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# Notes for Guidance on the Specification for Road Works Series NG 900 - Road Pavements - Bituminous Bound Materials

**CC-GSW-00900**
September 2017

CC Construction & Commissioning

Standards

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| | |
|---|---|
| **TII Publication Title** | *Notes for Guidance on the Specification for Road Works Series NG 900 - Road Pavements - Bituminous Bound Materials* |
| **TII Publication Number** | *CC-GSW-00900* |

| | | | | |
|---|---|---|---|---|
| **Activity** | *Construction & Commissioning (CC)* | | **Document Set** | *Standards* |
| **Stream** | *Guidance on Specification for Works (GSW)* | | **Publication Date** | *September 2017* |
| **Document Number** | *00900* | | **Historical Reference** | **Series NG 900** |

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**Updates to TII Publications resulting in changes to**

**Notes for Guidance on the Specification for Road Works Series NG 900 - Road Pavements - Bituminous Bound Materials CC-GSW-00900**

**Date:** September 2017

**Amendment Details**:

This document supersedes the November 2015 (including Amendment No. 1, January 2016) version of CC-GSW-00900. Amendments have been made in relation to Hot Rolled Asphalt and coated chippings as follows:

a) NG 10.1.7.1 Laying Conditions Specific to Hot Rolled Asphalt Mixtures
Sub-clause updated.

b) NG 10.1.9.2 Compaction Control Specific to Hot Rolled Asphalt Mixtures
Additional sub-clause added.

c) NG 10.1.11.1 Surface Macrotexture Specific to Hot Rolled Asphalt
Additional sub-clause added.

d) Annex A – Guidance Notes
   i) NGA 10.1.7.1 Updated.
   ii) NGA 10.1.9 Updated.
   iii) NGA 10.1.11 Updated.
   iv) NGA 10.1.11.1 Additional sub-clause added.
   v) Form NGA 10.1.11.1 HRA Macrotexture Visual Assessment Form added. Example photographs also added to Annex.

# ROAD PAVEMENTS – BITUMINOUS MATERIALS

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# NG 1. GENERAL REQUIREMENTS AND DEFINITIONS

## NG 1.1 General

The Notes for Guidance on Series 900 of the Specification for Road Works (CC-SPW-00900) are divided into Clauses corresponding to those in the Specification. The NG Clauses directly relate to Clauses in the Specification; however there are not corresponding NG Clauses to every Specification Clause.

These Notes for Guidance should be treated as being an interpretation of the Specification and should clarify the designer/compiler's point of view to the Employer's Representative/site engineer. Further background information is provided in Annex A.

## NG 1.2 Construction Products Regulation

The procedural guidelines for CE marked bituminous mixtures are outlined in Table NG 1.2a and procedural guidelines for CE marked microsurfacing and surface dressing product are outlined in Table NG 1.2b. Explanations and examples of various requirements are detailed in Clause NG 1.4.

Certain clauses of CC-SPW-00900 refer to individual mixtures and these mixtures are construction products. However other clauses such as placing, compaction, surface macrotexture and weather conditions must be considered in the context of the construction works if the works are to be fit for their intended use as a whole.

**Table NG 1.2a: Procedural Guidelines for CE Marked Bituminous Mixtures to IS EN 13108**

| Step | Responsible party | Description | Controls | Employer's Representative Checklist |
|---|---|---|---|---|
| | Designer | Select individual products and specify the performance criteria. | CC-SPW-00900, Contract documents and Appendices. | Not applicable. |
| | Aggregate producer | Manufacture aggregates (including filler aggregate) as constituents for the various products contained in CC-SPW-00900. | AVCP: Product Type testing, DoP, CE Marking and FPC<br>Responsibilities for certification:<br>(i) System 2+ Notified Body involvement<br>(ii) System 4 Manufacturer only | Review documentation for compliance with specified mixture performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc. |
| | Bituminous binder producer | Manufacture binders as constituents for the various products contained in CC-SPW-00900. | AVCP: Product Type testing, DoP, CE Marking and FPC<br>Responsibilities for certification:<br>(i) System 2+ Notified Body involvement | Review documentation for compliance with specified mixture performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc. |
| **1** | Bituminous mixture manufacturer | For each mixture, select constituent materials.<br>Demonstrate that the selected constituents fully comply with the requirements of CC-SPW-00900 for the given mixture and any other specific Contract requirements contained within the Appendices to the Specification, where applicable. | AVCP: Product Type testing, DoP, CE Marking and FPC<br>Responsibilities for certification:<br>(i) System 2+ Notified Body involvement<br>(ii) System 4 Manufacturer only<br>This can be carried out either by undertaking testing on receipt of materials or by purchasing constituents from manufacturers who can demonstrate full compliance under the relevant standard e.g. IS EN 13043. | Review documentation for compliance with specified mixture performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc. |
| **2** | Bituminous mixture manufacturer | For each mixture, select target compositional grading and binder content for the constituents that have been chosen.<br>Demonstrate that the selected product composition fully complies with the requirements of CC-SPW-00900 and any other specific Contract requirements | The composition of the manufactured bituminous mixture, relative to the declared composition, must consistently be within the tolerances given in IS EN 13108-21.<br>Grading specifications are presented as grading envelopes in within which the manufacturer's declared target grading must fall. The manufacturer's declared target grading in | Review documentation for compliance with specified mixture performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc. |

| Step | Responsible party | Description | Controls | Employer's Representative Checklist |
|---|---|---|---|---|
| | | contained within the Appendices to the Specification, where applicable. | combination with the tolerances from IS EN 13108-21 result in the overall grading envelope of the product to be supplied. | |
| **3** | Bituminous mixture manufacturer | Product Type testing<br>For each mixture, undertake the specific mixture design at the compositional grading and binder content chosen in accordance with IS EN 13108-20.<br>Demonstrate that the selected product composition complies with the requirements of CC-SPW-00900 and any other specific Contract requirements contained within the Appendices to the specification, where applicable. | Type testing (to include the requirements of the relevant table in CC-SPW-00900) carried out for each mixture and a test report is produced in accordance with IS EN 13108-20.<br>Any competent laboratory, including an in-house laboratory, can undertake type testing. IS EN 12697-38 contains the minimum competency expected.<br>Type tests relate to specific compositions. Any change in mix proportions or source material characteristics requires re-testing. | Review documentation for compliance with specified mixture performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc. |
| **4** | Bituminous mixture manufacturer | For each manufacturing facility implement a Factory Production Control System (FPC) in accordance with IS EN 13108-21. | Routine testing is required for FPC in accordance the requirements of IS EN 13108-21 and can be undertaken by any competent laboratory, including an in-house laboratory. IS EN 12697-38 contains the minimum competency expected.<br><br>FPC is subject to independent accreditation by a Notified Body. Notified Body must be listed on EU Nando website (http://ec.europa.eu/enterprise/newapproach/nando) as being registered for the relevant part of IS EN 13108. | Review documentation for compliance with specified mixture performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc.<br>Market Surveillance or Competent National Authority may audit production controls right back to Initial Type Testing and constituent materials, including auditing the competence of the laboratories used for testing.<br>Ask to see copy of the FPC certificate. |
| **5** | Bituminous mixture manufacturer | Declaration of Performance (DoP)<br>A declaration that the properties found from the Product Type testing complies with the requirements for the mixture. | The DoP to include sufficient details to establish:<br>(i) the constituents used<br>(ii) the test methods used for the testing<br>(iii) the test results achieved | Review documentation for compliance with specified mixture performance requirements. May reserve the right under the CPR to initiate further inspection, testing. Ask to see a copy of the DoP.<br>Market Surveillance or Competent National Authority may audit production controls right |

| Step | Responsible party | Description | Controls | Employer's Representative Checklist |
|---|---|---|---|---|
| | | | | back to product type testing and constituent materials, including auditing the competence of the laboratories used for testing. |
| **6** | Bituminous mixture manufacturer | CE Marking<br>The data from the FPC, Product type testing and DoP permit the manufacturer to affix a unique CE Mark to each mixture to allow the product to be placed on the market.<br>See Annex ZA of the relevant part of IS EN 13108. | A current FPC certificate and a current DoP for each product to be available prior to the CE Mark being affixed.<br>Responsibilities for certification:<br>(i) System 2+ Notified Body involvement<br>All products should be delivered under a CE marked delivery ticket in accordance with Annex ZA of the relevant part of IS EN 13108. | Review documentation for compliance with specified mixture performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc.<br><br>Witness the collection, splitting and dispatch of any site samples. |
| **Notes** | | | | |
| For requirements for constituent materials refer to CC-SPW-00900 Tables 1, 4, 7 or 10. | | | | |
| For requirements for product composition and properties refer to CC-SPW-00900 Tables 2, 5, 8 or 11. | | | | |

**Table NG 1.2b: Procedural Guidelines for CE Marked Microsurfacing and Surface Dressing to IS EN 12273 and 12271**

| Step | Responsible party | Description | Controls | Employer's Representative Checklist |
|---|---|---|---|---|
| | Designer | Select individual products (where applicable), provide the site data and specify the performance criteria. | CC-SPW-00900, Contract documents and Appendices. | Not applicable. |
| | Aggregate producer | Manufacture aggregates as constituents for the various products contained in CC-SPW-00900. | AVCP: Product Type testing, DoP, CE Marking and FPC<br>Responsibilities for certification:<br>(iii) System 2+ Notified Body involvement | Review documentation for compliance with specified performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc. |
| | Bituminous binder producer | Manufacture binders as constituents for the various products contained in CC-SPW-00900. | AVCP: Product Type testing, DoP, CE Marking and FPC<br>Responsibilities for certification:<br>(ii) System 2+ Notified Body involvement | Review documentation for compliance with specified performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc. |
| | Additives producer | Manufacture additives such as lime, cement, fibres as constituents for the Microsurfacing products contained in CC-SPW-00900. | Where a constituent is covered by a hEN:<br>AVCP: Product Type testing, DoP, CE Marking and FPC<br>Responsibilities for certification:<br>(i) System 2+ Notified Body involvement<br>(ii) System 4 Manufacturer only<br><br>Where a constituent is not covered by a hEN:<br>It shall be manufactured to a quality management system in accordance with IS EN 9001 or equivalent. | Review documentation for compliance with specified performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc. |

