

NRA Interim Advice Note 04/13

**Specification for Microsurfacing,
Surface Dressing and Bond Coat**

June 2013

Summary:

This Interim Advice Note sets out the revised specification for Clauses 918, 919, 920 and 922 within the NRA Manual for Contract Documents Volume 1 – Specification for Road Works. The Clauses deal with the following topics:

- Clause 918 – Microsurfacing
- Clause 919 – Surface Dressing: Recipe Specification
- Clause 920 – Bond Coats, Tack Coats and Bituminous Sprays
- Clause 922 – Surface Dressing: Design, Application and End Product Performance

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Specification for Microsurfacing, Surface
Dressing and Bond Coat**

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1. CLAUSE 918 – MICROSURFACING

- 1 Microsurfacing shall comply with IS EN 13808, BS 434: Part 2, sub-Clauses 918.2 to 918.24 and Tables 1.1, 1.2, 1.3 and 1.4.

Aggregate

- 2 Aggregate shall be crushed or natural sand free from silt, clay or other fine material. The aggregate, whether a mixture or not, shall have a smooth grading within the limits of Table 1.1.
- 3 Unless otherwise specified in Appendix 7/7, the coarse aggregate shall conform to the default declared Polished Stone Value (PSV) requirements of Table 1.2. PSV requirements for the coarse aggregate shall also conform to sub-Clauses 901.8 and 901.9.
Unless otherwise specified in Appendix 7/7, the coarse aggregate shall conform to the maximum Aggregate Abrasion Value (AAV) requirements of Table 1.3. AAV requirements for the coarse aggregate shall also conform to sub-Clause 901.10.
- 4 All testing shall be carried out in accordance with the relevant part of Clause 901.

Table 1.1 Aggregate Grading

Sieve Size (mm)	Percentage by mass of total aggregate and additive passing	
	3mm finished thickness	1,5mm finished thickness
6,3	100	100
4	80 – 100	100
2	75 – 100	95 – 100
1	55 – 90	70 – 95
0,250	20 – 45	30 – 50
0,063	5 – 15	5 – 15

Table 1.2: Polished Stone Value Requirements

Site Description	Polished Stone Value (PSV)
National Roads	PSV ₆₀ declared

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Table 1.3: Aggregate Abrasion Requirements

Traffic (cv/lane/day) at design life	Aggregate Abrasion Value (AAV)
< 250	AAV ₁₄
251 - 1000	AAV ₁₂
1001 – 1750	AAV ₁₂
1751 – 2500	AAV ₁₀
2501 – 3250	AAV ₁₀
> 3250	AAV ₁₀

Additive

- 5** The additive shall be CEM1 or CEM2 Portland cement complying with IS EN 197: Part 1 or hydrated lime complying with IS EN 459-1. At least 75% shall pass the 63 micron sieve.

Bitumen Emulsion

- 6** The microsurfacing bitumen emulsion shall comply with IS EN 13808 and the specific requirements of Table 1.4.

Table 1.4: Specification Framework for Cationic Bituminous Emulsions – Properties of the Emulsion

EN 13808, Table 1, EN Grade	Standard	Unit	C65BP 4
Nominal Grade			Microsurfacing
Binder Content [Notes 3 and 4]	IS EN 1428	% by mass	63 to 67 (Class 7)
Residual Binder after distillation	IS EN 1431	% by mass	≥ 63 (Class 7)
Breaking Value (Forshammer filler)	EN 13075-1		< 110 & 110-195 (Class 2 & 4)
Residue on Sieving, 500um	IS EN 1429	% by mass	NR (Class 0)
Redwood #2 Viscosity @ 85°C	IS EN 16345	Seconds	NR (Class 0)

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Notes

[1] Performance classes in accordance with IS EN 13808 Table 2.

[2] Tests must be carried out within 10 days of sampling.

[3] Binder contents carried out in accordance with IS EN 1428 exceeding the upper limit are permitted once the viscosity requirement is met.

[4] The binder content when determined by IS EN 1428 shall be defined as, 100 - (minus) Water Content.

Bond Coat

- 7 Where required, or stated in Appendix 7/4, bond coat shall comply with the requirements of Clause 920.

Composition of Mixed Material

- 8 The mixed material shall comprise aggregate, bitumen emulsion and, where appropriate, additive. The amount of emulsion used shall be between 180 litres/tonne and 250 litres/tonne of dry aggregate; the precise proportions of each constituent being selected after laboratory tests and trials using the same plant intended to be used in the Works. When additive complying with sub-Clause 918.5 is used, the proportion shall not normally exceed 2% by mass of aggregate.

Mixing

- 9 The materials shall be measured into a mechanical mixer and mixed such that the aggregate is completely and uniformly coated with bitumen emulsion and microsurfacing is produced of consistency that can be satisfactorily laid as described in sub-Clauses 918.14 to 918.16. When required, an additive complying with sub-Clause 918.5, shall be used to control consistency, mix, segregation and setting rate.

Preparation of Site

- 10 Before applying bond coat or spreading microsurfacing, any necessary patching of the road surface shall be completed. Immediately before application of bituminous materials, loose material, dust and vegetation shall be cleaned from the existing surface by sweeping, supplemented if necessary by air jet, removed from the site and disposed of in accordance with all relevant legislation. All ironwork, road studs and road markings shall be masked. At junctions with surfaces not to be treated, clean lines shall be defined by masking or other suitable means.

Laying

- 11 If required in the Contract and/or Appendix 7/4, a bond coat shall be applied in accordance with Clause 920 before spreading the microsurfacing.
- 12 The rate of spread of bond coat shall be in accordance with Clause 920.
- 13 Microsurfacing shall be evenly spread by mechanical means such that the aggregate cover (dry mass equivalent) is 4-6kg/m² for 3 mm finished thickness and 2-4kg/m² for 1,5 mm finished thickness.

