content that the mixture can be designed with. FPC tolerances are applied to the binder content appropriate for the mixture's design.
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.

PA	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. The designation of PA is followed by an indication of *D*, 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.
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 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.
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 *D*, 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.
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.

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

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.

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 Series 700.

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 NRA Series 000 and Clause 1 of this Series shall be provided.

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

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.

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 Table 13c and this Clause.

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

Permitted use

The use of reclaimed asphalt shall not be allowed in the production of any surface courses. The maximum amount of reclaimed asphalt permitted shall be 30% for Asphalt Concrete base and binder course design mixtures.

3.2.5 Additives

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

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 10% 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. Virgin binder shall constitute a minimum of 70% of the binder content when reclaimed asphalt is used.

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 NRA Series 000 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

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 ≥ 16mm and 5,0% for D < 16mm. 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.

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 design binder content shall be determined in accordance with the protocol described in Annex H of BS 594987. The minimum binder content is given in Table 5.

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

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 NRA Series 000 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.

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 mixtures.

5.2.5 Additives

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

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.

5.3.4 Void Content

Void content shall be reported as V_{max} and V_{min} 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 NRA Series 000 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 65/105-70des

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.

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.

6.3.4 Void Content

Void content shall be reported as V_{max} and V_{min} 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.

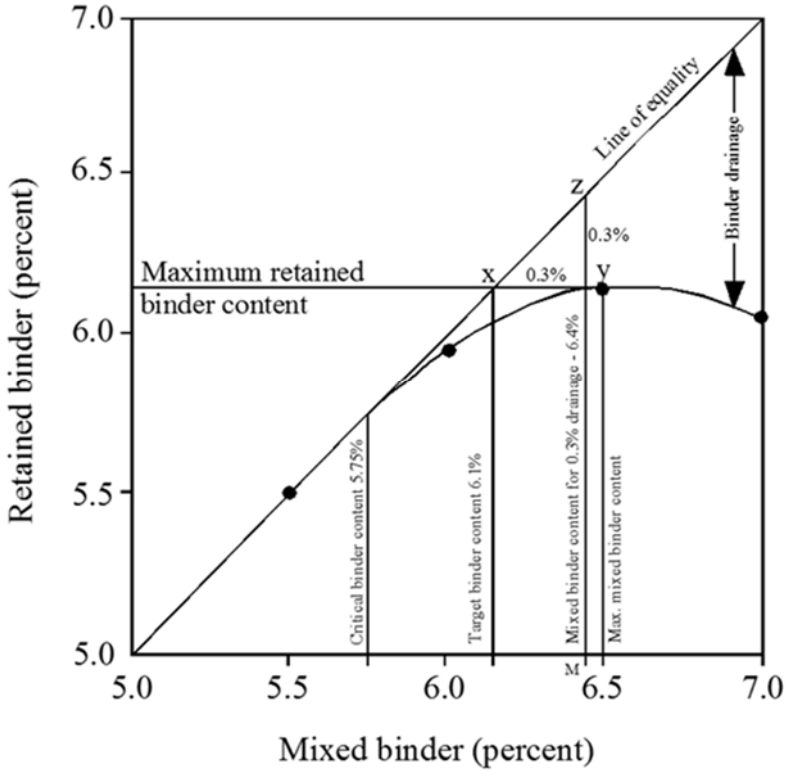
7.0
6.5
6.0
5.5
5.0
Retained binder (percent)
Line of equality
Binder drainage
z
0.3%
Maximum retained
binder content
x
0.3%
y
Critical binder content 5.75%
Target binder content 6.1%
Mixed binder content for 0.3% drainage - 6.4%
Max. mixed binder content
M
5.0
5.5
6.0
6.5
7.0
Mixed binder (percent)

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 NRA Series 000 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 NRA HD 300 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 NRA Series 000 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 NRA HD 300 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.

7.2.3.4 Performance Requirements

7.2.3.4.1 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.

7.2.3.4.2 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 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 7/3. Permitted categories of defects shall be in accordance with the requirements of Appendix 7/3.

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

7.2.3.5 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 NRA Series 000 and Clause 1 of this Series shall be provided.

7.2.3.5.1 Factory Production Control (FPC)

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

7.2.3.5.2 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.

7.2.3.5.3 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.

7.2.3.5.4 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 NRA HD 301. 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 NRA HD 301.

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 NRA HD 301 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 NRA HD 300.

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 NRA HD 301.

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 NRA HD 300. 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^2. 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^2.

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 NRA HD 301 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 V_{max} and V_{min} 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 NRA HD 301. 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 Series 700 and replacement with an approved surface course (in accordance with NRA HD 36) 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 NRA HD 301 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 NRA HD 301. 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 Series 700 and replacement with an approved surface course (in accordance with NRA HD 36) 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 Series 700, and replacement with an approved surface course (in accordance with NRA HD 36) 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 3^{o}C and 40^{o}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_{max} and V_{min} 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.

9. RECLAIMED ASPHALT

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

Reclaimed Asphalt shall only be added where it is demonstrated that the asphalt plant has the capability to add the Reclaimed Asphalt accurately and procedures are in place to record the quantity being added. The mixing time needs to be sufficient to achieve homogeneous blending of the active binder and the added bitumen.

9.1 Source

The source asphalt shall only contain mineral aggregate, filler and paving grade bitumen. Source asphalt containing tar shall not be permitted. Other contaminants should be considered on an individual basis in terms of their potential effect on the durability of the resulting asphalt and the environment.

9.2 Classification and Description

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

The mix group(s) and/or course(s) of the reclaimed asphalt from which the feedstock has been derived shall be declared. The presence and content of any foreign matter shall be classified as Group 1 and Group 2 and shall be declared.

The grading shall be carried out after removing the binder by solvent (or ignition) method. This grading shall be used for the mixture design. At the same time, a grading shall be carried out on the processed feedstock material to determine the maximum size of Reclaimed Asphalt particles.

The binder coating the aggregate particles shall be tested for binder content and recovered penetration and softening point. If the penetration of the recovered binder is less than 15 the recovered binder shall be considered inert for the purposes of consideration of the mixture binder content.

9.3 Storage

Feedstock that has been classified as acceptable shall be stored in labelled stockpiles, protected from rain, snow and direct sunshine. Feedstock from different stockpiles shall be treated separately without cross-contamination from other feedstock stockpiles unless it can be shown that the properties of the feedstock are similar. If the feedstock production process separates the material into more than one size then they shall be stored in separate stockpiles. The feedstock shall be stored under cover.

Since the requirements for bituminous mixtures are the same for mixtures with and without reclaimed asphalt, the level of homogeneity of the bituminous mixture in practice determines the maximum amount of reclaimed asphalt that can be used.