| Step | Responsible party | Description | Controls | Employer's Representative Checklist |
|---|---|---|---|---|
| 1 | Microsurfacing or Surface Dressing product manufacturer | For each product, select constituent materials<br>Demonstrate that the selected constituents fully comply with the requirements of CC-SPW-00900 for the given product and any other specific Contract requirements contained within the Appendices to the Specification, where applicable. | AVCP: Product Type testing, DoP, CE Marking and FPC<br>Responsibilities for certification:<br>(iii) System 2+ Notified Body involvement<br>(iv) System 4 Manufacturer only<br><br>This can be carried out either by undertaking testing on receipt of materials or by purchasing constituents from manufacturers who can demonstrate full compliance under the relevant standard e.g. IS EN 13043. | Review documentation for compliance with specified performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc. |
| 2 | Microsurfacing or Surface Dressing product manufacturer | For each product, select the design parameters for the constituents that have been chosen.<br>Demonstrate that the selected product composition fully complies with the requirements of CC-SPW-00900 and any other specific Contract requirements contained within the Appendices to the Specification, where applicable. | The composition of the product, relative to the declared design, must consistently be within the documented tolerances given in IS EN 12273 for Microsurfacing or IS EN 12271 for Surface Dressing. | Review documentation for compliance with specified performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc. |
| 3 | Microsurfacing or Surface Dressing product manufacturer | Determination of Product Type – Type Approval Installation Trial (TAIT).<br>For each product, undertake the specific design in accordance with IS EN 12273 for Microsurfacing or IS EN 12271 for Surface Dressing.<br>Demonstrate that the selected product composition complies with the requirements of CC-SPW-00900 and any other specific Contract requirements contained within the Appendices to the specification, where applicable. | A TAIT must be carried out for each product type and a test report is produced in accordance with IS EN 12273 for Microsurfacing and IS EN 12271 for Surface Dressing.<br>Any competent laboratory, including an in-house laboratory, can undertake type testing. IS EN 12697-38 contains the minimum competency expected.<br>A TAIT relates to a specific composition. Any change in sources of the constituent materials or characteristics requires re-testing. | Review documentation for compliance with specified performance requirements. May reserve the right under the CPR to initiate further inspection, testing etc. |

| Step | Responsible party | Description | Controls | Employer's Representative Checklist |
|---|---|---|---|---|
| 4 | Microsurfacing or Surface Dressing product manufacturer | For each product implement a Factory Production Control System (FPC) in accordance with IS EN 12273 for Microsurfacing and IS EN 12271 for Surface Dressing. | Routine testing is required for FPC in accordance the requirements of IS EN 12273 or IS EN 12271 as appropriate and can be undertaken by any competent laboratory, including an in-house laboratory. IS EN 12697-38 contains the minimum competency expected.<br><br>FPC is subject to independent accreditation by a Notified Body. Notified Body must be listed on EU Nando website (http://ec.europa.eu/enterprise/newapproach/nando) as being registered for IS EN 12273 or IS EN 12271. | Review documentation for compliance with specified performance requirements. May reserve the right under the CPR to initiate further inspection, testing, etc.<br>Market Surveillance or Competent National Authority may audit production controls right back to Initial Type Testing and constituent materials, including auditing the competence of the laboratories used for testing.<br>Ask to see copy of the FPC certificate. |
| 5 | Microsurfacing or Surface Dressing product manufacturer | Declaration of Performance (DoP)<br>A declaration that the properties found from the Product Type testing complies with the requirements for the product. | The DoP to include sufficient details to establish:<br>(iv) the constituents used<br>(v) the test methods used for the testing<br>(vi) the test results achieved | Review documentation for compliance with specified performance requirements. May reserve the right under the CPR to initiate further inspection, testing. Ask to see a copy of the DoP.<br>Market Surveillance or Competent National Authority may audit production controls right back to product type testing and constituent materials, including auditing the competence of the laboratories used for testing. |
| 6 | Microsurfacing or Surface Dressing product manufacturer | CE Marking<br>The data from the FPC, Product type testing and DoP permit the manufacturer to affix a unique CE Mark to each product to allow the product to be placed on the market.<br>See Annex ZA of IS EN 12273 for Microsurfacing and IS EN 12271 for Surface Dressing. | A current FPC certificate and a current DoP for each product to be available prior to the CE Mark being affixed.<br>Responsibilities for certification:<br>(i) System 2+ Notified Body involvement<br>All products should be delivered under a CE marked delivery ticket in accordance with Annex ZA of IS EN 12273 for Microsurfacing and IS EN 12271 for Surface Dressing. | Review documentation for compliance with specified performance requirements. May reserve the right under the CPR to initiate further inspection, testing.<br><br>Witness the collection, splitting and dispatch of any site samples. |
| Notes | | | | |
| For requirements for constituent materials refer to CC-SPW-00900 Tables 17. | | | | |
| For requirements for product composition and properties refer to CC-SPW-00900 Table 18. | | | | |

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

The responsibilities and tasks relevant to the systems required by Transport Infrastructure Ireland and in compliance with IS EN 13108 and the CPR are contained in Table NG 1.4 below.

The Type Testing procedure shall include any reclaimed asphalt addition. The tests for geometrical properties of the aggregate constituents, penetration and softening point of the binder and grading, binder content and binder properties of reclaimed asphalt shall be carried out on the constituents actually used in Type Testing. For other constituent properties tests carried out as part of the AVCP procedures used to demonstrate conformity of the aggregates, bitumens etc. with the appropriate European Standard shall be acceptable.

| System type | Responsibility | Tasks |
|---|---|---|
| **System 2+** | Notified body - FPC certification body (e.g. NSAI, SGS) | Issue a certificate of conformity of the product on the basis of:<br>Initial Inspection of the manufacturing plant and FPC system<br>Continuous surveillance, assessment and evaluation of the FPC |
| | Manufacturer | Determination of product type on the basis of type testing<br>factory production control<br>further testing of samples according to a prescribed test plan |
| **System 4** | Manufacturer | Determination of product type on the basis of type testing<br>factory production control |

**Table NG 1.4: Responsibilities and tasks relevant to the systems required by Transport Infrastructure Ireland**

## NG 1.5 Quality Assurance and Control

The data contained in CE Marking and DoP documentation provides a summary of the performance details of the product. It is important to ensure a review of the supporting documentation is undertaken prior to the commencement of the Works to ensure compliance with the requirements of CC-SPW-00900 product. This review is considered an audit trail and shall include the following:

(i) Test reports for the properties of the product.
(ii) Test reports for the properties of the constituents of the product – including aggregates, filler (if applicable) and bitumen.
(iii) Certificate of conformity of the Factory Production Control for the product.
(iv) Confirmation of the FPC tolerances applied to the product target grading composition and binder content.

## Operating Compliance Level

The FPC tolerances for determining compliance of individual samples are those provided in columns 2 to 6 of Table A.1 of IS EN 13108-21. The tolerances are applied to the declared target grading composition and binder content as contained in the CE Marking and DoP for the product.

The FPC tolerances for determining the permitted mean deviation from target are those provided in columns 7 to 11 of Table A.1 of IS EN 13108-21.

The Operating Compliance Level at the manufacturing plant is determined on an ongoing basis, the Operating Compliance Level report shall be provided to the Employer's Representative to indicate the assessment and verification of the constancy of performance.

The Operating Compliance Level reports required under factory production control should include the following information:

(i) Details of the 32 results that the OCL is being assessed against.
(ii) The OCL that the plant is operating to: A, B or C.
(iii) The mean deviations from target for the parameters relating to each of the product groups: small aggregate mixes, large aggregate mixes and hot rolled asphalt.

If Appendix 1/5 or 1/6 requires samples to be provided/tested in relation to FPC, the samples shall be taken in conjunction with the product manufacturer. Portions of the same samples shall be split between the manufacturer and the Employer's Representative to enable subsequent test results to be compared.

## NG 1.6 Products not covered by a Harmonised Technical Specification

Products and processes detailed in CC-SPW-00900 that are not covered by a harmonised technical specification must undergo an assessment process before approval is granted by Transport Infrastructure Ireland for use. Details of the assessment process are contained in Approval of Specific Products (DN-PAV-03075).

# NG 2. PREPARATORY WORK

## NG 2.1 Cold Milling of Bituminous Bound Flexible Pavement

The profile of the milled surface can be affected by a number of items including cutting tool spacing, condition of the cutting tools and speed of operation of the milling drum and machine.

The milling drum speed and milling machine speed can also affect the surface finish with typically a higher speed leading to a rougher surface finish.

## NG 2.2 Regulating

In laying regulating layers, base and binder course should be laid in thicker lifts to minimise the number of layers and interfaces between layers.

# NG 3. ASPHALT CONCRETE PRODUCTS

## NG 3.2 Constituent Materials

The manufacturer of the asphalt concrete product should be aware that:

(i) The Type Test reports for the constituent materials shall be submitted with the DoP for the product.
(ii) Polymer modified bitumen, where not permitted for asphalt concrete products, may be allowed subject to approval of a Departure from Standard from the Director of Professional Services at Transport Infrastructure Ireland.

## NG 3.2.2 Aggregates

## Coarse Aggregates for Surface Courses

The frequency of testing for Polished Stone Value and the method of assessment shall be in accordance with Surfacing Materials for New and Maintenance Construction, for Use in Ireland (DN-PAV-03023).

To gain further information on the performance of aggregates in road surfacings the Friction after Polishing test shall be undertaken. The test method in IS EN 12697-49 shall be followed with the exception that the test specimens should be aggregate mosaics rather than asphalt specimens (see Annex A of DN-PAV-03023 for further details). No thresholds for the results of these tests are included but records of the test results must be retained by the manufacturer for possible inspection for a minimum of 5 years after the date of construction. The results must also be forwarded to Transport Infrastructure Ireland at the time of construction when requested.

## NG 3.3 Product Composition

The binder content given in Table 2 is the minimum binder content after any correction due to density has been determined. The binder content declared on the DoP and CE Marking is the binder content required to achieve the properties declared. For FPC purposes the tolerances provided in Table A.1 of IS EN 13108-21 will be applied to the declared binder content.

The temperature of the mixture given in Table 2 is the maximum to prevent degradation of the binder; the temperature required at delivery to achieve adequate compaction in the Works may vary according to items such as product type, laid thickness, plant employed and prevailing conditions and as such should be agreed between the manufacturer and the laying contractor. The minimum temperature at delivery shall be declared.

## NG 3.3.6 Stiffness

CC-SPW-00900 requires that the stiffness of the mixture be recorded. This is a minimum default value for the mixture and should not be confused with the design stiffness. Further information on design stiffness refer to Pavement & Foundation Design (DN-PAV-03021).