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- 14** All voids, cracks and surface irregularities shall be completely filled. Application shall not be undertaken when the ground temperature falls below 4°C or when standing water is present on the surface. In warm dry weather the surfacing, immediately ahead of the spreading, shall be slightly damped by mist water spray applied mechanically.
- 15** The microsurfacing shall be rolled by a self-propelled or towed multi-wheeled smooth tread rubber-tired roller, having an individual wheel load between 0,75 and 1,5 tonnes, making at least six passes unless the Contractor demonstrates that rolling is unnecessary or that a smaller number of passes is satisfactory for a particular process. Rolling shall commence as soon as the microsurfacing has set sufficiently to ensure rutting or excessive movement will not occur.
- 16** The finished microsurfacing shall have uniform surface texture and colour throughout the work, without variations of texture within the lane width, or from lane to lane, due to segregation of aggregates or colour, due to variations in the emulsion water content of the mixture.
- 17** The finished surface shall be free from blowholes and surface irregularities due to scraping, scabbing, dragging, droppings, excess overlapping or badly aligned longitudinal or transverse joints, damage by rain or frost, or other defects. Microsurfacing which does not comply with this Clause or is non-uniform in surface texture or colour 24 hours after laying shall be rectified by removal and replacement with fresh material rolled in compliance with the Specification or, if this is impractical, by having fresh material superimposed and rolled in compliance with the Specification. Areas so treated shall be not less than 5m long and not less than one lane wide. All areas being worked on shall be kept free of traffic until permitted by the Employer's Representative.

Preliminary Microsurfacing Mixture Design and Trial Areas

- 18** Using the same plant proposed for the Works, the Contractor shall make trial mixes of the microsurfacing, varying the bitumen emulsion aggregate ratio to produce a microsurfacing of creamy consistency which, whilst the screed box is travelling at the laying speed, will flow ahead of the screeding blade across the whole width of the spreader at all times. At least three trial mixes shall be made, each sufficient to spread a trial area of 40 square metres, to the specified finished thickness. The preparation of the existing surface for the trials, the bond coat spreading and the rolling methods shall comply in all respects with Clause 918. Trial areas, which achieve the required spreading consistency, will be examined after 24 hours for surface texture and adhesion, and if satisfactory the test specified in sub-clause 918.19 shall be carried out on samples of the same composition.
- 19** For each of the satisfactory trial mixes, at least two circular specimens shall be prepared, as described in BS 434: Part 2, for a wet track abrasion test. The approved mix proportions for the main work shall be selected following laboratory tests using a combination of bitumen emulsion, aggregate blended where necessary with additive and water, having a wet track abrasion test result of less than 500g/m².
- 20** When a proposed mix has been approved variations shall not be made in mixing time, mix proportions or in the type, size, grading or source of any of the constituents without the agreement of the Employer's Representative who may require further tests to be made.

Site Control Tests

- 21** The mix proportions shall be controlled and the mass of all materials incorporated shall be checked and recorded at least four times daily. The quantity of emulsion used and the rate of spread of mixed material, in kilograms of aggregate per square metre, shall be recorded for each load of aggregate and, if required, for each separate run within a load of aggregate.
- 22** The Contractor shall provide all necessary testing equipment and whenever spreading is taking place shall carry out the tests specified in Table 1.4 at the frequency stated therein. A copy of the results of

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each of the tests, and of each recorded mass and check for rate of spread, shall be passed to the Employer's Representative.

- 23** 75g of the blended aggregate shall be weighed in a glass beaker or similar container and the corresponding quantities of water and cationic emulsion in the microsurfacing mix added. The microsurfacing shall be stirred with a slow deliberate action (about 60rpm) for 15 to 30 seconds, after which a specimen of about half the mixture shall be cast upon an impervious surface.
- 24** The cast specimen shall exhibit cohesive properties in not more than 10 minutes and when set and drenched in water shall be water fast as demonstrated by the absence of brown colour in the wash water.

Table 1.4: Site Control Tests

Test	Frequency	
	Batch Mixing	Continuous Mixing
Wet Track Abrasion Test (BS 434: Part 2)	4 times daily	Every second run
Grading of each separate stockpile of sand and crusher run fine aggregate	Every 20 tonnes	Every 20 tonnes
Grading of the samples of the blended aggregate	4 times daily	4 times daily
Percentage of the bitumen in cured seal	4 times daily	4 times daily

2. CLAUSE 919 – SURFACE DRESSING: RECIPE SPECIFICATION

1 The Contractor shall:

- (i) Carry out the Surface Dressing in accordance with the Contract as described in Appendix 7/21 subject to the schedule of constraints on site availability set out in Appendix 1/13.
- (ii) Use components which conform to harmonised European Standards (hEN), which are CE marked, and have employed a quality management system in accordance with IS EN 9001, or equivalent, as part of their factory production control.
- (iii) Be responsible for the techniques and processes subject to the requirements described in Appendix 7/21. The tolerances permitted for this work shall be as specified in Appendix 7/21.
- (iv) As part of the Works Proposals, provide the Employer's Representative with a written statement detailing the proposed method of executing the Works, which may also be subject to the approval of the National Roads Authority.
- (v) Guarantee the materials and workmanship against defects and against failure to meet the specification for a period of one year, or as otherwise described in Appendix 7/21, from the date of completion of the work.

Materials and Equipment – Binder

2 The binder shall be of the following type and grade:

- (i) Cationic 70% Emulsion – C69B 3
- (ii) Premium Polymer Modified Emulsion – C72BP 3
- (iii) Super Premium Polymer Modified Emulsion – C72BP 3

Cationic Bitumen Emulsions shall be in accordance with IS EN 13808.

Fluxed and cutback bitumen binders shall not be permitted.

Abbreviated terms used in (i) – (iii) above correspond to IS EN 13808 Table 1.