9.4 Mixture Design

The composition and properties of the bituminous mixture contained in Table 2 are suitable for mixtures with up to 10% Reclaimed Asphalt as a constituent. Where more than 10% Reclaimed Asphalt is used, additional properties shall be established in accordance with Table 13b.

The fresh binder added to the mixture shall be a single designated paving grade in accordance with IS EN 12591; combinations of grades shall not be permitted. The penetration and softening point of the combined fresh and active binder shall fall within the permitted range for the mixture designation.

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 requirements of Clause 9.6 shall be applied in this respect.

The following shall be declared on the Type Test report:

(i) The percentage of Reclaimed Asphalt in the mixture.
(ii) The proposed active binder content utilised for the mixture.
(iii) The grade of fresh binder added to the mixture.

9.6 Testing

In addition to routine testing requirements, the testing in Table 13c shall be carried out.

If the grading of the Reclaimed Asphalt is shown to have changed, the proportion of each fraction of fresh aggregate shall be adjusted to reinstate the intended grading.

If the adjustment cannot be completed because the amount of one (or more) fractions from the Reclaimed Asphalt is more than is required in the final mixture, then the proportion of Reclaimed Asphalt to be added shall be reduced or some of that fraction will have to be screened out from the Reclaimed Asphalt.

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 fresh binder required in the mixture design shall be recalculated if the change in binder content and/or the change in recovered penetration of the Reclaimed Asphalt exceed the amounts in Table 13d.

If the fresh binder has to be changed by a grade or more, the mixture design under Clause 9.4 above shall be repeated.

9.7 Traceability

As with all bituminous mixture constituents, Reclaimed Asphalt shall be traceable through the production process. This shall include documentation relating to the testing carried out on the Reclaimed Asphalt from the initial stockpile through to the products that it was used in.

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 Series 700. 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/m² 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 ± 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^2, 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 2ºC.
(ii) The air temperature is less than 0ºC.
(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.

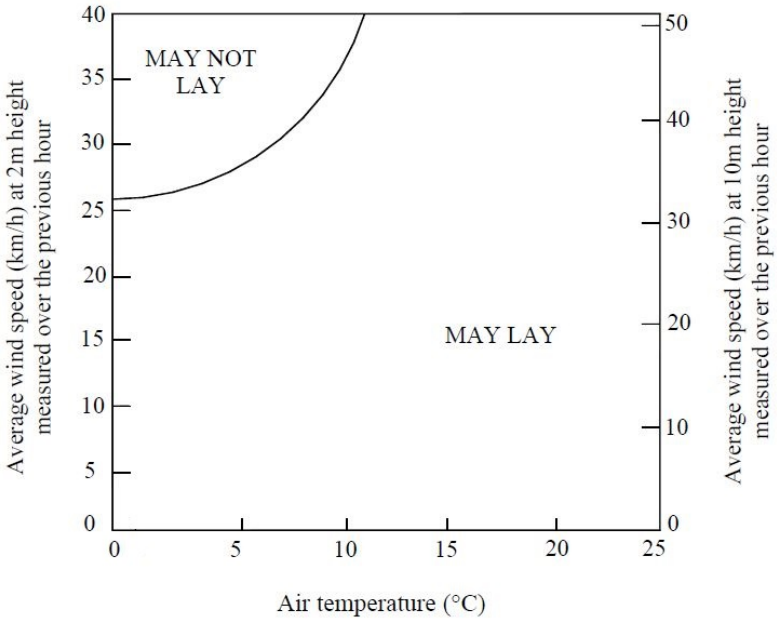

Figure 10.1.5.a

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.

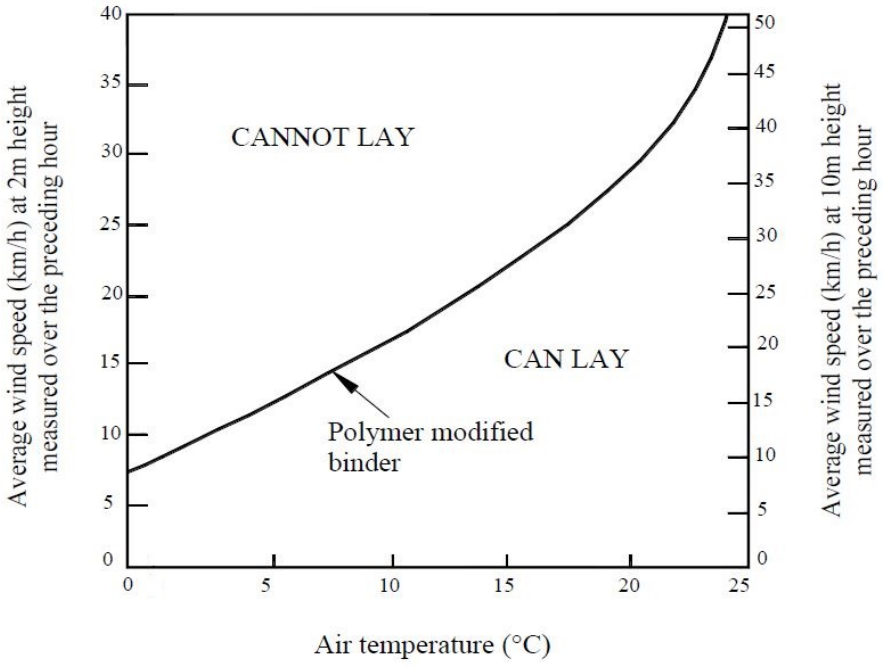

Figure 10.1.5.b

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 fatting 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 10% 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 shall be demonstrated utilising the cores that are being extracted for void analysis.

10.1.7.1 Laying Conditions Specific to Hot Rolled Asphalt Mixtures

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:

(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 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; and
(iii) At the discretion of the Employer's Representative.

Monitoring of the performance of the mechanical chipping spreader shall be carried out in accordance with BS 598-1 to check the rate of spread of chippings being achieved. Measurements shall be repeated for every 100 linear metres laid and in the following circumstances:

(i) If the source of the chippings changes;
(ii) If visual observation indicates a change in the size or shape of the chippings;
(iii) If the chipping spreader is changed; and
(iv) At the discretion of the Employer's Representative.

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 45^0 or 60^0 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 45^0 or 60^0 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^2 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 1,4 J/cm^2 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 in accordance with the requirements of Table 3, Table 6, Table 9 and Table 12 and the specific requirements of this Clause.

Where ‘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. 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 mean air void content shall be determined in accordance with 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 the surface course layer. The core log shall note if the site is confined.