# NG 4. HOT ROLLED ASPHALT PRODUCTS

## NG 4.2 Constituent Materials

The manufacturer of the hot rolled asphalt product should be aware that:

(i) The Type Test reports for the constituent materials shall be submitted with the DoP for the product.
(ii) Polymer modified bitumen shall only be allowed subject to approval of the Director of Professional Services at Transport Infrastructure Ireland.
(iii) Coated chippings are considered a product under EN 13108-4 and therefore require an associated product type testing, DoP and CE Marking for the properties specified in Clause 4.2.4, Table 4 and Table 5.

## NG 4.2.4 Coated Chippings

For guidance on conducting the friction after polishing test refer to NG 3.2.2.

## NG 4.3 Product Composition

The binder content given in Table 5 is the minimum binder content after any correction due to density has been determined. The binder content declared on the DoP and CE Marking is the binder content required to achieve the properties declared. For FPC purposes the tolerances provided in Table A.1 of IS EN 13108-21 will be applied to the declared binder content.

The temperature of the mixture given in Table 5 is the maximum to prevent degradation of the binder; the temperature required at delivery to achieve adequate compaction in the Works may vary according to items such as product type, laid thickness and prevailing conditions and as such should be agreed between the manufacturer and the laying contractor. The minimum temperature at delivery shall be declared.

# NG 5. STONE MASTIC ASPHALT PRODUCTS

## NG 5.2 Constituent Materials

The manufacturer of the stone mastic asphalt product should be aware that:

(i) The Type Test reports for the constituent materials shall be submitted with the DoP for the product.

## NG 5.2.2 Coarse Aggregates for Surface Courses

For guidance on conducting the friction after polishing test refer to NG 3.2.2.

## NG 5.3 Product Composition

The binder content given in Table 8 is the minimum binder content after any correction due to density has been determined. The binder content declared on the DoP and CE Marking is the binder content required to achieve the properties declared. For FPC purposes the tolerances provided in Table A.1 of IS EN 13108-21 will be applied to the declared binder content.

The temperature of the mixture given in Table 8 is the maximum to prevent degradation of the binder; the temperature required at delivery to achieve adequate compaction in the Works may vary according to items such as product type, laid thickness and prevailing conditions and as such should be agreed between the manufacturer and the laying contractor. The minimum temperature at delivery shall be declared.

# NG 6. POROUS ASPHALT PRODUCTS

## NG 6.2 Constituent Materials

The manufacturer of the porous asphalt product should be aware that:

(i) The Type Test reports for the constituent materials shall be submitted with the DoP for the product.

## NG 6.2.2 Coarse Aggregates for Surface Courses

For guidance on conducting the friction after polishing test refer to NG 3.2.2.

## NG 6.3 Product Composition

The binder content given in Table 11 is the minimum binder content after any correction due to density has been determined. The binder content declared on the DoP and CE Marking is the binder content required to achieve the properties declared. For FPC purposes the tolerances provided in Table A.1 of IS EN 13108-21 will be applied to the declared binder content.

The temperature of the mixture given in Table 11 is the maximum to prevent degradation of the binder; the temperature required at delivery to achieve adequate compaction in the Works may vary according to items such as product type, laid thickness and prevailing conditions and as such should be agreed between the manufacturer and the laying contractor. The minimum temperature at delivery shall be declared.

# NG 7. SURFACE TREATMENTS

## NG 7.1 Microsurfacing

## NG 7.1.2 Product Composition

## NG 7.1.2.4 Application of Bond Coat

The bond coat applied to microsurfacing is dependent on the type of microsurfacing installed:

(i) In a two layer system, the bond coat application does not need to be integrated with the microsurfacing operation.
(ii) In a single layer system, the bond coat shall be applied immediately prior to the microsurfacing application via an integrated spraybar on the microsurfacing machine.

## NG 7.1.3 Performance Requirements

The 'Design Working Life' stated in the specification should be clearly stated as applying to the microsurfacing.

An appropriate special requirement should be included in the Conditions of Contract drawing particular attention if a working design life of longer than five years is required.

The Producer shall be aware that the 'Design Working Life' is different to the 'Defects Period', as defined in the Conditions of the Contract.

## NG 7.1.3.1 Defects Determined by Visual Inspection

Because microsurfacing defects are usually obvious, it is anticipated that the need for a full assessment procedure will be rare.

Identification and rectification for defects within the 'Defects Period' shall be treated in accordance with the Conditions of Contract.

## NG 7.1.3.3 Surface Shear Strength

The surface shear strength test is carried out on the cured surface to monitor the effectiveness of the bond to the substrate. Limits are not set for the test; it is for information purposes only.

## NG 7.1.4 Construction Products Regulation

## NG 7.1.4.3 Declaration of Performance (DoP)

The Producer shall continue to monitor the TAIT site and declare the period for which the performance characteristics have been retained in order to establish the long term benefits of the product installed. The period is the time at which the surfacing should no longer be expected to provide the surface properties required at the site in question. (This is a separate consideration to the assessment period for defects referred to under Clause 7.1.3.1 and does not imply that any additional stated period will always be attained).

In order to allow the Producer to declare the period for which the performance characteristics have been retained, monitoring should continue for the whole life of the microsurfacing. For measuring macrotexture on heavily trafficked roads, reference should be made to the records available from the annual surveys on the National Road network to demonstrate compliance. In the event of a dispute on the macrotexture results, volumetric patch tests in accordance with IS EN 13036-1 should be used. For other roads, volumetric patch tests in accordance with IS EN 13036-1 should be used. Alternative methods may be used (to speed up testing) provided that they have been calibrated against the patch test.

## NG 7.2 Surface Dressing

## NG 7.2.2 Recipe Surface Dressing (RSD)

## NG 7.2.2.1 Constituent Materials

## NG 7.2.2.1.1 Binder

The type of binder to be used shall be found in Appendix 7/21. The Producer should state the source of binder he proposes to use together with the data required by Appendix 7/21.

## NG 7.2.2.1.2 Aggregates

The Producer should state with his tender submission the source of his aggregates and the grading and flakiness index for each source and nominal size.

The requirements in Table 18 give the optimal quality of chippings to enable adhesion of rapid setting cationic emulsions to chippings. Careful washing with careful transportation, storage and handling needs to be considered to ensure consistency and optimal condition of chippings.

For guidance on conducting the friction after polishing test refer to NG 3.2.2.

## NG 7.2.3 Surface Dressing Product (End Performance)

Producers are expected to visit the site(s), to assess the parameters required and, in conjunction with Appendix 7/3, to design a suitable surface dressing. When the Producer makes his site visit for the purposes of tendering he should satisfy himself as to the road hardness and traffic category.

## NG 7.2.3.2 Product Composition

## NG 7.2.3.2.1 Product Types

The Purchaser may limit the type of surface dressing permitted in Appendix 7/3.

## NG 7.2.3.2.2 Application of Binder

The Producer should check the binder sprayer for accuracy of transverse distribution prior to commencing the Works. This check should assess the ability of the spraybar in real working conditions.

## NG 7.2.3.2.3 Application of Chippings

The Producer should check the chipping spreader for accuracy of transverse distribution prior to commencing the Works for all sizes of chippings to be used.

## NG 7.2.3.4 Performance Requirements

The 'Design Working Life' stated in the specification should be clearly stated as applying to the surface dressing product.

An appropriate special requirement should be included in the Conditions of Contract drawing particular attention if a working design life of longer than five years is required.

The Producer shall be aware that the 'Design Working Life' is different to the 'Defects Period', as defined in the Conditions of the Contract.

## NG 7.2.3.4.1 Defects Determined by Visual Inspection

Because surface dressing defects are usually obvious, it is anticipated that the need for a full assessment procedure will be rare.

Identification and rectification for defects within the 'Defects Period' shall be treated in accordance with the Conditions of Contract.

## NG 7.2.3.5.3 Declaration of Performance (DoP)

The Producer shall continue to monitor the TAIT site and declare the period for which the performance characteristics have been retained in order to establish the long term benefits of the product installed. The period is the time at which the surfacing should no longer be expected to provide the surface properties required at the site in question. (This is a separate consideration to the assessment period for defects referred to under Clause 7.2.3.4.1 and does not imply that any additional stated period will always be attained).

In order to allow the Producer to declare the period for which the performance characteristics have been retained, monitoring should continue for the whole life of the surface dressing. For measuring macrotexture on heavily trafficked roads, reference should be made to the records available from the annual surveys on the National Road network to demonstrate compliance. In the event of a dispute on the macrotexture results, volumetric patch tests in accordance with IS EN 13036-1 should be used. For other roads, volumetric patch tests in accordance with IS EN 13036-1 should be used. Alternative methods may be used (to speed up testing) provided that they have been calibrated against the patch test.

## NG 7.3 High Friction Surfacing

## NG 7.3.1 Constituent Materials

## NG 7.3.1.2 Aggregates

The polished stone value test cannot be carried out on material supplied to site. The manufacturer shall provide a requisite graded sample for natural aggregates.

## NG 7.3.3 Performance Requirements

The 'Design Working Life' stated in the specification should be clearly stated as applying to the high friction surfacing.

An appropriate special requirement should be included in the Conditions of Contract drawing particular attention if a performance duration of longer than five years is required.

The Producer shall be aware that the 'Design Working Life' is different to the 'Defects Period', as defined in the Conditions of the Contract.

## NG 7.3.3.1 Defects Determined by Visual Inspection

Because high friction surfacing defects are usually obvious, it is anticipated that the need for a full assessment procedure will be rare.

Identification and rectification for defects within the 'Defects Period' shall be treated in accordance with the Conditions of Contract.

## NG 7.3.4 Declaration of Performance (DoP)

The Producer shall continue to monitor the TAIT site and declare the period for which the performance characteristics have been retained in order to establish the long term benefits of the product installed. The period is the time at which the surfacing should no longer be expected to provide the surface properties required at the site in question. (This is a separate consideration to the assessment period for defects referred to in DN-PAV-03075 and does not imply that any additional stated period will always be attained).

In order to allow the Producer to declare the period for which the performance characteristics have been retained, monitoring should continue for the whole life of the surface dressing. For measuring macrotexture on heavily trafficked roads, reference should be made to the records available from the annual surveys on the National Road network to demonstrate compliance. In the event of a dispute on the macrotexture results, volumetric patch tests in accordance with IS EN 13036-1 should be used. For other roads, volumetric patch tests in accordance with IS EN 13036-1 should be used. Alternative methods may be used (to speed up testing) provided that they have been calibrated against the patch test.

# NG 8. MISCELLANEOUS PRODUCTS AND PROCESSES

## NG 8.1 Low Energy Bound Mixtures

## NG 8.1.1 Constituent Materials

## NG 8.1.1.2 Aggregates

The aggregate component of the LEBM should be of a quality generally suitable for use in hydraulically bound material or asphalt. The emphasis should be on ensuring that deleterious materials, such as clay lumps and badly weathered aggregate, are excluded from the recycled material.