3 The binder shall have the characteristics defined in Tables 2.1, 2.2 and 2.3. The properties in Table 2.1 characterise the emulsion. Table 2.2 and Table 2.3 define the properties and performance classes applicable to the residual binders obtained after distillation, recovery, stabilisation and ageing procedures.

When tested by the methods given in Tables 2.1, 2.2 and 2.3, the various grades shall conform to the limits specified in that table.

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Table 2.1: Specification Framework for Cationic Bituminous Emulsions – Properties of the Emulsion

EN 13808, Table 1, EN Grade	Standard	Unit	C69B 3	C72BP 3	C72BP 3
Binder Content [Notes 2 and 3]	IS EN 1428	% by mass	67 to 71 (Class 9)	≥ 71 (Class 11)	≥ 71 (Class 11)
Residual Binder after distillation	IS EN 1431	% by mass	≥ 67 (Class 9)		
Breaking Value (Forshammer filler)	EN 13075-1		< 110 & 70-155 (Class 2 & 3)	< 110 & 70-155 (Class 2 & 3)	< 110 & 70-155 (Class 2 & 3)
Residue on Sieving, 500um	IS EN 1429	% by mass	≤ 0.2 (Class 3)	≤ 0.2 (Class 3)	≤ 0.5 (Class 4)
Redwood #2 Viscosity @ 85°C	IS EN 16345	Seconds	20-100 (Class 3)	20-100 (Class 3)	20-100 (Class 3)

Table 2.2: Specification Framework for Cationic Bituminous Emulsions – Properties of Residual, Recovered, Stabilised and Aged Binders

EN 13808, Table 1, EN Grade	C69B 3	C72BP 3	C72BP 3
	Residual Binder by Distillation	Bituminous Phase of the emulsion	Bituminous Phase of the emulsion

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Table 2.3: Specification Framework for the Technical Requirements and Performance Classes for Residual, Recovered, Stabilised and Aged Binders from Cationic Bituminous Emulsions

EN 13808, Table 1, EN Grade	Standard	Unit	C69B 3	C72BP 3	C72BP 3
Penetration @ 25°C	IS EN 1426	0.1mm	≤ 270 (Class 6)	≤ 270 (Class 6)	≤ 270 (Class 6)
Softening Point °C	IS EN 1427	°C	DV (Class 1)	≥ 39 (Class 7)	≥ 39 (Class 7)
Cohesion by Pendulum Test	IS EN 13588	J/cm ²		≥ 1.2 (Class 3)	≥ 1.4 (Class 2)

Notes

[1] Performance classes in accordance with IS EN 13808 Tables 2, 3 and 4.

[2] Tests must be carried out within 10 days of sampling.

[3] Binder contents carried out in accordance with IS EN 1428 exceeding the upper limit are permitted once the viscosity requirement is met.

[4] The binder content when determined by IS EN 1428 shall be defined as, 100 - (minus) Water Content.

[5] DV: Declared Value.

- 4** The Contractor shall provide a Binder Data Sheet giving details of the properties of each binder proposed, including those specified in Appendix 7/21. The recovery of the binder shall be carried out in accordance with Clause 923. The test to determine the Pendulum Cohesion shall be carried out in accordance with IS EN 13588. The Contractor shall provide rheological product identification data for modified binders in accordance with Clause 928. Health and Safety information and a safe handling guide from the manufacturer shall be provided together with details of any weather restrictions placed upon use of the binder.

All testing shall be carried out in accordance with the relevant part of Clause 901.

Compliance with the requirements for binder in accordance with this Clause shall be declared by the manufacturer within the Type Test Reports.

- 5** The binder application shall be uniform and shall be of sufficient width to allow a full lane to be dressed in a single pass. Binder distributors shall have controlled metering and be capable of variable application. Before a distributor is used in the works, the Contractor shall demonstrate, to the satisfaction of the Employer's Representative, the distributor conforms to this Clause 919 through operation within a trial area designated by the Employer's Representative.

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Materials and Equipment – Chippings

6 The chippings shall be crushed rock or crushed gravel complying with the requirements of sub-Clause 901.4, and be of the size specified in the following designated nominal sizes:

- (i) 2/6(6mm) Nominal Size 6mm
- (ii) 6/10(10mm) Nominal Size 10mm
- (iii) 10/14(6mm) Nominal Size 14mm
- (iv) 14/20(6mm) Nominal Size 20mm

The grading of the chippings specified in accordance with IS EN 13043 shall be determined in accordance with IS EN 933-1 and shall conform to the requirements in Table 2.4.

Table 2.4: Grading of Aggregate Sizes

Size (mm)	14/20	10/14	6/10	2/6
Nominal Size (mm)	20	14	10	6
Test sieve aperture size (mm)	% by mass passing			
40	100			
31.5	98 - 100	100		
20	85 - 99	98 - 100	100	
16	Record Value (Design Aid) [Note 1]			
14	0 - 20	85 - 99	98 - 100	
12.5		Record Value (Design Aid) [Note 1]		100
10		0-20	85-99	
8			Record Value (Design Aid) [Note 1]	98 - 100
6.3	0 - 5		0 - 20	85 - 99
4		0 - 5	0 - 5	Record Value (Design Aid) [Note 1]
2				0 - 20
1				0 - 5
0.063	0 - 0.5	0 - 0.5	0 - 0.5	0 - 1

Notes

[1] Tables in HD 37 may be used to allow for variations in chipping size when determining application rates of binder

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In his proposals, the Contractor shall state the source and characteristics of chippings to be used and the coating, if any.

Unless otherwise specified in Appendix 7/21, the chippings shall conform to the default declared Polished Stone Value (PSV) requirements of Table 2.5. PSV requirements for the chippings shall also conform to sub-Clauses 901.8 and 901.9.