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 and cores.

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 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; further on-going maximum density information shall be obtained from the maximum density determined from the samples taken in accordance with Table 20. The maximum density used for the in situ void content shall be updated on a rolling average basis of ten consecutive maximum density results.

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, one from each wheel track zone of the finished road pavement. Cores shall be cut and void content determined in accordance with 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, a pair of cores shall be taken from the wheel tracks of 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. 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 specified in Table 3. The core log shall note if the site is confined.

For material from each mixing plant, a pair of cores shall be taken every 250 linear metres laid, 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. For schemes less than 250m in length, a minimum of three pairs 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 3.

In the event that any of the core pairs do not comply with Table 3, then further cores shall be taken as necessary 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 lengths not less than 15m.

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, a pair of cores shall be taken from the wheel tracks of 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. The mean air void content at refusal shall be determined in accordance with Table 20. 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. The core log shall note if the site is confined.

10.1.9.2 Compaction Control Specific to Hot Rolled Asphalt Mixtures

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 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.

Vibratory rollers may be used if they are capable of achieving the minimum standard of compaction of an 8 tonne dead weight roller. The use of such rollers on HRA with pre-coated chippings shall be restricted to final finishing rolling.

10.1.9.3 Compaction Control Specific to Stone Mastic Asphalt Mixtures

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 9. The cores shall be extracted from the wheel tracks in the binder layer and outside of the wheel tracks for the surface course layer. The core log shall note if the site is confined.

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

The resistance to permanent deformation of material laid in the Works shall be monitored by testing in accordance with Table 20. Six cores shall be taken from the first kilometre length of material from each mixing plant and thereafter one further core from each subsequent lane kilometre. The cores shall be extracted from the wheel tracks in the base and binder layers.

10.1.10.2 Performance Requirements Specific to Hot Rolled Asphalt Surface Course Mixtures

The resistance to permanent deformation of material laid in the Works shall be monitored by testing in accordance with Table 20. Six cores shall be taken from the first kilometre length of material from each mixing plant and thereafter one further core from each subsequent lane kilometre. The cores shall be extracted outside of the wheel tracks for the surface course layer.

10.1.10.3 Performance Requirements Specific to Stone Mastic Asphalt Mixtures

The resistance to permanent deformation of material laid in the Works shall be monitored by testing in accordance with Table 20. Six cores shall be taken from the first kilometre length of material from each mixing plant and thereafter one further core from each subsequent lane kilometre. The cores shall be extracted from the wheel tracks in the binder layer and outside of the wheel tracks for the surface course layer.

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 13473-1-2004 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.

10.1.12 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 Series 700.

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 25^{o}C unless the maximum temperature within the laid material has fallen below 35^{o}C.

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 (hEN's) 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 15ºC.

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 NRA GD 101. 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 NRA HD 301.

High friction surfacing shall not be installed on concrete substrate unless otherwise verified by the prTAIT in accordance with NRA HD 301.

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 NRA HD 301.

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 1583 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 location 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 NRA HD 301.

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 NRA HD 301 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 ±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 ±15mm 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^2 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 NRA HD 300.

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 Series 700, and replacement with an approved surface course (in accordance with NRA HD 36) 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	$C_{100/0}$	$C_{100/0}$	EN 933-5
Fines Content	f_4	f_4	EN 933-1
Shape - Flakiness Index	na	FI_{30}	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	$WA_{24}2$[1]	$WA_{24}2$[1]	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	30%	0%	
Fine Aggregate			
Grading	0/2 or 0/4	0/2 or 0/4	EN 933-1
Fines Content	f_{22}	f_{22}	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			
[1] 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 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[1] base des		AC 20 dense/HDM[1] 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_{min} - minimum	minimum		minimum		minimum	minimum	minimum	minimum	minimum
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[2]	5,4 to 6,6[2]	5,4 to 6,6[2]	5,4 to 6,6[2]	5,4 to 6,6[2]
Binder grade	dense	HDM	dense	HDM					
40/60	✓	✓	✓	✓					
70/100	✓		✓		✓	✓	✓	✓	✓
160/220[3]					✓	✓	✓	✓	✓
Properties									
Void content – Minimum[4]	$V_{min\ 4,0}$		$V_{min\ 4,0}$		$V_{min\ 3,0}$	$V_{min\ 3,0}$	$V_{min\ 4,0}$	$V_{min\ 4,0}$	$V_{min\ 3,0}$
Void content – Maximum[4]	$V_{max\ 10,0}$		$V_{max\ 7,0}$		$V_{max\ 7,0}$	$V_{max\ 7,0}$	$V_{max\ NR}$	$V_{max\ NR}$	$V_{max\ 7,0}$
Resistance to permanent deformation[4]	$WTS_{Air1,0}$ $PRD_{Air9,0}$		$WTS_{Air1,0}$ $PRD_{Air9,0}$						
Water sensitivity[4]	$ITSR_{70}$		$ITSR_{70}$		$ITSR_{80}$	$ITSR_{80}$	$ITSR_{80}$	$ITSR_{80}$	$ITSR_{80}$
Stiffness[4]	To be recorded		To be recorded						
Temperature of the mixture - maximum									
40/60	190		190						
70/100	180		180		180	180	180	180	180
160/220					170	170	170	170	170

Table 2 Asphalt Concrete – Product Composition and Properties (contd.)

Notes
[1] Delete as appropriate
[2] 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.
[3] The use of 160/220 paving grade binder shall only be permitted for accommodation works.
[4] Test methods and test conditions contained in Table 19.

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[1] base des		AC 20 dense/HDM[1] 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	
Alignment, levels, tolerances, thickness & regularity (mm)														
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
40/60 pen	-	105	-	105										
70/100 pen	-	90	-	90	130	100	130	100	115	90	115	90	130	100
160/220 pen					110	85	110	85	95	75	95	75	110	85
Properties														
Air Void content in situ in laid material[2]	$V_{max\ 7,0}$		$V_{max\ 7,0}$		To be recorded		To be recorded		To be recorded		To be recorded		To be recorded	
Air Void content in situ within 100mm of joint[2]	$V_{max\ 9,0}$		$V_{max\ 9,0}$											
Air Void content in situ at refusal[2]	$V_{min\ 0,5}$		$V_{min\ 0,5}$											
Resistance to permanent deformation[2]	To be recorded		To be recorded											
Water sensitivity[2]	To be recorded		To be recorded		To be recorded		To be recorded		To be recorded		To be recorded		To be recorded	
Stiffness[2]	To be recorded		To be recorded											
Surface Macrotexture (mm)[2]														
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[3]		1,2[3]		1,2[3]		1,2[3]			
Average per 1000m - maximum					1,7[3]		1,7[3]							
Average for a set of 10 measurements - minimum					1,0[3]		1,0[3]		1,0[3]		1,0[3]			
Notes														
[1] Delete as appropriate														
[2] Applicable to trafficked surfaces, not accommodation works. Test methods and test conditions contained in Table 20														
[3] Restricted conditions apply, refer to NRA HD36														