## NG 8.1.1.6 Additives

Additives shall only be allowed subject to approval of the Director of Professional Services at Transport Infrastructure Ireland.

## NG 8.1.2 Product Composition

When determining the grading of materials containing asphalt planings, samples should be dried to constant mass at 40°C and care should be taken not to break down the aggregated particles of asphalt unnecessarily.

Care should be taken not to have too high a cement content as this may change the properties of the material from a flexible material to a flexible semi-rigid material.

## NG 8.1.2.2 Testing

A Percentage Refusal Density (PRD) or other suitable mould should be used for testing the LEBM. Where long-term storage of materials is required, an inexpensive mould such as plastic soil pipe should be used.

## NG 8.4 Permanent Repair Material Systems

Clauses 8.4 and 10.3.3 are not intended to be an exhaustive specification for the use of proprietary systems, but rather to form a set of minimum performance related requirements for manufacturers and/or Contractors.

Given the intended use of PRMS, as defined in Clause 8.4, the maximum advised individual area of repair allowed using PRMS shall be approximately $2m^2$.

## NG 8.4.2 Product Composition

It is the responsibility of the product manufacturer to meet the testing requirements of Clause 8.4.2 by having the required tests carried out testing in an INAB-accredited laboratory, or similar approved. These tests shall be carried out on samples of proposed PRMS. Results of such testing shall be forwarded to the Employer's Representative prior to installation of the PRMS on site.

## NG 8.5 Localised Surface Repair Systems

Clauses 8.5 and 10.3.4 are not intended to be an exhaustive specification for the use of proprietary systems, but rather to form a set of minimum performance related requirements for manufacturers and/or Contractors.

Given the intended use of LSRS, as defined in Clause 8.5, the maximum advised individual area of repair allowed using LSRS shall be approximately $2m^2$.

## NG 8.6 Emergency Repair Material Systems

Clauses 8.6 and 10.3.5 are not intended to be an exhaustive specification for the use of proprietary systems, but rather to form a set of minimum performance related requirements for manufacturers and/or Contractors.

Given the intended use of ERMS, as defined in Clause 8.6, the maximum advised individual area of repair allowed using ERMS shall be approximately $2m^2$.

## NG 8.6.2 Product Composition

It is the responsibility of the product manufacturer to meet the testing requirements of Clause 8.6.2 by having the required tests carried out testing in an INAB-accredited laboratory, or similar approved. These tests shall be carried out on samples of proposed ERMS. Results of such testing shall be forwarded to the Employer's Representative prior to installation of the ERMS on site.

# NG 9. RECLAIMED ASPHALT

Where Reclaimed Asphalt forms 10% or less of the total mix, the design parameters and frequency of testing reflect the low risk that this has on the performance of the mixture. Where Reclaimed Asphalt forms more than 10% of the total mix, the design parameters and frequency of testing reflect the potential risk that this has on the performance of the mixture.

## NG 9.1 Source

Any other contaminants consideration should take into account any hazardous materials contained in the source material.

## NG 9.7 Traceability

When reclaimed asphalt is added as a constituent of a product the Factory Production Control Quality Plan in place at the manufacturing plant shall include specific references to its use. The procedures, inspections and tests to control the constituent, the equipment used for its addition and the production process shall specifically address and document the use of the reclaimed asphalt.

# NG 10. WORKS

## General

The general texting requirements for bituminous mixtures and surface treatments are outlined in Table NG 10.1. Coring requirements for bituminous mixtures and surface treatments are outlined in Table NG 10.2. Detailed requirements, test methods and parameters form part of CC-SPW-00900 Clauses 7 (for performance requirements for surface treatments), 10 and 11.

| **Test** | **Bituminous Mixture** | | | | | | **Surface Treatment / Misc. Product and Process** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **AC** | | **HRA** | **SMA** | | **PA** | **Microsurfacing** | **Recipe Surface Dressing** | **Surface Dressing Product** | **High Friction Surfacing** | **Low Energy Bound Mixtures** | **PRMS/ LSRS/ ERMS** |
| | **Base & Binder** | **Surface** | **Surface** | **Binder** | **Surface** | **Surface** | | | | | | |
| Layer thickness | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| Temperature | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| Water Sensitivity | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| Grading | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| Binder Content | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| Air Void content in-situ in laid material | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | ✓[2] | |
| Air Void content in-situ within 100mm of joint | ✓ | | | | | | | | | | | |
| Air Void content in-situ at refusal | ✓ | | | | | | | | | | | |
| Resistance to permanent deformation | ✓ | | ✓ | ✓ | ✓ | | | | | | | |
| Stiffness | ✓ | | | | | | | | | | ✓[2] | |
| Surface Macrotexture | | ✓ | ✓ | | ✓ | | ✓[1] | | ✓[1] | ✓[1] | | ✓ |
| Hydraulic Conductivity | | | | | | ✓ | | | | | | |
| Visual Assessment | | | | | | | ✓[1] | | ✓[1] | ✓[1] | | |
| Bond to Substrate | | | | | | | ✓[3] | | | ✓ | | |
| Application of Binder – rate of spread and accuracy | | | | | | | | ✓ | | | | |
| Application of Chippings – rate of spread and accuracy | | | | | | | | ✓ | | | | |
| Stability Test | | | | | | | | | | | ✓ | |
| In situ density relative to refusal density | | | | | | | | | | | ✓[2] | |
| Moisture Content | | | | | | | | | | | ✓[2] | |
| **Notes** | | | | | | | | | | | | |
| [1] As part of performance requirements for the 'Design Working Life' | | | | | | | | | | | | |
| [2] As part of performance requirements in CC-SPW-00900 Clause 10.3.1.1 | | | | | | | | | | | | |
| [3] As part of general performance requirements | | | | | | | | | | | | |

**Table NG 10.1 – General Testing Requirements for the Works**

| **Test** | | **Product group** | | | | | |
|---|---|---|---|---|---|---|---|
| | | **AC** | | **HRA** | **SMA** | | **PA** |
| **Cores** | **Test** | **Base & Binder** | **Surface** | **Surface** | **Binder** | **Surface** | **Surface** |
| Every 1000 linear metres laid per running lane – not in wheel track, 1 pair | Air Void | | 100mm dia. | 100mm dia. | | 100mm dia. | 100mm dia. |
| Every 1000 linear metres laid per running lane – in wheel track, 1 pair | Air Void | 150mm dia. | | | 150mm dia. | | |
| Every 250 linear metres laid per running lane – within 100mm of unsupported joint, 1 pair | Air Void | 150mm dia. | | | | | |
| Every 1000 linear metres laid per running lane – in wheel track, 1 pair | Air Void (refusal) | 150mm dia. | | | | | |
| Every 1000 linear metres laid per running lane – in wheel track, 1 core (6 in first km) | Permanent Deformation | 200mm dia. | | | 200mm dia. | | |
| Every 1000 linear metres laid per running lane – not in wheel track, 1 core (6 in first km) | Permanent Deformation | | | 200mm dia. | | 200mm dia. | |
| Every 1000 linear metres laid per running lane – in wheel track, 1 pair | Stiffness | 150mm dia. | | | | | |
| **Notes** | | | | | | | |
| Dia: Diameter of cores | | | | | | | |
| For schemes less than 1,000m in length, refer to CC-SPW-00900 for specific requirements | | | | | | | |
| For cores in hard shoulders, refer to CC-SPW-00900 for specific requirements | | | | | | | |
| [1]For resistance to permanent deformation test, 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 | | | | | | | |

**Table NG 10.2 – Coring Requirements for the Works**

[1] *Amended as per Amendment No. 1, Item 1.*

# NG 10.1 Bituminous Mixtures

## NG 10.1.2 Works Proposals

Works proposals should be documented and communicated to all relevant personnel to ensure that working practices maximise the durability of the finished pavement surface. Certain key factors that the Contractor proposals should contain before work commences include:

(i) Mechanical laying (wherever practicable).
(ii) Bonding of layers.
(iii) Good compaction, particularly at joints.
(iv) Pre-planning of compaction process.
(v) Sealing of edges and joints to prevent water ingress.

It should be recognised that different climatic conditions require different working practices and these scenarios should be considered prior to works commencing. The Contractor should document and communicate any change to working practices to suit changing conditions.

## NG 10.1.3 Transport

The Contractor should always minimise the time between manufacture and laying. The rate of delivery to the site and to the paver should be sufficient to keep the paver continually operational but the rate of delivery should not lead to too many trucks awaiting tipping as the temperature drop in the load can be detrimental to the compaction of the product in the Works.

The Contractor should liaise with the manufacturer to ensure the time between manufacture of the product and the time of laying will permit the product to be laid in accordance with CC-SPW-00900.

## NG 10.1.4 Bond Coat

Where a HBM base layer is cured with a sealing coat, the requirement to apply a bond coat prior to the application of the first asphalt layer should still be necessary.

The checks to determine the rate of spread and accuracy of spread should ensure that an even distribution of bond coat is applied to the full extent of the substrate.

Proprietary additives and ‘non-tack’ bond coats, which are available from some manufacturer, may be used. These materials may be useful for work in urban areas where pedestrian and cyclist traffic is sometimes unavoidable.

## NG 10.1.5 Weather Conditions

In compaction plans drawn up under the works proposals, Contractors will need to take account of the limiting conditions shown in Figures 10.1.5.a and 10.1.5.b. These limiting conditions are based on a minimum available compaction time of 8 min and shall be applied for materials at nominal thicknesses below 50mm (where air temperatures and particularly wind speeds have a significant effect).

The Contractor should be aware that additional constraints can apply during winter and/or night time laying which can affect the suitability of the weather conditions. These constraints include:

(i) The temperature of the mixtures drops rapidly during winter and night time laying operations. Extra care needs to be taken to ensure bituminous mixtures are adequately protected during transportation, off-loading, laying and rolling.

(ii) Cooling of bituminous layers, factors affecting cooling (wind chill, temperature) and time available for compaction (particularly during short night time lane possessions) need to be borne in mind whilst planning for laying operations.
(iii) Human factors and health, welfare and safety implications should be given extra consideration for winter and night time working.

## NG 10.1.6 Temperatures

The Contractor should pay close attention to the temperature of the product. The 'Requirements of the Works' tables in CC-SPW-00900 provide minimum rolling temperatures at which compaction should be substantially complete, therefore it will be necessary to commence rolling at temperatures exceeding the minimum. Minimum delivery temperatures are provided in many instances to assist with the compaction process.

The Contractor should make due allowances for weather conditions which may affect the rate of cooling of the laid material. For works conducted in hot weather refer to TRL Report 494 for advice.