Unless otherwise specified in Appendix 7/21, the chippings shall conform to the maximum Aggregate Abrasion Value requirements of Table 2.6. AAV requirements for the coarse aggregate shall also conform to sub-Clause 901.10.

Unless otherwise specified in Appendix 7/21, and in accordance with IS EN 13043 Clause 4.2.2 and the relevant section of SR17, the chippings shall conform to the maximum Los Angeles Co-efficient requirements of Table 2.7.

The resistance of the chippings to freezing and thawing shall comply with sub-Clause 901.6.

The shape of the chippings shall comply with category FI20 as defined in IS EN 13043, Clause 4.1.6, tested at frequency specified in Appendix 1/5.

All testing shall be carried out in accordance with the relevant part of Clause 901.

Compliance with the requirements for chippings in accordance with this Clause shall be declared by the manufacturer within the Type Test Reports.

Table 2.5: Polished Stone Value Requirements

Site Description	Polished Stone Value (PSV)
National Roads	PSV ₆₀ declared

Table 2.6: Aggregate Abrasion Requirements

Traffic (cv/lane/day) at design life	Aggregate Abrasion Value (AAV)
< 250	AAV ₁₄
251 - 1000	AAV ₁₂
1001 - 1750	AAV ₁₂
1751 - 2500	AAV ₁₀
2501 - 3250	AAV ₁₀
> 3250	AAV ₁₀

Table 2.7: Los Angeles Co-efficient Requirements

Site Description	Los Angeles Co-efficient (LA)
National Roads with Surface Dressing on concrete or Asphaltic Concrete with AADT greater than 1000	LA ₂₀
National Roads with AADT greater than 200 or where steel wheeled rollers are used for compaction	LA ₂₅
Other lightly trafficked National Roads where local experience has demonstrated satisfactory performance of material from that source	LA ₃₀

- 7** Chipping spreaders shall have controlled metering and be capable of variable or fixed width application to match the binder sprayer. Before a spreader is used in the works, the Contractor shall demonstrate, to the satisfaction of the Employer's Representative, the spreader conforms to this Clause 919 through operation within a trial area designated by the Employer's Representative.

Preparation

- 8** Any necessary remedial works to the road surface and structure, verges and road drainage shall be completed either prior to commencement of the works, or as part of the Contract and agreed as acceptable by the Employer's Representative and the Contractor before Surface Dressing commences.
- 9** Before binder is applied, street furniture shall be masked using self-adhesive masking material. Oil, sand or similar materials shall not be used. Any packed mud or other deposits on the road surface shall be removed and the road surface shall be swept free of all loose material.
- 10** Traffic Safety and Management for National Roads including motorways shall be in accordance with Chapter 8 - Temporary Traffic Measures and Signs for Road Works and the "*Guidance for the Control and Management of Traffic at Road Works*" and any site specific additional requirements specified in Appendix 1/13.

Application

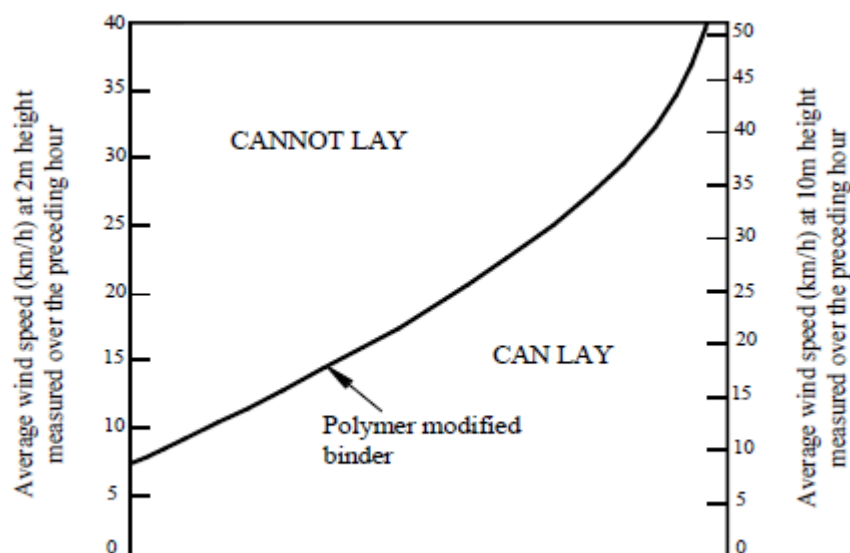
- 11** Binder shall be applied to the road surface at the rates specified in the Contract and in Appendix 7/21. The Contractor shall mark out areas where an adjusted binder rate is needed, because of localised conditions and note such changes in the As Built Records. Application restrictions to be observed in the event of adverse weather shall be as specified below together with any additional limitations set out in Appendix 7/21.
- (i) When there is precipitation or if heavy precipitation is forecast.
 - (ii) When there is free water on the surface.
 - (iii) When the spraying, road and air temperatures are at or below the values given in Table 2.7.
 - (iv) Within the limits of wind speed stated in Figure 2.1.