Table 4 Hot Rolled Asphalt – Requirements for Constituent Materials

Test	Hot Rolled Asphalt		Test Method
	Surface Course	Pre Coated Chippings	
Coarse Aggregate			
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_4	EN 933-1
Shape - Flakiness and size	FI_{35}	FI_{15} 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	$WA_{24}2$[1]	$WA_{24}2$[1]	EN 1097-6
Resistance to Polishing - PSV (general use mixtures)	PSV_{44}	see Appendix 7/1	EN 1097-8
Resistance to Polishing - PSV (mixtures for roundabouts)	PSV_{60}	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%	
Fine Aggregate			
Grading	0/2 or 0/4	na	EN 933-1
Fines Content	f_{10} sand f_{22} CRF	na	EN 933-1
Type	crushed rock fines (CRF), sand or mixture of both	na	na
Added Filler			
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			
[1] 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			
[2] 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 [4]	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
Sieve Size	% by mass passing					
31,5						100
20	100	100	100	100		85 to 100
16	-	-	-	-		[3]
14	95 to 100	95 to 100	93 to 100	93 to 100		0 to 15
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
% aggregate passing 2 retained 0,500 - maximum	13		14			
Binder content B_{min} - minimum	minimum	minimum	minimum	minimum	minimum	Range
Design	7,2	7,2	7,4	7,4	9,6	1,2 to 1,8
Binder grade						
40/60	✓	✓	✓	✓	✓	✓
Polymer Modified Binder[1]	✓	✓	✓	✓		
Properties						
Binder volume[2]	$B_{vol\ 15,5}$	$B_{vol\ 15,5}$	$B_{vol\ 15,5}$	$B_{vol\ 15,5}$		
Air Void content[2]	$V_{max\ 7,0}$	$V_{max\ 7,0}$	$V_{max\ 7,0}$	$V_{max\ 7,0}$		
Resistance to permanent deformation[2]	$WTS_{Air15,0}$ $RD_{Air\ 7,0}$	$WTS_{Air15,0}$ $RD_{Air7,0}$	$WTS_{Air15,0}$ $RD_{Air7,0}$	$WTS_{Air15,0}$ $RD_{Air7,0}$		
Water sensitivity[2]	$ITSR_{80}$	$ITSR_{80}$	$ITSR_{80}$	$ITSR_{80}$		
Temperature of the mixture - maximum						
40/60	190	190	190	190	190	
PMB 65/105-60	[3]	[3]	[3]	[3]		
Notes						
[1] with approval of Transport Infrastructure Ireland						
[2] Test methods and test conditions contained in Table 19						
[3] Supplier Declared Value						
[4] Refer to Series 2000 for HRA 0/2F use						

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 [4]		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	
Alignment, levels, tolerances, thickness & regularity (mm)												
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											
Temperature of the mixture - minimum	Delivery	Rolling	Delivery	Rolling	Delivery	Rolling	Delivery	Rolling	Delivery	Rolling	Delivery	Rolling
40/60	155	110	155	110	155	110	155	110	140	110	na	
PMB 65/105-60	[3]	[3]	[3]	[3]	[3]	[3]	[3]	[3]				
Properties												
Air Void content[1]	To be recorded		To be recorded		To be recorded		To be recorded					
Resistance to permanent deformation[1]	To be recorded		To be recorded		To be recorded		To be recorded					
Water sensitivity[1]	To be recorded		To be recorded		To be recorded		To be recorded					
Surface Macrotexture (mm) [1]												
Mandatory speed of traffic > 60km/hr												
Average per 1000m - minimum	1,5		1,5		1,5		1,5					
Average per 1000m - maximum[2]	2,0		2,0		2,0		2,0					
Average for a set of 10 measurements - minimum	1,2		1,2		1,2		1,2					
Mandatory speed of traffic ≤ 60km/hr and all roundabouts												
Average per 1000m - minimum	1,2		1,2		1,2		1,2					
Average per 1000m - maximum[2]	1,7		1,7		1,7		1,7					
Average for a set of 10 measurements - minimum	1,0		1,0		1,0		1,0					
Notes												
[1] Test methods and test conditions contained in Table 20												
[2] The maximum requirement is assessed on the basis of 1000m segments and is not applicable to individual 'set of 10 measurements'												
[3] Supplier Declared Value												
[4] Refer to Series 2000 for HRA 0/2F use												

Table 7 Stone Mastic Asphalt – Requirements for Constituent Materials

Test	Stone Mastic Asphalt		Test Method
	Binder	Surface Course	
Coarse Aggregate			
Aggregate of a single type and source	na	✓	EN 932-3
Type - Crushed Rock	✓	✓	na
Type - Crushed Gravel	$C_{100/0}$	$C_{100/0}$	EN 933-5
Fines Content	f_4	f_4	EN 933-1
Shape - Flakiness and size	FI_{35}	FI_{15}	EN 933-3
Resistance to Fragmentation - Los Angeles	LA_{30}	LA_{25}	EN 1097-2
Resistance to Freezing & Thawing - Soundness	MS_{25}	MS_{25}	EN 1367-2
Resistance to Freezing & Thawing - Water Absorption	$WA_{24}2$[1]	$WA_{24}2$[1]	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%	
Fine Aggregate			
Grading	0/2 or 0/4	0/2 or 0/4	EN 933-1
Fines Content	f_{22}	f_{22}	EN 933-1
Type	crushed rock fines, sand or mixture with max 50% sand	Crushed rock fines of PSV_{55} minimum	na
Added Filler			
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			
[1] 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 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
Binder content B_{min} - minimum	minimum	minimum	minimum	minimum	minimum	minimum	minimum
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		
Binder grade							
40/60	✓	✓	✓			✓	✓
70/100	✓	✓	✓				
PMB 65/105-60	✓	✓	✓	✓	✓		
Additives							
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
Properties							
Binder drainage[1]	$D_{0,3}$	$D_{0,3}$	$D_{0,3}$	$D_{0,3}$	$D_{0,3}$	$D_{0,3}$	$D_{0,3}$
Air Void content minimum[1]	$V_{\text{min } 2,0}$	$V_{\text{min } 2,0}$	$V_{\text{min } 2,0}$	$V_{\text{min } 2,0}$	$V_{\text{min } 2,0}$	$V_{\text{min } 2,0}$	$V_{\text{min } 2,0}$
Air Void content maximum[1]	$V_{\text{max } 8,0}$	$V_{\text{max } 8,0}$	$V_{\text{max } 8,0}$	$V_{\text{max } 5,0}$	$V_{\text{max } 5,0}$	$V_{\text{max } 5,0}$	$V_{\text{max } 5,0}$
Water sensitivity[1]	$ITSR_{80}$	$ITSR_{80}$	$ITSR_{80}$	$ITSR_{80}$	$ITSR_{80}$	$ITSR_{80}$	$ITSR_{80}$
Resistance to permanent deformation[1]	$WTS_{Air1,0}$ PRD_{Air}	$WTS_{Air1,0}$ PRD_{Air}	$WTS_{Air1,0}$ PRD_{Air}	$WTS_{Air1,0}$ PRD_{Air}	$WTS_{Air1,0}$ PRD_{Air}	$WTS_{Air1,0}$ PRD_{Air}	$WTS_{Air1,0}$ PRD_{Air}
Temperature of the mixture - maximum							
40/60	190	190	190			190	190
70/100	180	180	180				
PMB 65/105-60	[2]	[2]	[2]	[2]	[2]		
Notes							
[1] Test methods and test conditions contained in Table 19, PRD_{Air} values to be reported							
[2] Supplier Declared Value							