## NG 10.1.7 Laying

Materials should be laid by paver unless there are small or inaccessible areas where hand laying is the only practicable method. Pavers should be used with the minimum of hand raking and making up. As far as practicable, the paver should work continuously without stopping.

Base and binder course should be laid in thicker lifts to minimise the number of layers and material interfaces.

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

The purpose of a trial strip for each HRA and coated chipping combination is to ensure the proposed plant and method of construction are compatible with achieving the desired positive macrotexture in an even and consistent manner for the chosen combination of materials. The requirement for a trial will enable a verification procedure that should be scheduled into the programme for the works

The trial strip does not have to be undertaken on the site. However evidence shall be provided to confirm that the trial has taken place. The trial location shall be provided to enable a visual inspection to be carried out.

The Contractor should check the distribution of chippings from the chipping spreader on every site. Making preliminary adjustments to the chipping spreader by laying chippings on a clean hard surface allows the rate of spread across the width of the machine to be measured and adjusted prior to use. Well maintained plant and in particular the "vanes" of the chipper are critical in ensuring consistent spreading capabilities.

The Contractor shall establish the rate of spread of chippings necessary and monitor the rate of spread achieved by the mechanical chipping spreader. BS 598-1 Clause 4.3 requires monitoring to be undertaken with 5 chipping trays placed per half width of the chipping spreader, for this to be repeated and the average rate of spread determined for 10 chipping trays. As a guide, for a typical coated chipping, each tray should be within approximately ±1kg of the mean.

As an indication, experience has shown that an even rate of spread across the mat of 60-70% of shoulder-to-shoulder cover can provide adequate macrotexture.

Unchipped channels not less than 150 mm wide shall be left alongside the kerb to allow surface water to flow to the gullies.

Stockpiles of coated chippings on site should be sheeted to protect them from wind-blown dust and in the winter to stop them becoming too cold as this can make achieving adhesion and embedment more difficult. In particularly hot weather, the stockpile should be doused with cold water prior to use to assist in breaking up clumps of chippings and aid free flow of the chippings through the chipping spreader.

## NG 10.1.8 Joints

Wherever possible, the number of cold joints should be minimised. This can be achieved by using wide screeds and/or paving in echelon. Joints should be located in low stressed areas of the pavement wherever practicable.

Where it is not possible to offset the joint by 150mm from the parallel joint in the layer beneath, due to traffic management constraints, the Contractor shall submit an alternative proposal for review by the Employer's Representative.

To ensure that water does not enter the pavement from the side, sealing the edges of the finished pavement is always required for the high side of the elevation. Sealing of the low side is conditional on whether it is necessary to let water out or stop water getting into the pavement.

## NG 10.1.9 Compaction Control

The Contractor should put in place an effective compaction plan appropriate to the site circumstances which is clearly understood by the paving crew.

The number of rollers used on a typical site shall be:

(i) At least one operational roller at all times.
(ii) A second roller when the daily tonnage exceeds 150 tonnes.
(iii) A third roller when the daily tonnage exceeds 300 tonnes.

These requirements are based on the assumption that sufficient water and fuel is readily available otherwise additional rollers may be needed.

The Contractor should provide evidence using site trials to indicate a proposed vibratory roller will achieve adequate compaction compared to a deadweight roller. Any evidence should be representative of the conditions likely to be encountered in the Works. Factors which are relevant in such trials include:

(i) Types of compacted material and source of aggregate,
(ii) Thickness and temperature of layers,
(iii) Condition of the proposed roller compared with that previously used.

Site trials are not required to prove vibrating rollers where the final density or air voids is measured as compaction and is therefore a controlled parameter.

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

The initial trapping of the coated chippings by the first roller pass is key to ensuring retention of the coated chippings in the HRA mat. Further compaction after the initial 'trap' should be visually monitored and controlled, to ensure a positive macrotexture is being maintained.

## NG 10.1.11 Surface Macrotexture

## NG 10.1.11.1 Surface Macrotexture Specific to Hot Rolled Asphalt

Hot Rolled Asphalt (HRA) surface course consists of a mat of dense, gap-graded bituminous material. A layer of coated chippings is applied if the coarse aggregate content is 30% or 35%. Good workmanship is required on site to ensure the correct spread and embedment of chippings. To ensure contact with vehicle tyres, the chippings must have a positive texture and be laid to be proud of the asphalt mat. This property is subject to a visual inspection in the first instance.

Chipping loss from chipped HRA should be kept to a minimum. However, surfaces that conform to a specified macrotexture should not be rejected merely on the basis of minor chipping loss. A loss of less than 5% over a test section is considered to be within acceptable limits.

In the resolution of a non-conformance, a test result should not be considered in isolation unless it is so far outside the specified parameters that the probability of the overall test section conforming to specification is minimal.

In addition to the assessment of macrotexture by the volumetric patch and/or laser techniques, TII has developed other methods for assessing the presence of positive macrotexture in HRA using visual assessment and 3D photogrammetry. The method for visual assessment is described in Annex A, section NGA 10.1.11.1. The method for 3D photogrammetry is described in CC-PAV-04010 The Use of Close Range Photogrammetry to Characterise Texture in a Pavement Surfacing Material.

## NG 10.1.12 Trafficking

## Use of Surfaces by Traffic

Appropriate measures may include signage and lining in accordance with the Guidance for the Control and Management of Traffic at Road Works.

## NG 10.2 Surface Treatments

## NG 10.2.1 General

## NG 10.2.1.1 Preparation

For high friction surfacing, the Producer should ensure the surface is properly prepared. The surface to which the binder or mixture is applied shall be dry and free from dust, oil, excess bitumen and other contaminant that may cause lack of adhesion.

## NG 10.2.2 Microsurfacing

## NG 10.2.2.1 Works Proposals and Approval Process

Microsurfacing should not be applied if either the pavement or air temperature is below 10°C nor if there is a possibility of the treatment freezing within 24 hours of placement.

## NG 10.2.3 Surface Dressing

## NG 10.2.3.1 Recipe Surface Dressing (RSD)

## NG 10.2.3.1.2 Handling and Storage

Stockpiles should be covered if there is a risk of contamination.

The reproducibility of the test method for fines content is variable. Therefore it is conceivable that is the same sample, tested at two different laboratories could result in one result being 0.5% and the other being 0.7%. Noting that factory production control applies up to the point of delivery, samples for quality assurance tests shall be taken at the point and time of delivery.

If the above needs to be clarified between the Purchaser and aggregate manufacturer, 1 additional sample per 500t shall be taken jointly between the aggregate manufacturer and the purchaser and tested at two different independent accredited laboratories and the mean of the results taken as the absolute result, subject to both laboratories complying with the reproducibility limits.

## NG 10.2.3.1.3 Application of Binder

The Producer should check the binder sprayer for accuracy of transverse distribution prior to commencing the Works. This check should assess the ability of the spraybar in real working conditions.

## NG 10.2.3.1.4 Application of Chippings

The Producer should check the chipping spreader for accuracy of transverse distribution prior to commencing the Works for all sizes of chippings to be used.

## NG 10.2.3.1.5 Rollers

The Producer's method of rolling should ensure that the chippings are pressed into the binder film and lie on their longest dimension, in order to be stable.

The Producer should check the ability of the rollers to spray water on to the drums or tyres before commencement of the Works. Heavy steel-wheeled rollers (greater than 5 tonnes) can cause crushing of aggregate, thereby reducing the size and accelerating the loss of texture and therefore they should not be used.

## NG 10.2.3.1.7 Joints

In order to ensure that only the binder is overlapped on transverse joints the chipping application should stop short of the end of the binder film. Where this is not possible, the Producer shall submit an alternative proposal for review by the Employer's Representative.

Longitudinal joints should have overlapped binder films obtained by leaving a wet edge approximately 100mm wide.

The Producer should ensure that double chipping does not take place as this will form a ridge. The Producer should avoid quartering (spraying of a part bar) wherever possible, but may be necessary at tapers and other similar locations. An overlap (up to 300mm) should be provided to ensure full rate of spread of binder at all points.

## NG 10.2.3.1.8 Weather Conditions

Maximum road temperature recorded on the day of the Works should be compatible with the binder being used. Spraying should only proceed within the working temperatures of the binder being used. The Producer should make adequate provisions for aftercare when the maximum temperature is approached.

## NG 10.2.3.1.10 Trafficking and Aftercare

Traffic control immediately after surface dressing is most crucial in the production of good quality surface dressing, as slow moving vehicles tend to increase embedment. On high speed roads the best way of doing this is to introduce convoy vehicles into the traffic stream in order to keep speeds low. The deployment of 20km/h signs, when permitted, is an extremely useful method of inducing caution in the road user. If possible, cones should be used to vary the lane position so that as much of the dressing as possible is subjected to slow speed traffic.

The lane should be suction swept prior to removal of the convoying vehicles from the traffic stream, care being taken not to remove chippings, which would otherwise become part of the mosaic. The larger the size of aggregate used for the surface dressing, the greater degree of aftercare and sweeping necessary to ensure success and safety. It may not be necessary to sweep multiple-layered surface dressings, unless there are windrows which should be removed. If the work has been carried out correctly there will be no loose large chippings. Provided there are no loose large sized chippings it may be useful to gradually increase the speed of the convoying vehicles to disperse excess small chippings to the side of the lane for subsequent removal.

The minimum time period before unrestricted traffic will depend on the type of surface dressing, properties of binder and chippings, site category, traffic volumes and site speed limit. Traffic should not be allowed to pass over new surface dressings at uncontrolled speeds until such time as the binder and the surface dressing has stabilised and the surface dressing been thoroughly swept.

It is essential that the Producer monitors the surface dressing for some time after opening to traffic, particularly:

(i) In hot weather, as at high temperatures the binder cohesion is low when using emulsions.
(ii) In humid or cool weather, the binder takes longer to gain cohesion.

Both of the above conditions result in lower initial resistance to traffic forces and this may result in damage to the surface dressing mosaic.

Appropriate aftercare may include signage and traffic control in accordance with the Guidance for the Control and Management of Traffic at Road Works.

## NG 10.2.3.2 Surface Dressing Product (End Performance)

## NG 10.2.3.2.1 Works Proposals and Approval Process

General weather limitations should be covered by the Producer's works proposals. Any site specific weather limitations should be specified under 'special restrictions' in Appendix 7/3.

## NG 10.2.4 High Friction Surfacing

## NG 10.2.4.2 Existing Surface

To increase adhesion and ensure bonding of the product to the substrate, the Contractor may consider the use of retexturing (shot blasting) or the use of special primer to prepare the substrate prior to the application of high friction surfacing if deemed to be necessary. The Contractor may consider the use of retexturing if the macrotexture is outside the range specified in CC-SPW-00900.