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TABLE 2.7: Working Temperatures for Binder

Binder / Element	Cationic 70% Emulsion (°C)	Polymer Modified Bitumen (°C)	Maximum (°C)
Spraying	80	Manufacturer's recommendation	85
Road	8	Manufacturer's recommendation	35 (≥ 200 cv/lane/day) 40 (≤ 200 cv/lane/day)
Air	6	Manufacturer's recommendation	

FIGURE 2.1: Limiting wind speed conditions for laying surface dressing



- 12 During application, the chipping spreader shall not fall more than 30 metres behind the binder sprayer.
- 13 Transverse joints shall be formed with spraying starting and finishing on a protective strip not less than 1 metre wide at each end of the lane length being treated. Transverse joints shall be of binder overlap only and not wider than 100 mm. There shall be no ridges or bare strips. Longitudinal joints shall coincide with centre of lane markings. Longitudinal joints shall be of binder overlap only and, while ensuring that the proposed rate of spread is achieved across the joint, shall not be wider than 150 mm. There shall be no ridges or bare strips.
- 14 The overlap areas of binder for both transverse and longitudinal joints shall not be chipped during the Surface Dressing of the first strip. In multiple Surface Dressings, joints shall be staggered to provide a uniform finish. At intermediate stops in the gritting process, the chippings spreader shall stop 150mm to 300mm short of the sprayed area. At ends of sections, chippings shall be applied right up to the end of the strip of sprayed binder.
- 15 Rolling shall be performed by pneumatic tyred rollers as specified in Clause 903. Rubber coated vibratory steel rollers may be used where road profile and chipping quality allow. The rollers shall

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have fully operating sprinkler systems, spraying water or other release agent onto the drum or tyres, so that if the chippings start to move under the roller exposing binder the sprinklers are available immediately. Each layer of chippings shall receive a minimum number of four passes.

Testing

- 16** To ensure Quality Control of the specified components during the Works, the Contractor shall obtain samples and carry out tests to confirm the binder and chipping properties required within Clause 919 and Appendix 7/21, at the frequency specified in Appendix 1/6.

Sampling of binder shall be carried out in accordance with IS EN 58. Each sample shall consist of 5 litres of binder and a minimum of two samples shall be taken.

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

- 17** To ensure Quality Control of equipment during the Works, the Contractor shall carry out the tests for rates of spread and accuracy of application of binder and chippings in accordance with the test methods in IS EN 12272-1 at the frequency specified in Appendix 1/5.
- 18** Test results shall be reported verbally to the Employer's Representative within 24 hours of carrying out testing and confirm in writing within seven days. The Contractor shall supply and deliver samples of material to the Employer's Representative in accordance with Appendix 1/6.

Aftercare

- 19** Masking shall be removed after the Surface Dressing has been applied and before opening the road to restricted traffic.
- 20** In accordance with Chapter 8 - Temporary Traffic Measures and Signs for Road Works and the "*Guidance for the Control and Management of Traffic at Road Works*", aftercare signage and traffic control shall be installed to regulate traffic behaviour after the road is opened.
- 21** The Contractor shall monitor the Surface Dressing closely for a minimum period of 2 hours, or as specified in Appendix 7/21, after the road is opened to restricted traffic. The Contractor shall reinstate traffic safety and management procedures or institute other such remedial action where necessary, such as dusting, if there are signs of distress, such as turning of the chippings, in order to prevent further damage to the Surface Dressing.
- 22** The time period before unrestricted traffic may use the Surface Dressing shall not exceed that specified in Appendix 7/21. All aftercare signage shall be removed once unrestricted traffic is permitted to use the Surface Dressing. The Contractor shall remove surplus chippings from the road by suction sweeping before it is opened to unrestricted traffic. This operation shall not dislodge chippings or disturb the chipping mosaic.
- 23** Further operations to remove subsequently loosened chippings shall be carried out over the next 48 hours. This shall not dislodge chippings or disturb the chipping mosaic. The road, and adjacent side roads, footways and paved areas shall be kept substantially free of loose chippings for a period of 30 days after completion of the work.
- 24** Road markings, in accordance with the Contract, should not be installed or renewed until there are no further loose chippings on the Surface Dressing and the chipping mosaic has developed and closed to its final condition.

As Built Records

- 25** Not more than 30 days after completion of the work the Contractor shall provide a record of the progress of the work in accordance with NRA GD101. Such records shall incorporate all relevant information, including:
- (i) Design requirements;
 - (ii) Site location;
 - (iii) Road assessment;
 - (iv) Variations to the design and those necessitated by localised site conditions;
 - (v) Test results;
 - (vi) Plant details;
 - (vii) Traffic control carried out;
 - (viii) Weather information;
 - (ix) Site photographs taken at each stage of the works;
 - (x) Unforeseen problems;
 - (xi) A list of complaints, if any, from the general public or road users; and
 - (xii) Any other information that the Employer's Representative may reasonably require to have included.

Defects

- 26** Any defects identified arising from deficiencies in the materials, workmanship and aftercare manifest during or at the end of the defects period shall be rectified by the Contractor at his own expense.

The extent such defects will be monitored by the Employer's Representative using a visual method of assessment. If there is a failed section, the Contractor will be invited to inspect the site in order to agree remedial measures.

In the event that the Contractor and Employer's Representative are unable to reach agreement on whether a section has failed by qualitative visual assessment described in IS EN 12272-2, the level of defects shall be determined in accordance with the quantitative test methods in IS EN 12272-2.

3. CLAUSE 920 – BOND COATS, TACK COATS AND OTHER BITUMINOUS SPRAYS

- 1** Bond coat shall be sprayed grade polymer modified bitumen emulsion complying with BS 594987 Clause 5.5, Appendix 7/4 and Tables 3.1, 3.2 and 3.3. Bond coat shall be the preferred material for use. Where tack coat incorporating a cationic bitumen emulsion is proposed for use it shall have prior written approval from the Employer’s Representative.
- 2** The rate of spread for bond coats shall be 0.35 kg/m² of residual binder. The rate of spread for tack coats shall be 0.2 kg/m² of residual bitumen.
- 3** A bond coat shall be sprayed onto the surface prior to overlay in accordance with sub-Clauses 920.4 and 920.5. Bond coats for Asphalt Concrete and Hot Rolled Asphalt shall be in accordance with BS 594987 and sub-Clause 920.4. Application shall be by spray tanker. For small areas application may be by hand held sprayer with the agreement of the Employer’s Representative. The surface shall be prepared for the application of a bituminous spray and when undertaking spraying and any specified blinding works shall be done in accordance with the requirements as set out in Appendix 7/4. These works shall be undertaken in accordance with this Clause and any specified requirements as described in Appendix 7/4.