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[2]		SMA 10 surf des[2]	
Alignment, levels, tolerances, thickness & regularity (mm)														
Horizontal alignment	See Clause 702													
Levels	See Clause 702													
Tolerances	± 6		± 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		+ 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
40/60	130	100	130	100	130	100					130	100	130	100
70/100	125	90	125	90	125	90								
PMB 65/105-60	145	115	145	115	145	115	145	115	145	115				
Properties														
Air voids minimum[1]	$V_{min\ 2,0}$		$V_{min\ 2,0}$		$V_{min\ 2,0}$		To be recorded		To be recorded		To be recorded		To be recorded	
Air voids maximum[1]	$V_{max\ 8,0}$		$V_{max\ 8,0}$		$V_{max\ 8,0}$		To be recorded		To be recorded		To be recorded		To be recorded	
Water sensitivity[1]	To be recorded		To be recorded		To be recorded		To be recorded		To be recorded		To be recorded		To be recorded	
Resistance to permanent deformation[1]	To be recorded		To be recorded		To be recorded		To be recorded		To be recorded		To be recorded		To be recorded	
Surface Macrotexture (mm) [1]														
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[3]		1,0		1,0[3]		1,0	
Average per 1000m - maximum	na		na		na		1,8[3]		1,6		1,8[3]		1,6	
Average for a set of 10 measurements - minimum	na		na		na		0,9[3]		0,9		0,9[3]		0,9	
Notes														
[1] Test methods and test conditions contained in Table 20														
[2] These mixture designations shall not be permitted for use on roads carrying greater than 100 cv/lane/day														
[3] Restricted conditions apply, refer to NRA HD36														

Table 10 Porous Asphalt – Requirements for Constituent Materials

Test	Porous Asphalt	Test Method
	Surface Course	
Coarse Aggregate		
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	FI_{15} 8/14 FI_{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
Reclaimed Asphalt		
Maximum allowed	0%	
Fine Aggregate		
Grading	0/2 or 0/4	EN 933-1
Fines Content	f_{22}	EN 933-1
Type	crushed rock fines	na
Added Filler		
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		
[1] If the water absorption value is greater than WA242, the aggregate shall be deemed acceptable if the Soundness meets the MS_{25} requirement		

Table 11 Porous Asphalt – Product Composition and Properties

hEN reference	EN 13108 – 7 Porous Asphalt
Table column reference	1
Layer	Surface
Mixture designation	PA 14 Surf des
Sieve Size	% by mass passing
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[1]
Binder content B_{min} - minimum	minimum
PMB 65/105-70	6,0
Properties	
Binder drainage[2]	$D_{0,3}$
Air Void content minimum expected[2]	$V_{\text{min 20}}$
Air Void content maximum expected[2]	$V_{\text{max 28}}$
Water sensitivity[2]	$ITSR_{80}$
Particle Loss (Cantabro Wear Test)[2]	PL_{20}
Binder grade	
PMB 65/105-70	✓
Temperature of the mixture - maximum	
PMB 65/105-70	[3]
Notes	
[1] Includes 2% hydrated lime by weight of total aggregate	
[2] Test methods and test conditions contained in Table 19	
[3] 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	
Alignment, levels, tolerances, thickness & regularity (mm)		
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	
Bond and joints		
Joint location	No joints permitted - shall be laid in echelon	
Longitudinal & transverse joint treatment	No treatment	
Temperature of the mixture - minimum	Delivery	Rolling
PMB 65/105-70	145	115
Properties		
Air voids minimum[1]	$V_{min\ 20}$	
Air voids maximum[1]	$V_{max\ 28}$	
Water sensitivity[1]	To be recorded	
Hydraulic Conductivity[1]	Average 0,12 seconds (min value 0,8s)	
Notes		
[1] Test methods and test conditions contained in Table 20		

Table 13a Reclaimed Asphalt – Classification and Description of Feedstock

Test	Reference in EN 13108-8	Requirement	Test frequency	Test Method
Source – mix group(s)	5.1	declared		-
Foreign Matter	4.1	F_1	1 per 500t	EN 12697-42
Binder type	4.2.1	Paving grade	-	-
Binder recovered penetration[1]	4.2.2	declared	1 per 500t	EN 12697-3 plus EN 1426
Binder recovered Softening Point	4.2.2	declared	1 per 500t	EN 12697-3 plus EN 1427
Grading of the aggregate content	4.3	declared	1 per 500t	EN 12697-2 Cl. 3.2.2
Binder content	4.4	declared	1 per 500t	EN 12697-1 or 39
Maximum size of RA particles U_{RA}	4.5	declared	1 per 500t	EN 12697-2
Notes				
[1] Where the penetration of the recovered binder of the reclaimed asphalt is tested and shown to be less than 15 it shall be treated as aggregate for the purpose of consideration of binder content				

Table 13b Reclaimed Asphalt – Design Process when Reclaimed Asphalt is a Constituent