## NG 10.2.4.4 Weather Conditions

The level of relative humidity and temperature affects production rates so the Contractor should seek the manufacturer's recommendations for the particular system proposed for use.

## NG 10.2.4.5 Laying

The Contractor should apply high friction surfacing systems to surface courses within the intervals specified in Table 23d in order to reduce the risk of premature failure.

## NG 10.3 Miscellaneous Products and Processes

## NG 10.3.1 Low Energy Bound Mixtures

## NG 10.3.1.10 Stability Test

The Producer should note that a stability test may not be necessary if:

(i) Evidence is available to show that the proposed construction (materials, construction and thicknesses) has performed well at other sites under the same moisture conditions, or
(ii) The construction is of a type that is unlikely to be susceptible to deformation, or
(iii) Where a PTR is used to compact the low-energy layer, after 8 passes of a PTR with a minimum wheel load of 3 tonnes there is no measurable deformation.

If the LEBM construction is to be trafficked by special, very heavy vehicles, the Producer should give additional consideration to the performance of the material under trafficking in relation to such vehicles.

## NG 10.3.1.11 Performance Requirements

It is important that the Producer establishes a testing regime for end performance properties (stiffness, tensile strength, etc.) appropriate to the nature of the Works. It is recommended, given the precision of the testing, that the results are assessed for conformity in sets of six. However, this recommendation does not mean that a full set of six specimens needs to be made up at one time.

For works of a reasonable size, it is recommended that specimens are prepared at an overall frequency of three per 1000 tonnes with a minimum of three per working day. Conformity should be assessed on a rolling basis. It may be possible to relax this requirement for small and intermittent jobs.

40kg of material is required for each sample to have sufficient material for the three test samples (PRD, cylindrical and moisture content) to be produced. PRD samples require a minimum of 5kg of material; cylindrical samples, 4kg; moisture content samples, 3kg; as well as three particle size distribution tests from a bulk sample of six individual samples.

The performance criteria in CC-SPW-00900 represent the minimum permitted end-product compliance criteria. However, they can be supplemented by other laboratory and non-destructive in situ test methods as agreed with the Employer's Representative. For Cement-Bitumen Treated Materials (CBTM) and Bitumen Stabilised Mixtures (BSM), particularly those containing asphalt planings, analysing for bitumen content is unlikely to be of value. This aspect of process control is better controlled through tank reconciliation. A description of the supplementary test methods and expected outcomes of the testing can be included in the Producer's Material Quality Plan declaration. Supplementary testing can be of value to both the Producer and the Employer. For example, a non-destructive falling weight test device can, in certain circumstances, be used to show the in situ performance of the layer and also show that curing is occurring. It is advised that any agreed supplementary testing is used as a tool for 'acceptance' (as opposed to 'rejection') so that, along with practical evidence at other sites, these may be used to resolve non-compliance issues should they occur.

## NG 10.3.1.12 Trafficking

## Use of Surfaces by Traffic

Appropriate measures may include signage and lining in accordance with the Guidance for the Control and Management of Traffic at Road Works.

## NG 10.3.2 Geotextiles and Geotextile-related Products

## NG 10.3.2.3 Installation

Unless detailed in the manufacturer's requirements, the geotextile should not be left exposed for extended periods.

When laying asphalt over steel meshes, the paver should not be allowed to 'push' the asphalt delivery truck on the mesh. The delivery truck should either unload into the paving machine, and then move away, or should drive under its own power just ahead of the paving machine.

## NG 10.3.3 Permanent Repair Material Systems

## NG 10.3.3.1 Works Proposals

Prior to the commencement of the Works, the Contractor shall supply copies of documentation relating to the PRMS to the Employer's Representative. Records submitted shall include details of materials proposed and laboratory test results.

## NG 10.3.4 Localised Surface Repair Systems

## NG 10.3.4.1 Works Proposals

Prior to the commencement of the Works, the Contractor shall supply copies of documentation relating to the LSRS to the Employer's Representative. Records submitted shall include details of materials proposed and laboratory test results.

# Annex A – Guidance Notes

# NGA 1. GENERAL REQUIREMENTS AND DEFINITIONS

## NGA 1.5 Quality Assurance and Control

## Operating Compliance Level

IS EN 13108-21 contains tolerances for use in the Assessment and Verification of the Constancy of Performance (AVCP) for the evaluation of conformity of bituminous mixtures under FPC. Compositional grading and binder content is demonstrated under FPC by applying the tolerances to the declared target grading and binder content. An example FPC for an Asphalt Concrete AC 20 dense bin 70/100 des is contained in Table NGA 1.5.

| Test sieve (mm) | Sieve Designation | Product Composition from CC-SPW-00900, Table 2 | Declared target grading and binder content | Tolerances from IS EN 13108-21, Table A.1 | Conformity specification |
|---|---|---|---|---|---|
| 31,5 | 1,4D | 100 | 100 | -2 +0 | 98 – 100 |
| 20 | D | 95 – 100 | 99 | -9 +5 | 90 - 100 |
| 10 | sieved/2 | 52 - 72 | 62 | ± 9 | 53 - 71 |
| 6,3 | Optional extra coarse sieve | 38 - 56 | 47 | ± 9[1] | N/A[1] |
| 2 | 2mm | 20 – 40 | 30 | ± 7 | 23 – 37 |
| 0,250 | Characteristic fine sieve | 6 – 20 | 13 | ± 5 | 8 - 18 |
| 0,063 | 0,063mm | 2 - 9 | 5,5 | ± 3 | 2,5 – 8,5 |
| Binder $B_{min}$ (other crushed rock) | - | min 4,8 | 4,9 | ± 0,6 | 4,3 – 5,5 |
| **Notes** | | | | | |
| [1] There is no requirement in IS EN 13108-21 to apply a conformity tolerance to an optional extra coarse or fine aggregate sieve. However, to monitor mixture consistency it may be appropriate for the Producer to apply the same tolerance as that applied to the characteristic coarse or fine sieve. | | | | | |
| The example given is based on crushed rock aggregate. It should be noted that other aggregates can be used. | | | | | |
| The tolerances shown in the above table apply to the analysis of individual samples in accordance with Table A.1, IS EN 13108-21. | | | | | |

**Table NGA 1.5: Example of a Declared FPC (AC 20 dense bin 70/100 des)**

# NGA 2. PREPARATORY WORK

## NGA 2.1 Cold Milling of Bituminous Bound Flexible Pavement

The tool spacing of a standard milling drum is typically 15mm and is adequate for general milling. An improved surface finish can be achieved using a milling drum with a tool spacing of 8mm or less and is preferable where only one replacement layer is being installed. However the output of a milling machine with a smaller tool spacing is lower and cost of operation is higher due to the increased number of cutting tools on the drum.

# NGA 7. SURFACE TREATMENTS

## NGA 7.1 Microsurfacing

## NGA 7.1.2 Product Composition

## NGA 7.1.2.3 Surface Preparation

The cleanliness of the substrate will influence the bond with the microsurfacing; the use of high pressure washing to remove strongly adherent material will improve the bond and milling the existing surface will improve this further.

## NGA 7.1.3 Performance Requirements

## NGA 7.1.3.2 Macrotexture

In order to achieve the required macrotexture category set out in Appendix 7/10 after eleven months and before thirteen months, it is good practice to have an initial macrotexture after placement of minimum 1.2mm, measured in accordance with IS EN 13036-1.

## NGA 7.2 Surface Dressing

## NGA 7.2.3 Surface Dressing Product (End Performance)

## NGA 7.2.3.2 Product Composition

## NGA 7.2.3.2.2 Application of Binder

The class of spraybar is a guide to the evenness of transverse distribution which the spraybar is capable of producing.

## NGA 7.2.3.2.3 Application of Chippings

With multi-layered surface dressings it is very important to obtain the correct rate of spread of the larger chipping as under or over chipping will reduce the quality of the dressing and may result in it failing to perform as a multi-layered system.

Particular attention should be paid to the rate of spread in the vicinity of the overlaps in the chipping spreader mechanism as the performance, particularly of worn spreaders, can be significantly different in these areas from the rest of the spreader. The rate of spread for secondary chippings is less important and an excess is usually beneficial so that spreading with, for example, two tail board gritters in echelon are often satisfactory.

The class of chipping spreader is a guide to the evenness of transverse distribution which it is capable of producing.

# NGA 8. MISCELLANEOUS PRODUCTS AND PROCESSES

## NGA 8.1 Low Energy Bound Mixtures

## NGA 8.1.1 Constituent Materials

### NGA 8.1.1.1 Binder

Long-term performance of LEBM is reliant on the slow curing properties. The curing rate can be increased when the LEBM contains cement (or other hydraulic binders), and foamed bitumen/bitumen emulsion.

### NGA 8.1.1.5 Water

An excess of water increases curing time and potentially reduces the mixture strength due to poorer adhesion.

### NGA 8.1.1.6 Additives

Typical additives that may be used include granulated blast furnace slag, ground granulated blast furnace slag, lime, and pulverised fly ash.

## NGA 8.1.2 Product Composition

The grading envelopes specified in CC-SPW-00900 can be summarised as follows:

(i) Zone A: Suitable for all LEBM;
(ii) Zone B: Finely graded aggregate suitable in certain circumstances;
(iii) Zone C: Coarse grading suitable for in situ stabilisation; and
(iv) Zone D: Limited fines suitable for bitumen stabilised mixtures.

The grading envelopes are wide and should be considered general grading requirements. The aggregate grading should be uniformly graded to provide maximum density where smaller particles are packed between the larger particles to reduce the void space between particles and create more particle to particle contact. However, some void space is necessary to provide adequate volume for the binder to occupy and promote rapid drainage and resistance to frost.

In noting that having a high cement content may change the properties of the material, it is good practice to limit the volume of cement to no more than 6% by aggregate weight.

### NGA 8.1.2.1 Mixture Production

Moisture content has a large influence on the workability of the material; it can control the degree of compaction that may be achieved. The optimum moisture content is the natural selection as target moisture content.

The moisture content can be expected to be reasonably consistent when the material is uniform. However, variations in the moisture content must be anticipated when the following conditions are encountered:

(i) Cracks in the surfacing allow water to penetrate the underlying pavement layers, resulting in higher moisture in the vicinity of the crack.
(ii) Where the road has unsurfaced shoulders, an increase in moisture content at the high side of superelevated curves should be expected.
(iii) The pavement materials at the bottom of sag vertical curves is often more moist than elsewhere in the pavement.