Table 3.1: Specification Framework for Cationic Bituminous Emulsions – Properties of the Emulsion

EN 13808, Table 1, EN Grade	Standard	Unit	C65B 3	C40B 4	C65BP 3
Nominal Grade			Cationic 65%	Cationic 40%	Bond Coat
Use			Tack Coat	Tack Coat	Bond Coat
Binder Content [Notes 2 and 3]	IS EN 1428	% by mass	63 to 67 (Class 7)	38 to 42 (Class 3)	63 to 67 (Class 7)
Residual Binder after distillation	IS EN 1431	% by mass	≥ 63 (Class 7)	≥ 38 (Class 3)	≥ 63 (Class 7)
Breaking Value (Forshammer filler)	EN 13075-1		< 110 & 70-155 (Class 2 & 3)	< 110 & 110-195 (Class 2 & 4)	< 110 & 110-195 (Class 2 & 4)
Residue on Sieving, 500um	IS EN 1429	% by mass	NR (Class 0)	NR (Class 0)	NR (Class 0)
Redwood #2 Viscosity @ 85°C	IS EN 16345	Seconds	NR (Class 0)	NR (Class 0)	NR (Class 0)

**NRA INTERIM ADVICE NOTE SPECIFICATION FOR MICROSURFACING,
SURFACE DRESSING AND BOND COAT**

Table 3.2: Specification Framework for Cationic Bituminous Emulsions – Properties of Residual, Recovered, Stabilised and Aged Binders

EN 13808, Table 1, EN Grade	C65B 3	C40B 4	C65BP 3
Nominal Grade	Cationic 65%	Cationic 40%	Bond Coat
Use	Tack Coat	Tack Coat	Bond Coat
	Residual Binder by Distillation	NR	NR

Table 3.3: Specification Framework for the Technical Requirements and Performance Classes for Residual, Recovered, Stabilised and Aged Binders from Cationic Bituminous Emulsions

EN 13808, Table 1, EN Grade	Standard	Unit	C65B 3	C40B 4	C65BP 3
Nominal Grade			Cationic 65%	Cationic 40%	Bond Coat
Use			Tack Coat	Tack Coat	Bond Coat
Penetration @ 25°C	IS EN 1426	0.1mm	< 270 (Class 6)		
Softening Point °C	IS EN 1427	°C	DV (Class 1)		
Cohesion by Pendulum Test	IS EN 13588	J/cm ²			

Notes

[1] Performance classes in accordance with IS EN 13808 Tables 2, 3 and 4

[2] Tests must be carried out within 10 days of sampling.

[3] Binder contents carried out in accordance with IS EN 1428 exceeding the upper limit are permitted once the viscosity requirement is met.

[4] The binder content when determined by IS EN 1428 shall be defined as, 100 - (minus) Water Content.

[5] DV: Declared Value

[6] NR: Not Required

- 4 Binder distributors shall have controlled metering and be capable of variable application. Before a distributor is used in the works, the Contractor shall demonstrate, to the satisfaction of the Employer's Representative, the distributor conforms to this Clause 920 through operation within a trial area designated by the Employer's Representative.
- 5 Before spraying is commenced, the surface shall be free of all loose material, the surface as a whole shall be dry and any damp areas shall be completely free of standing water.

**NRA INTERIM ADVICE NOTE SPECIFICATION FOR MICROSURFACING,
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- 6** Blinding material, where required by the Contract, shall consist of a hard clean crushed rock, fine aggregate or sand. Blinding material shall not contain more than 15 per cent retained on a 6,3 mm sieve. It shall be applied to the binder and left unrolled. The rate of application shall be 5,5-7,0kg/m².
- 7** All loose material on the sprayed surface, including any blinding material, shall be removed before any further layer of the pavement is laid.

4. CLAUSE 922 – SURFACE DRESSING: DESIGN, APPLICATION AND END PRODUCT PERFORMANCE

- 1** The Contractor shall be responsible for the design of the Surface Dressing, choice of materials, techniques and processes based on site and traffic data specified in Appendix 7/3 and subject to the schedule of constraints on site availability in Appendix 1/13.
- 2** The Contractor shall:
 - (i) Provide a Design Proposal to achieve the performance requirements in terms of macrotexture and maximum levels of defects as set out in this Clause and in Appendix 7/3 ensuring that the Surface Dressing has an initial stability such that it is capable of withstanding the normal traffic for the site when first opened.
 - (ii) State the Estimated Design Life of the Surface Dressing in the Design Proposal.
 - (iii) Use materials which are produced in plants that are independently accredited to IS EN 9001 or an equivalent quality management system.
 - (iv) Use a product conforming to a harmonised European Standard and which is CE marked.
 - (v) As part of the Works Proposals, provide the Employer's Representative with a written statement detailing the proposed method of executing the work, which may also be subject to the approval of the National Roads Authority.
 - (vi) Carry out the Surface Dressing in accordance with IS EN 12271 and the Design Proposal to the tolerances specified in Appendix 7/3.
- 3** The Contractor shall guarantee the design, materials and workmanship against defects and against failure to meet the end product performance requirements for a period of two years, or as otherwise specified in Appendix 7/3, from the date of completion of the work. In accordance with sub-Clauses 922.23 and 922.24, the Employer's Representative will monitor the performance levels of the Surface Dressing during the guarantee period and bring any defects to the attention of the Contractor.

The System

- 4** The proposed Surface Dressing shall have been subject to a Type Approval Installation Trial (TAIT) in accordance with IS EN 12271, which shall be self-certified within the quality management scheme described in Appendix A. The TAIT shall have been carried out on a site with similar characteristics and traffic category to that to be treated in the Contract. The Contractor shall provide, with his Design Proposal, a Data Sheet giving details of the properties of each system proposed, including the data specified in this Clause and in Appendix 7/3.