Test	Frequency of testing according to quantity of Reclaimed Asphalt in mix		Test Method
	≤ 10%	> 10% to 30%	
Recovered Penetration of mixture	n/a	Within the permitted penetration range for the mixture designation	EN 12697-3 plus EN 1426
Recovered Softening Point of mixture	n/a	Within the permitted softening point range for the mixture designation	EN 12697-3 plus EN 1427
Binder drainage	n/a	Maximum 0,3%	EN 12697-27
Permanent deformation	n/a	$WTS_{AIR\ 1,0}$	EN 12697-22 procedure B 60^0C small device
Proposed Active Binder Content	declared	declared	-
Notes			
The above requirements are in addition to the product composition and properties requirements of Table 2			

Table 13c Reclaimed Asphalt – Works Testing when Reclaimed Asphalt is a Constituent

Test	Frequency of testing – based on addition of RA to mix			Test Method
	≤ 10%	> 10% to ≤ 20%	> 20% to 30%	
Recovered Penetration	n/a	1 per 5000t	1 per 2000t	EN 12697-3 plus EN 1426
Recovered Softening Point	n/a	1 per 5000t	1 per 2000t	EN 12697-3 plus EN 1427
Indirect Tensile Strength (ITS)	n/a	1 pair of 100mm diameter cores per 1000m laid	1 pair of 100mm diameter cores per 1000m laid	EN 12697-23
Moisture Induced Sensitivity Test (MIST) conditioning[1]	n/a	1 pair of 100mm diameter cores per 1000m laid	1 pair of 100mm diameter cores per 1000m laid	
Rheology[2]	n/a	1 loose sample of 25kg per 1000m laid	1 loose sample of 25kg per 1000m laid	
Notes				
The above requirements are in addition to the requirements of the works testing contained in Table 3				
[1] MIST forms part of on-going research sponsored by Transport Infrastructure Ireland, the requirement is to make the samples available to the Employer's Representative to forward to the TII network management inspectorate				
[2] Rheological data forms part of on-going research sponsored by Transport Infrastructure Ireland, the requirement is to make the samples available to the Employer's Representative to forward to the TII network management inspectorate				

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

Reclaimed Asphalt in Mix	**5%**	**10%**	**15%**	**20%**	**30%**
Trigger level of change in Reclaimed Asphalt – binder content – for recalculation of design	2%	1%	0,7%	0,5%	0,3%
Trigger level of change in Reclaimed Asphalt – recovered penetration – for recalculation of design	20 pen	10 pen	6,7 pen	5 pen	3,33 pen
Notes					
Figures above shall be used as examples; trigger levels for intermediate quantities of Reclaimed Asphalt added shall be calculated on a pro-rata basis.					

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					
Initial Binder Characteristics							
Penetration at 25°C	EN 1426	0,1mm	40 to 60	70 to 100	160 to 220	65 to 105 (Class 6)	65 to 105 (Class 6)
Softening point	EN 1427	°C	48 to 56	43 to 51	35 to 43	≥ 60 (Class 6)	≥ 70 (Class 4)
Storage Stability Difference in softening point	EN 13399 EN 1427	°C				≤5 (Class 2)	≤5 (Class 2)
Fraass Breaking point, max	EN 12593	°C				≤ -12 (Class 6)	≤ -12 (Class 6)
Cohesion Force Ductility (50mm/min traction)	EN 13589 EN 13703	J/cm^2				≥1 (Class 4)	≥1 (Class 4)
Elastic Recovery @ 25°C	EN 13398	%				TBR (Class 1)	TBR (Class 1)
Flash Point minimum	EN ISO 2592	°C	≥ 230	≥ 230	≥ 220	≥ 220 (Class 4)	≥ 220 (Class 4)
Solubility, minimum	EN 12592	%(m/m)	≥ 99,0	≥ 99,0	≥ 99,0		
Binder Characteristics, after short term ageing to EN 12607-1 (RTFOT)							
Change of Mass, Max	EN 12607-1	%	≤ 0,5	≤ 0,8	≤ 1,0	≤1,0 (Class 5)	≤1,0 (Class 5)
Retained pen 25°C, min	EN 1426	%	≥ 50	≥ 46	≥ 37	≥60 (Class 7)	≥60 (Class 7)
Increase in softening point, maximum	EN 1427	°C	≤ 9	≤ 9	≤ 11	≤8 (Class 2)	≤8 (Class 2)
Decrease in softening point, maximum	EN 1427	°C				≤2 (Class 2)	≤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 IS EN 58 & IS 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)	≥ 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)	< 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)	≤ 0,5 (Class 4)
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)	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	Bituminous Phase of the emulsion
Penetration at 25°C	EN 1426	0,1mm			≤ 270 (Class 6)	≤ 270 (Class 6)	≤ 270 (Class 6)	≤ 270 (Class 6)
Softening point	EN 1427	°C			DV (Class 1)	DV (Class 1)	≥ 39 (Class 7)	≥ 39 (Class 7)
Cohesion (pendulum test)	EN 13588	J/cm^2	≥ 1,0		-	≥ 1,0	≥ 1,2	≥ 1,4
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 IS EN 58 & IS 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

	Series 900 reference		Layer thickness – nominal[1]	Layer thickness - minimum	Horizontal alignment	Levels[3]	Bond coat rate of spread
Mixture designation	table	column					
Material							
AC 32 dense/HDM[2] base	2	1	70 to 150	55	See Clause 702	See Clause 702	0,30kg/m² of residual binder
AC 20 dense/HDM[2] bin	2	2	50 to 100	40			
SMA 14 bin	8	1	30 to 60[2]	25			
SMA 10 bin	8	2	20 to 50[2]	15			
SMA 6 bin	8	3	15 to 40[2]	10			
Notes							
[1] 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.							
[2] 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.							
[3] 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		
Coarse Aggregate		
Type - Crushed Rock	✓	EN 932-3
Type - Crushed Gravel	$C_{100/0}$	EN 933-5
Shape - Flakiness and size	FI_{20}[1]	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_{20}	EN 1097-2
National Roads with AADT greater than 200 or where steel wheeled rollers are used for compaction	LA_{25}	EN 1097-2
Other lightly trafficked National Roads where local experience has demonstrated satisfactory performance of material from that source	LA_{30}	EN 1097-2
Resistance to Freezing & Thawing - Soundness	MS_{25}	EN 1367-2
Resistance to Freezing & Thawing - Water Absorption	$WA_{24}2$[2]	EN 1097-6
Resistance to Polishing - PSV	see Appendix 7/3[3] or Appendix 7/21[3]	EN 1097-8
Resistance to Surface Abrasion - AAV	see Appendix 7/3[3] or Appendix 7/21[3]	EN 1097-8
Notes		
[1] Applies to 14/20, 10/14, 6/10 chipping. FI to be declared for 2/6 chipping. Not required for 2/4 chipping		
[2] 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		
[3] The PSV and AAV shall be specified in Appendix 7/3 for Surface Dressing Products and Appendix 7/21 for Recipe Surface Dressing		