For recently reclaimed asphalt, the target moisture content will depend on the moisture content reached in the road. Due to the effect of variable moisture content in the road, the target moisture content of the mix can be slightly dry of optimum.

# NGA 9. RECLAIMED ASPHALT

## NGA 9.4 Mixture Design

The grading analysis of the reclaimed asphalt feedstock will not be identical to the grading of the aggregate after the binder has been removed. A film of mortar consisting of binder plus filler will coat the larger particles and other small particles will be bound together, both of which will increase the apparent coarse aggregate content at the expense of the finer fractions. If the reclaimed asphalt is processed into different sizes for subsequent recomposition into asphalt mixtures with large proportions of reclaimed asphalt, an allowance for the finer particles in each coarse fraction will have to be made by comparison of analyses with and without removing the binder.

Although the soluble bitumen may be determined, the extent to which it is still an active binder may differ. With age, bitumen tends to harden, as measured by a reduced penetration, and its ability to adhere to aggregate particles is inhibited. The proportion of active binder is needed because the recycled asphalt mixture needs a high enough binder content (a combination of the active binder and the added fresh binder) to bind the particles together and provide durability without the binder draining and/or allowing the aggregate to move relative to other particles when loaded, which may result in deformation. Testing for the binder drainage characteristics of the mixture will help to establish the contribution of the active binder content of the Reclaimed Asphalt to the mixture; excess drainage suggests the assumed active binder content is too low and requires a reduction in added fresh binder.

# NGA 10. WORKS

## NGA 10.1 Bituminous Mixtures

### NGA 10.1.3 Transport

Asphalt begins to lose temperature as soon as the product is manufactured. The rate of change can be minimised with hot storage and good insulated transport but it can still lead to cold spots or colder pockets of material within the bulk load.

### NGA 10.1.4 Bond Coat

Inter-layer bond is essential to prevent ingress of water and resultant deterioration of the pavement. It is also important to ensure that the pavement acts as a homogenous structure. It is difficult to overestimate the importance of bond.

When proprietary additives and 'non-tack' bond coats break, sometimes accelerated by using proprietary breaking agents, the residual binder is not as tacky or sticky, only becoming so at the high temperatures associated with the asphalt overlay when they melt at the interface, thereby achieving a bond.

### NGA 10.1.5 Weather Conditions

The layer thickness has a major effect on the time available for compaction before the temperature drops below that at which the compaction is effective. Materials laid 50mm or more thick, other than Hot Rolled Asphalt with chippings, are likely to be tolerant of all but the most extreme conditions encountered in Ireland.

### NGA 10.1.6 Temperatures

The temperature of the asphalt after a period of production can be lower in some parts of the load compared to others; notably the beginning and end of the load and any areas that have been exposed. This can lead to unsatisfactory compaction even when the apparent temperature of the load is within acceptable tolerances.

### NGA 10.1.7 Laying

It is good practice to use pavers with automatic levelling devices.

Stopping the paver can adversely affect the ride quality of the finished pavement. Therefore, there should be sufficient mixed material on site when paving commences to ensure that lack of supply will not stop operations. However, an excess number of delivery vehicles should also be avoided as it can result in congestion on site and an extended time between mixing and laying for each load.

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

The application of coated chippings and subsequent compaction requires skill, care and attention in order to achieve the desired result of uniform positive texture. An over-chipped surface can result in excessive chip loss and an under-chipped surface can result in lack of texture. Mixture temperature and ambient weather conditions also play an important role in achieving the desired result as the subsequent

rolling and 'trapping in' of the chippings can lead to over or under embedment of the chippings if attention is not paid to the action of the roller. In addition the size and shape of the coated chippings has a large bearing on a successful outcome.

## NGA 10.1.8 Joints

However a joint in a bituminous layer is constructed, it will always be the weakest part of the pavement.

In most circumstances it is possible to offset the joint by 150mm from the parallel joint in the layer beneath.

Compaction at joints with unsupported edges will never achieved the levels attained in the body of the mat. This is recognised in the air void content requirements and the requirement to use an edge compressing tool to improve the compaction at the edge.

To ensure that water does not enter the pavement from the side, sealing the edges of the finished pavement is always required for the high side of the elevation. Sealing of the low side is conditional on whether it is necessary to let water out or stop water getting into the pavement.

## NGA 10.1.9 Compaction Control

There is no conclusive evidence to show all vibratory rollers provide consistently greater compaction than that achieved with conventional deadweight rollers. It is desirable that compaction should be optimised so site trials of vibratory rollers, proposed as an alternative to conventional deadweight rollers, may be beneficial. The operation of a vibrating roller requires a higher degree of skill and experience than a deadweight as the driver must adjust both the amplitude and frequency of the vibrators to the materials and prevailing conditions. Hence the trial should not only determine the required number of passes of the vibratory roller, but also the frequency and amplitude of the vibrating rolls and roller speed. Additional advice is included in TRL Report LR1102.

If compaction trials have been carried out, the frequency and amplitude of vibrating rollers and travelling speed of the roller which have been found to be satisfactory should be used. The Contractor can use equations [1] and [2], to select the paving and rolling rates to achieve the minimum number of roller passes required before the surfacing has cooled to the minimum temperature for compaction:

Rolling length (m) = Average paving speed (m/min) x T (min) [1]

Roller passes = (Rolling rate/paving rate) x No of rollers [2]

Where:

(i) Rolling rate (mÇ/min) = Roller width (m) x Roller speed (m/min)

(ii) Paver rate (mÇ/min) = Paver width (m) x Paver speed (m/min))

(iii) T = time required for compaction (usually 10 minutes for HRA and 8 minutes for mixtures without pre-coated chippings)

## NGA 10.1.11 Surface Macrotexture

Surface course layers are the interface between the vehicle tyre and the road pavement. A consideration of their long term contribution to skidding resistance performance, over the design life, must include both the microtexture and the macrotexture of the laid material. In general the depth of

initial surface macrotexture is the determining factor in the ability of the surface course to assist in the dispersal of surface water from the tyre-road contact area in wet conditions at higher speed. It is for this reason that differing target levels are set for speeds above and below 60km/hr. This speed limit is generally applied to urban areas where free-flowing high speed traffic is inappropriate regardless of the geometric configuration.

## NGA 10.1.11.1 Surface Macrotexture Specific to Hot Rolled Asphalt Mixtures

To characterise texture as being positive or non-positive with HRA and coated chippings, TII has developed new methods using visual and 3D photogrammetry techniques.

**Visual Assessment**

Visual Assessment shall be carried out at the same location and at the same frequency as the macrotexture measurements under Clause 10.1.11.1 of CC-SPW-00900.

The criteria contained in Form NGA 10.1.11 provides a suitable format for assessing the macrotexture condition from a visual assessment perspective. Example photographs are also contained in this Annex to assist with the inspection.

To assist the completion of the table, a small steel rule and / or a 1m spirit level are useful tools to rest on the surface to assess whether the coated chippings are above the level of the HRA mastic (positive) or at the same level or below the level of the HRA mastic (non-positive).

The tools also assist with scale when photographs are used to emphasise a specific surface attribute.

**3D Photogrammetry**

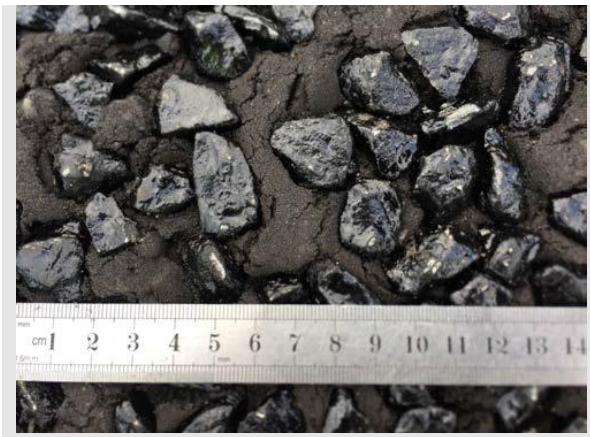
The test method for characterising the surface macrotexture of a pavement surface as positive or non-positive is described in CC-PAV-04010 The Use of Close Range Photogrammetry to Characterise Texture in a Pavement Surfacing Material.

## Form NGA 10.1.11 - HRA Macrotexture - Visual Assessment Form

| | | | | | |
|---|---|---|---|---|---|
| **Scheme / Contract** | | | | | |
| **Inspected By** | | | | | |
| **Laying Contractor** | | | **Date of inspection** | | |
| **Source of HRA** | | | | | |
| **Source of Chippings** | | | | | |
| **Location (lane/carriageway** | | | | | |
| **Chainage from** | | | **Chainage to** | | |
| **Chip embedment** | | | | **evident** | **%** |
| Positive - chippings are above the level of the material mastic | | | | | |
| Non Positive - chippings are at the same level or below the material mastic | | | | | |
| Mixture of above - state what combination | | | | | |
| **Chip distribution** | **evident** | **% estimate** | | **evident** | **%** |
| Uniform transverse | | | Irregular transverse | | |
| Uniform longitudinal | | | Irregular longitudinal | | |
| Excessive rate of | | | Insufficient rate of | | |
| **Location (lane/carriageway** | | | | | |
| **Chainage from** | | | **Chainage to** | | |
| **Chip embedment** | | | | **evident** | **%** |
| Positive - chippings are above the level of the material mastic | | | | | |
| Non Positive - chippings are at the same level or below the material mastic | | | | | |
| Mixture of above - state what combination | | | | | |
| **Chip distribution** | **evident** | **% estimate** | | **evident** | **%** |
| Uniform transverse | | | Irregular transverse | | |
| Uniform longitudinal | | | Irregular longitudinal | | |
| Excessive rate of | | | Insufficient rate of | | |
| **Location (lane/carriageway** | | | | | |
| **Chainage from** | | | **Chainage to** | | |
| **Chip embedment** | | | | **evident** | **%** |
| Positive - chippings are above the level of the material mastic | | | | | |
| Non Positive - chippings are at the same level or below the material mastic | | | | | |
| Mixture of above - state what combination | | | | | |
| **Chip distribution** | **evident** | **% estimate** | | **evident** | **%** |
| Uniform transverse | | | Irregular transverse | | |
| Uniform longitudinal | | | Irregular longitudinal | | |
| Excessive rate of spread | | | Insufficient rate of | | |
| **Location (lane/carriageway** | | | | | |
| **Chainage from** | | | **Chainage to** | | |
| **Chip embedment** | | | | **evident** | **%** |
| Positive - chippings are above the level of the material mastic | | | | | |
| Non Positive - chippings are at the same level or below the material mastic | | | | | |
| Mixture of above - state what combination | | | | | |
| **Chip distribution** | **evident** | **% estimate** | | **evident** | **%** |
| Uniform transverse | | | Irregular transverse | | |
| Uniform longitudinal | | | Irregular longitudinal | | |
| Excessive rate of spread | | | Insufficient rate of | | |