Binder

- 5** The binder application shall be uniform and shall be of sufficient width to allow a full lane to be dressed in a single pass.

Chippings

- 6** Unless otherwise specified in Appendix 7/3, the chippings shall conform to the default declared Polished Stone Value (PSV) requirements of Table 4.1. PSV requirements for the chippings shall also conform to sub-Clauses 901.8 and 901.9.

**NRA INTERIM ADVICE NOTE SPECIFICATION FOR MICROSURFACING,
SURFACE DRESSING AND BOND COAT**

Table 4.1: Polished Stone Value Requirements

Site Description	Polished Stone Value (PSV)
National Roads	PSV ₆₀ declared

Preparation

- 7 Any necessary remedial works to the road surface and structure, verges and road drainage shall be completed either prior to commencement of the works, or as part of the Contract and agreed as acceptable by the Employer's Representative and the Contractor before Surface Dressing commences.
- 8 Before binder is applied, street furniture shall be masked using self-adhesive masking material. Oil, sand or similar materials shall not be used. Any packed mud or other deposits on the road surface shall be removed and the road surface shall be swept free of all loose material.
- 9 Traffic Safety and Management for National Roads including motorways shall be in accordance with Chapter 8 - Temporary Traffic Measures and Signs for Road Works and the "*Guidance for the Control and Management of Traffic at Road Works*" and any site specific additional requirements specified in Appendix 1/13.

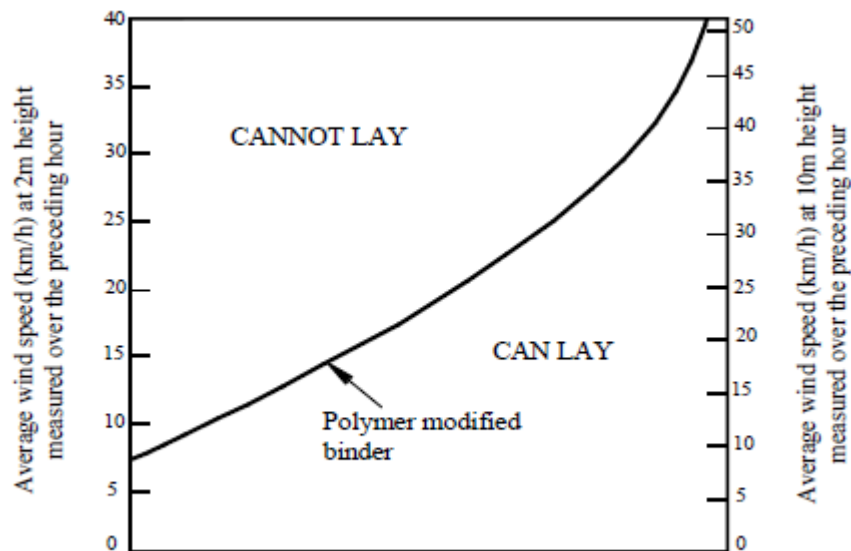
Application

- 10 Application restrictions to be observed in the event of adverse weather shall be as specified below together with any additional limitations set out in Appendix 7/3.
 - (i) When there is precipitation or if heavy precipitation is forecast.
 - (ii) When there is free water on the surface.
 - (iii) When the spraying, road and air temperatures are at or below the values given in Table 4.2.
 - (iv) Within the limits of wind speed stated in Figure 4.1.

TABLE 4.2: Working Temperatures for Binder

Binder / Element	Cationic 70% Emulsion (°C)	Polymer Modified Bitumen (°C)	Maximum (°C)
Spraying	80	Manufacturer's recommendation	85
Road	8	Manufacturer's recommendation	35 (≥200 cv/lane/day) 40 (≤ 200 cv/lane/day)
Air	6	Manufacturer's recommendation	

FIGURE 4.1: Limiting wind speed conditions for laying surface dressing



- 11 During application, the chipping spreader shall not fall more than 30 metres behind the binder sprayer.
- 12 Transverse joints shall be formed with spraying starting and finishing on a protective strip not less than 1 metre wide at each end of the lane length being treated. Transverse joints shall be of binder overlap only and not wider than 100 mm. There shall be no ridges or bare strips. Longitudinal joints shall coincide with centre of lane markings. Longitudinal joints shall be of binder overlap only and, while ensuring that the proposed rate of spread is achieved across the joint, shall not be wider than 150 mm. There shall be no ridges or bare strips.
- 13 The overlap areas of binder for both transverse and longitudinal joints shall not be chipped during the Surface Dressing of the first strip. In multiple Surface Dressings joints shall be staggered to provide a uniform finish. At intermediate stops in the gritting process, the chip spreader shall stop 150mm to 300mm short of the sprayed area. At ends of sections, chippings shall be applied right up to the end of the strip of sprayed binder.
- 14 Rolling shall be performed by pneumatic tyred rollers as specified in Clause 903. Rubber coated vibratory steel rollers may be used where road profile and chipping quality allow. The rollers shall have fully operating sprinkler systems, spraying water or other release agent onto the drum or tyres, so that if the chippings start to move under the roller exposing binder the sprinklers are available immediately.

Testing

- 15 Test results shall be reported verbally to the Employer's Representative within 24 hours of carrying out the test and confirm in writing within seven days. The Contractor shall supply and deliver samples of material to the Employer's Representative in accordance with Appendix 1/6.