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_c85/20	10/14G_c85/20	6,3/10G_c85/20	2,8/6,3G_c85/20	2/4G_c85/20
Sieve Size	% by mass passing				
40	100				
31,5	98 to 100	100			
20	85 to 99	98 to 100	100		
16	Record value[1]				
14	0 to 20	85 to 99	98 to 100		
12,5		Record value[1]		100	
10		0 to 20	85 to 99		
8			Record value[1]	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[1]	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					
[1] Record value for information purposes					

Table 19 Test Methods and Conditions – Products

Property	Test method	Sample Preparation
		Note [1, 2]
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[3] and maximum density to EN 12697-5 procedure A in water	EN 12697-30 Impact compaction or EN 12697-31 gyratory compaction
Void content at refusal	EN 12697-8 Using bulk density to EN 12697-6 procedure B SSD[3] (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 60^0C small device	EN 12697-33 305mm square slabs compacted by a laboratory roller compactor
Resistance to permanent deformation HRA	EN 12697-22 procedure A 60^0C small device	EN 12697-33 305mm square slabs compacted by a laboratory roller compactor
Stiffness	EN 12697-26 IT-CY 20^0C	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 20^0C	150mm cylindrical specimens, thickness 75 mm
Hot Rolled Asphalt Design Binder content	BS 594987 Annex H [4]	BS 594987 Annex H

Notes

[1] Unless otherwise stated, tests shall be carried out on specimens at the target composition manufactured by laboratory mixing in accordance with EN 12697-35

[2] Where sample preparation requires compaction, 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

[3] For Porous Asphalt and other materials with a void content greater than 10%, procedure D by dimensions shall be used

[4] The addition factors in BS 594987 Table H.5 shall be zero in all cases

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 Cl 4.7 cores 150mm diameter
	maximum density to EN 12697-5 procedure A in water	EN 12697-27 Cl 4.3 sample from augers[1] 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 Cl 4.7 cores 150mm diameter (using same cores extracted for void content)
	maximum density to EN 12697-5 procedure A in water	
Water sensitivity	EN 12697-12 method A	EN 12697-27 Cl 4.3 sample from augers[1]
Resistance to permanent deformation	EN 12697-22 procedure B 60^0C Small device	EN 12697-27 Cl 4.7 cores 200mm min diameter or Cl 4.8 saw cut slabs 320mm x 260mm
Resistance to permanent deformation HRA	EN 12697-22 procedure A 60^0C Small device	EN 12697-27 Cl 4.7 cores 200mm min diameter
Stiffness	EN 12697-26 IT-CY 20^0C	EN 12697-27 Cl 4.7 cores 150mm diameter
Stiffness LEBM	EN 12697-26 IT-CY 20^0C	150mm cylindrical specimens, thickness 75 mm
Hydraulic Conductivity	EN 12697-40	
Macrotexture	EN 13036-1	
Notes		
[1] Preferably from the same location as where the cores will be taken		

Table 21 – Not Used

Table 22a Surface Dressing – Categories of Binder and Chipping Application from IS EN 12271

Parameter[1]	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[2])
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					
[1] Test method for performance categories are defined in IS EN 12272-1.					
[2] 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_1)	Reconciliation of binder used to area of surface dressing for each job site (Category F_1)	Every 100,000m^2 and at change of binder type or source (Category F_2)	Every 25,000m^2 and at change of binder type or source (Category F_3)	Every 10,000m^2 and at change of binder type or source (Category F_4)
Accuracy of spread of binder	As set out in the quality plan (Category F_0)	As set out in the quality plan (Category F_0)	Every 100,000m^2 and at change of binder type or source (Category F_1)	Every 100,000m^2 and at change of binder type or source (Category F_1)	Every 100,000m^2 and at change of binder type or source (Category F_1)
Rate of spread of chippings - tolerance	Reconciliation of chippings used to area of surface dressing for each job site (Category F_1)	Reconciliation of chippings used to area of surface dressing for each job site (Category F_1)	Every 100,000m^2 and at change of binder type or source (Category F_2)	Every 25,000m^2 and at change of binder type or source (Category F_3)	Every 25,000m^2 and at change of binder type or source (Category F_3)
Accuracy of spread of chippings	As set out in the quality plan (Category F_0)	As set out in the quality plan (Category F_0)	Every 100,000m^2 and at change of binder type or source (Category F_1)	Every 100,000m^2 and at change of binder type or source (Category F_1)	Every 100,000m^2 and at change of binder type or source (Category F_1)
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_2, F_3 and F_4 shall include the requirement of category F_1 in addition to the requirements by area.					

Table 23a High Friction Surfacing – Requirements for Binders

		Test Method
Physical Property		
Adhesive strength[1]	≥ 1,7 MPa	IS EN 1542
Elongation at break point for epoxy, methyl methacrylate, and polyurethane cold binders[1]	≥ 30%	IS EN ISO 527-1
Tensile strength of epoxy, methyl methacrylate, and polyurethane cold binders[2]	≥ 10,5 MPa	IS 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		
[1] Test specimens to be cured for 7 days at 23±2 °C and tested immediately without delay		
[2] Prepare samples per manufacturer's recommendation. Tests are carried at 23±2 °C		

Table 23b High Friction Surfacing – Requirements for Manufactured Aggregates

		Test Method
Physical Property Calcined Bauxite		
Resistance to Polishing - PSV[1]	PSV_{70+}	EN 1097-8
Resistance to Surface Abrasion - AAV[2]	AAV_4	EN 1097-8 Annex A
Particle Density	$\rho_{2,8}$	EN 1097-6
Resistance to Freezing & Thawing - Water Absorption	$WA_{24}0,5$	EN 1097-6
Particle Angularity	Blocked shape (not flakes)	Visual Assessment
Sieve Size	% by mass passing	
4	100	EN933-1
3,35	95 to 100	
1,18	0 to 5	
0,60	0 to 0,5	
Mineralogy for Manufactured Aggregate		
Diasporic or Gibbsitic Corundum	60-85%	X-ray Diffraction
Chemical Composition for Manufactured Aggregate		
Al_2O_3	≥ 82,0%	EN 932-3
Fe_2O_3	≤ 4,5%	
SiO_2	≤ 12,5%	
K_2O+Na_2O	≤ 0,5%	
TiO_2	≤ 4,5%	
Notes		
[1] The test is carried out on aggregate passing a 10mm sieve and retained on a 7,2mm grid sieve		
[2] 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
Physical Property Natural Aggregate		
Resistance to Polishing - PSV[1]	PSV_{70+}	EN 1097-8
Resistance to Surface Abrasion - AAV[2]	Declared	EN 1097-8 Annex A
Particle Density	Declared	EN 1097-6
Resistance to Freezing & Thawing -Water Absorption	$WA_{24}1,0$	EN 1097-6
Particle Angularity	Blocked shape (not flakes)	Visual Assessment
Sieve Size		
4	100	EN933-1
3,35	95 to 100	
1,18	0 to 5	
0,60	0 to 0,5	
Notes		
[1] The test is carried out on aggregate passing a 10mm sieve and retained on a 7,2mm grid sieve		
[2] 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 Series 700, 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 1583	≥ 0.5 N/mm^2 (at 20±2°C)