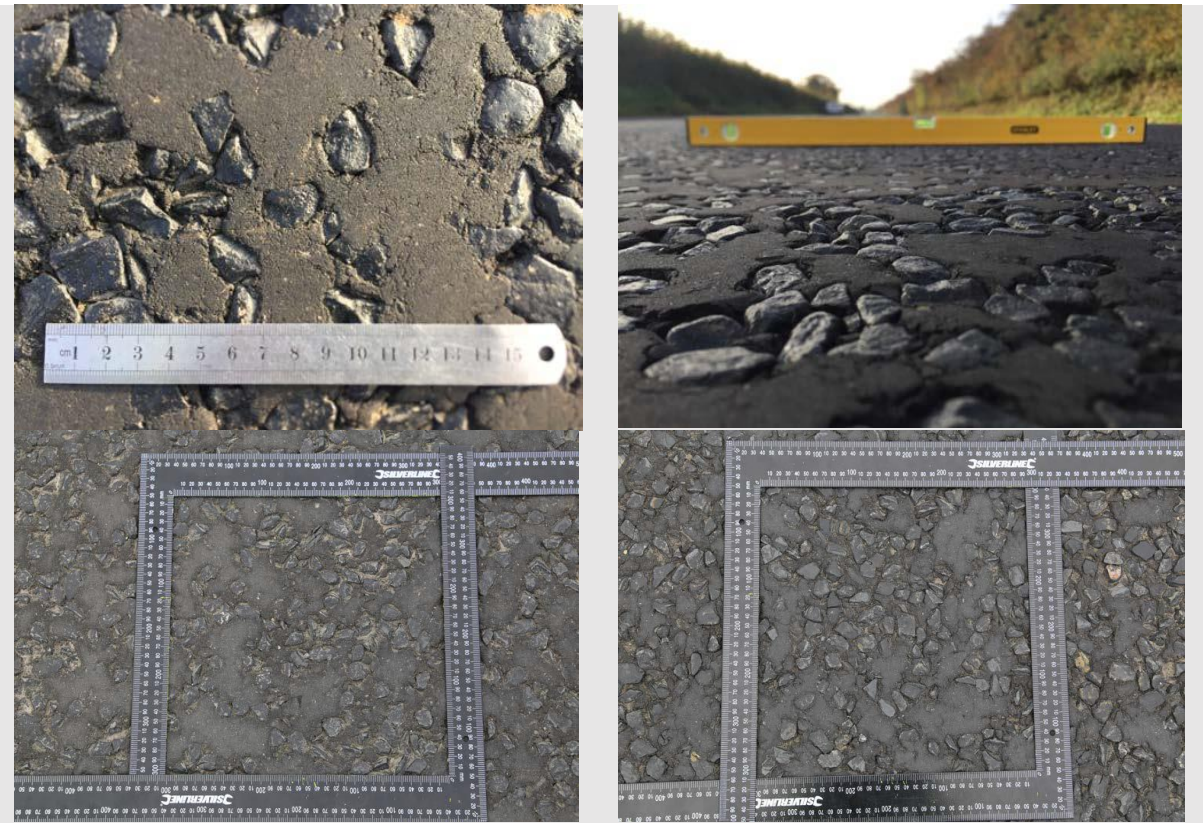
**Example Photographs to Assist Inspection**

## Chip Embedment on newly installed HRA surface - Positive



## Chip Embedment on older trafficked HRA surface - Positive

**Chip Embedment – Non Positive**



**Chip Distribution – Uniform**

**Chip Distribution – Irregular**

**Excessive Rate of Spread** **Insufficient Rate of Spread**

# NGA 10.2 Surface Treatments

## NGA 10.2.1 General

### NGA 10.2.1.1 Preparation

In preparation for surface dressing, repairs to the existing road, such as patching, should be carried out well in advance of the Works. Requirements for pre-treatments should follow Design of Bituminous Mixtures, Surface Treatments, and Miscellaneous Products and Processes (DN-PAV-03074). Pre-treatment should be carried out in such a manner that the hardness and macrotexture of the remedial work is sufficiently similar to the rest of the road to avoid problems of variable appearance and behaviour in the completed surface dressing for at least the duration of the maintenance/performance period; for example, patching using close textured asphalt concrete should be carried out in the previous summer otherwise it may absorb bitumen into the voids and chipping loss may ensue. The existing road variability and surface characteristics have a bearing on the achievable levels of performance that may be specified. If the existing surface is hot rolled asphalt, the patches will have to be laid with hot rolled asphalt and preferably sufficiently far in advance of the Works for the binder to wear off the surface, otherwise there will be excess binder in that area and fatting may occur. Stone mastic asphalt should be repaired with the same material of similar consistency and highly textured variable substrata should be sealed with a pad coat. Patches should not have a horizontal sealing strip applied as this will show through the dressing very rapidly and has been known to initiate fatting failure. The use of binder rich materials should not be used to pre-seal areas especially longitudinally in the wheel tracks as the dressing will fat up and macrotexture will be lost.

Cleanliness of the existing road surface is extremely important. The binder will adhere only to the top layer of the material on which it is sprayed and if there is mud or dust then the surface dressing will fail rapidly, through the lack of bond with the underlying structure. It may be necessary in some circumstances to use high pressure washing to remove strongly adherent material. The masking of street furniture should be carried out with care as the interface between the furniture and the surrounding surface should be sprayed in order to exclude water from the road structure, but any cover must not be rendered immovable.

## NGA 10.2.3 Surface Dressing

### NGA 10.2.3.1 Recipe Surface Dressing (RSD)

#### NGA 10.2.3.1.2 Handling and Storage

Wastage and contamination can be minimised by laying concrete or asphalt floors to chipping stockpile areas.

Loading shovels or lorries should never drive up on stockpiles. Operators should be careful not to contaminate chippings by scraping stockpile floors.

Care should be taken to ensure that the dust content of chippings, as loaded in the chipping spreader, is still within the required limits. Use of clean chippings is one of the most important factors in achieving good adhesion with the binder in surface dressing.

It is preferable that chippings be damp, (but not dripping wet), when used with emulsions, to ensure better wetting and adhesion by minimising the barrier effect of any dust that is present. Excess water may be a particular problem when chippings are delivered directly from the production plant. Early stockpiling in advance is advised. Wet chippings can cause problems particularly early or late in the

season, when drying conditions are poor. Excessively wet chippings can cause dilution of the binder and consequent runoff and blotching of the newly laid layer of chippings and may result in poor adhesion of chippings.

## NGA 10.2.3.1.3 Application of Binder

The class of spraybar is a guide to the evenness of transverse distribution which the spraybar is capable of producing.

## NGA 10.2.3.1.4 Application of Chippings

With multi-layered surface dressings it is very important to obtain the correct rate of spread of the larger chipping as under or over chipping will reduce the quality of the dressing and may result in it failing to perform as a multi-layered system.

Particular attention should be paid to the rate of spread in the vicinity of the overlaps in the chipping spreader mechanism as the performance, particularly of worn spreaders, can be significantly different in these areas from the rest of the spreader. The rate of spread for secondary chippings is less important and an excess is usually beneficial so that spreading with, for example, two tail board gritters in echelon are often satisfactory.

The class of chipping spreader is a guide to the evenness of transverse distribution which it is capable of producing.

## NGA 10.2.3.1.5 Rollers

The aim of rolling should be to orientate the chippings and place them in contact with the binder rather than provide compaction. Although water may not be needed all the time, when it is, it is needed urgently. Heavy steel-wheeled rollers (greater than 5 tonnes) can cause crushing of aggregate, thereby reducing the size and accelerating the loss of texture.

## NGA 10.2.3.1.7 Joints

When spraying from a completed section some hand-applied spraying and masking of the end is necessary in order to abut the joint without forming a ridge.

As the binder overlap is generally in a lightly trafficked location, the additional thickness of binder film is unlikely to be a problem.

## NGA 10.2.3.1.10 Trafficking and Aftercare

The mode of operation of surface dressing contracts can necessitate the adoption of techniques requiring equipment for traffic management and safety over and above that normally required by static works. Where traffic lights are required as part of the traffic management scheme and in order to facilitate the relocation of the lights, some sites may require the provision of additional sets over and above the minimum necessary, to ensure that the work progresses with a minimum of interruption and disruption to road users.

In the event remedial works are required, the Producer should reinstate traffic safety and management procedures. If there are signs of distress, such as turning of the chippings, application of ‘dust’ may be a necessary remedial action in order to prevent further damage to the surface dressing.

## NGA 10.2.3.2 Surface Dressing Product (End Performance)

## NGA 10.2.3.2.3 Performance Requirements

Double and multiple-layered dressings using modified binders normally show reduced loss of macrotexture with time. An increase in macrotexture depth over time indicates that the surface is losing chippings.

## NGA 10.2.4 High Friction Surfacing

## NGA 10.2.4.5 Laying

On occasion, cracking which extends into the surface course can be induced by the application of high friction surfacing. The risk of this occurring is much greater when the surface course is newly applied and untrafficked.

## NGA 10.3 Miscellaneous Products and Processes

## NGA 10.3.1 Low Energy Bound Mixtures

## NGA 10.3.1.6.3 In Situ Produced Mixtures

Where the in situ moisture content of the material to be recycled fails to meet the specified moisture content range, corrective action should be taken either by aeration to reduce the moisture content or by controlled addition of water to increase the moisture content.

Aeration of the affected area should be achieved by full depth passes of the recycling machine to disturb and loosen the material and assist the evaporation of excess moisture. The material should be kept in a loose condition until subsequent moisture content tests show that the treated material has reached the required moisture content range. The layer should be re-graded nominally to the required profile and provisionally compacted in preparation for stabilisation.

An increase in moisture content of the affected area should be achieved by the addition of water through an adjustable spraybar system in conjunction with full depth passes of the recycling machine to achieve a uniform distribution of the water throughout the layer. Increments of water should be added and mixed in until subsequent moisture content tests show that the material has reached the required moisture content range. The layer should be re-graded nominally to the required profile and provisionally compacted in preparation for stabilisation.

## NGA 10.3.2 Geotextiles and Geotextile-related Products

## NGA 10.3.2.3 Installation

When laying asphalt over steel meshes, a tracked paver may be less likely to cause rucking than a wheeled paver. Care should be taken by drivers of all vehicles on the mesh not to make aggressive turns, stops or starts that could disturb the mesh.

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