Table 24a Low Energy Bound Mixtures – Requirements for Virgin Aggregates and Virgin Filler

Test		Test Method
Coarse Aggregate		
Resistance to Fragmentation - Los Angeles	LA_{30}	EN 1097-2
Type - Crushed Rock	✓	na
Type - Crushed Gravel	$C_{100/0}$	EN 933-5
Fines Content	f_4	EN 933-1
Shape - Flakiness	na	na
Resistance to Freezing & Thawing - Soundness	MS_{25}	EN 1367-2
Resistance to Freezing & Thawing - Water Absorption	$WA_{24}2$[1]	EN 1097-6
Fine Aggregate		
Type	crushed gravel fines, crushed rock fines, sand or mixture	na
Filler		
Grading	EN 13043 table 24	EN 933-10
Type	crushed gravel fines, crushed rock fines, sand	na
Notes		
[1] 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 24b Low Energy Bound Mixtures, Binder Properties – Cationic Bitumen Emulsions

Table column reference			1	2
Use			Recycling	Recycling
Grade			C60B4	C60BP4[1]
Test	Test Method	Unit		
Binder content	EN 1428	% by mass	58 to 62 (Class 6)[2]	58 to 62 (Class 6)[2]
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)
Properties of the Binder				
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				
[1] Emulsion with polymer-modified bitumen is recommended for base and binder course				
[2] 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[1]	CBTM / CAM[2]	BSM[3]	CAM[4]
Cement	2	1	1	1
Foamed Bitumen or Bituminous Emulsion	-	2	2	3
Notes				
[1] CTM: Cement Treated Mixture				
[2] CBTM: Cement-Bitumen Treated Material				
[3] BSM: Bitumen Stabilised Mixture				
[4] 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[1]	C[2]	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[3]	5 to 21	5 to 38	3 to 21	5 to 12
Notes				
[1] Grading zone shall not be used with bitumen bound mixtures.				
[2] Grading zone shall only be used in an in situ stabilisation process with a layer thickness greater than 100mm				
[3] 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[1]	Daily	Grading and moisture content Before production and weekly	EN 933-1 EN 1097-5
Combined grading of mixture[2]	Continual	Daily	EN 12967-2
Moisture content of mixture[3]	Continual	Daily	EN ISO 17892-1
Notes			
[1] For in situ LEBM: only aggregate (virgin or reclaimed) added to meet the design gradation			
[2] For in situ LEBM: sample has to be taken on site behind recycler pass before binder addition			
[3] 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[1]	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			
[1]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_{eq} (1hr) dB**	**LA_{max} 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
Bush Hammering				
Polished Aggregate Recovery of Skidding Resistance	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
Shot Blasting				
Polished Aggregate Recovery of Skidding Resistance	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
Grooving/Grinding				
Polished Aggregate Recovery of Skidding Resistance	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
Longitudinal Scabbling				
Polished Aggregate Recovery of Skidding Resistance	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
Water Jetting				
Polished Aggregate Recovery of Skidding Resistance	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
Coarse Aggregate		
Aggregate of a single type and source	✓	EN 932-3
Type - Crushed Rock	✓	na
Type - Crushed Gravel	$C100/0$	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
Reclaimed Asphalt		
Maximum allowed	0%	
Added Filler		
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
Properties		
Air Void content minimum[1]	$V_{\text{min } 2,0}$	$V_{\text{min } 2,0}$
Air Void content maximum[1]	$V_{\text{max } 10,0}$	$V_{\text{max } 13,0}$
Water sensitivity[1]	$ITSR_{80}$	$ITSR_{80}$
Resistance to permanent deformation[1,2]	$WTS_{Air1,0}$ PRD_{Air}	$WTS_{Air1,0}$ PRD_{Air}
Notes		
[1] Test methods and test conditions contained in Table 19		
[2] PRD_{Air} 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
Alignment, levels, tolerances & regularity (mm)	
Levels	Match existing pavement
Tolerances	0/+3
Adjacent to surface water or linear drainage channel	+ 10 - 0
Surface Macrotexture (mm)	
All locations including roundabouts	
Minimum	1,0
Notes	
[1] 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[1]	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	
[1] 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
Alignment, levels, tolerances & regularity (mm)	
Levels	Match existing pavement
Tolerances	0/+3
Adjacent to surface water or linear drainage channel	+ 10 - 0
Surface Macrotexture (mm)	
All locations including roundabouts	
Minimum	1,0
Notes	
[1] 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[1]	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	
[1] Traffic Category at time of repair works	

Table 28a Emergency Repair Material Systems – Requirements for Constituent Materials

Test	Emergency Repair Material	Test Method
Coarse Aggregate		
Aggregate of a single type and source	✓	EN 932-3
Type - Crushed Rock	✓	na
Type - Crushed Gravel	$C100/0$	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
Reclaimed Asphalt		
Maximum allowed	0%	
Added Filler		
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
Properties		
Air Void content minimum[1]	$V_{\text{min } 2,0}$	$V_{\text{min } 2,0}$
Air Void content maximum[1]	$V_{\text{max } 10,0}$	$V_{\text{max } 13,0}$
Water sensitivity[1]	$ITSR_{60}$	$ITSR_{60}$
Resistance to permanent deformation[1]	$WTS_{Air1,0}$ PRD_{Air}	$WTS_{Air1,0}$ PRD_{Air}
Notes		
[1] Test methods and test conditions contained in Table 19, PRD_{Air} values to be reported		
[2] Supplier Declared Value		

Table 28c Emergency Repair Material Systems – Requirements of the Works

Reference	Emergency Repair Material Systems
Table column reference	1
Location	Carriageway
Alignment, levels, tolerances & regularity (mm)	
Levels	Match existing pavement
Tolerances	0/+3
Adjacent to surface water or linear drainage channel	+ 10 - 0
Surface Macrotexture (mm)	
All locations including roundabouts	
Minimum	1,0
Notes	
[1] Test methods and test conditions contained in Table 20	

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