Aftercare

- 16** Masking shall be removed after the Surface Dressing has been applied and before opening the road to restricted traffic.
- 17** In accordance with Chapter 8 - Temporary Traffic Measures and Signs for Road Works and the “*Guidance for the Control and Management of Traffic at Road Works*”, aftercare signage and traffic control shall be installed to regulate traffic behaviour after the road is opened.
- 18** The time period before unrestricted traffic may use the Surface Dressing shall not exceed that specified in Appendix 7/3. All aftercare signage shall be removed once unrestricted traffic is permitted to use the Surface Dressing. The Contractor shall remove surplus chippings from the road by suction sweeping before it is opened to unrestricted traffic. This operation shall not dislodge chippings or disturb the chipping mosaic.
- 19** The Contractor shall monitor the Surface Dressing closely for a minimum period of 2 hours, or as specified in Appendix 7/3, after the road is opened to traffic. The Contractor shall reinstate traffic safety and management procedures or institute other such remedial action where necessary, such as dusting, if there are signs of distress, such as turning of the chippings, in order to prevent further damage to the Surface Dressing.
- 20** Further operations to remove subsequently loosened chippings shall be carried out over the next 48 hours. This shall not dislodge chippings or disturb the chipping mosaic. The road, and adjacent side roads, footways and paved areas shall be kept substantially free of loose chippings for a period of 30 days after completion of the work.

As Built Records

- 21** Not more than 30 days after completion of the work the Contractor shall provide a record of the progress of the work in accordance with NRA GD101. Such records shall incorporate all relevant information, including:
 - (i) Design proposal;
 - (ii) Type Approval Installation Trial;
 - (iii) Site location;
 - (iv) Road assessment;
 - (v) Variations to the design and those necessitated by localised site conditions;
 - (vi) Test results;
 - (vii) Plant details;
 - (viii) Traffic control carried out;
 - (ix) Weather information;
 - (x) Site photographs taken at each stage of the works;
 - (xi) Unforeseen problems;
 - (xii) A list of complaints, if any, from the general public or road users; and
 - (xiii) Any other information that the Employer’s Representative may reasonably require to have included.

Performance Standards during the Guarantee Period

Surface Macrotexture

- 22** The Contractor is responsible for maintaining the surface macrotexture requirements set out in Appendix 7/3 throughout the guarantee period. The Employer's Representative will monitor the surface macrotexture.

The definitive test is the volumetric patch technique measured in accordance with IS EN 13036-1 except that 10 individual measurements shall be made on the nearside (inside) wheel-track of the most heavily trafficked lane or for low traffic category sites the track carrying the most stress. The average macrotexture depth of each lane kilometre, or the complete carriageway lane where this is less than 1,000 metres, shall be as specified in Appendix 7/3. The average of each set of 10 individual measurements shall be not less than 80% of the minimum permitted.

The Employer's Representative reserves the right to use data gathered from annual NRA pavement condition surveys to monitor the performance of surface macrotexture.

Defects

- 23** The extent of chipping loss or other defects will be monitored by the Employer's Representative using a visual method of assessment. The performance standard is that any section of the Works shall be deemed as having failed if the areas of defects do not comply with the classes specified in Appendix 7/3. If there is a failed section, the Contractor will be invited to inspect the site in order to agree remedial measures.

In the event that the Contractor and Employer's Representative are unable to reach agreement on whether a section has failed by qualitative visual assessment described in IS EN 12272-2, the level of defects shall be determined in accordance with the quantitative test methods in IS EN 12272-2. Any section failing to meet the required standard as specified in Appendix 7/3 shall be subject to remedial action by the Contractor after agreement of the Employer's Representative.

5. REFERENCES

5.1 National Roads Authority Publications:

NRA Design Manual for Roads and Bridges (NRA DMRB), generally and specifically:

- NRA DMRB Volume 0 Section 3 Part 2, GD 101 – Preparation and Delivery Requirements for As-Built Records
- NRA DMRB Volume 7 Section 5 Part 1, HD 36 – Surfacing Materials for New and Maintenance Construction
- NRA DMRB Volume 7 Section 5 Part 2, HD 37 – Bituminous Surfacing Materials and Techniques

5.2 National Standards Authority of Ireland Publications:

National Standards Authority of Ireland (2004). Guidance on the use of IS EN 13043 – Aggregates for Bituminous Mixtures and Surface Treatments for Roads, Airfields and Other Trafficked Areas. S.R. 17: 2004. Dublin: National Standards Authority of Ireland.

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National Standards Authority of Ireland (1997). Tests for general properties of aggregates – Part 1 : Methods for sampling. IS EN 932-1: 1997. Dublin: National Standards Authority of Ireland.

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National Standards Authority of Ireland (2002). Surface Dressing – Test Methods – Part 1: Rate of Spread and Accuracy of Spread of Binder and Chippings. IS EN 12272-1: 2002. Dublin: National Standards Authority of Ireland.

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National Standards Authority of Ireland (2002). Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas. IS EN 13043: 2002. Dublin: National Standards Authority of Ireland.

Bitumen and Bituminous Binders – Determination of Breaking Behaviour – Part 1: Determination of Breaking Value of Cationic Bituminous Emulsions, Mineral Filler Method. EN 13075-1

National Standards Authority of Ireland (2008). Bitumen and Bituminous Binders – Determination of Cohesion of Bituminous Binders with Pendulum Test. IS EN 13588: 2008. Dublin: National Standards Authority of Ireland.

National Standards Authority of Ireland (2013). Bitumen and Bituminous Binders – Framework for Specifying Cationic Bituminous Emulsions. IS EN 13808: 2013. Dublin: National Standards Authority of Ireland.

National Standards Authority of Ireland (2012). Bitumen and Bituminous Binders – Determination of Efflux Time of Bituminous Emulsions using the Redwood No. 2 Viscometer. IS EN 16345: 2012. Dublin: National Standards Authority of Ireland.

5.3 British Standards Institute Publications:

British Standards Institution (1989). Specification for hot binder distributors for road surface dressing. BS 1707:1989. London: British Standards Institution.

British Standards Institution (2010). Asphalt for Roads and Other Paved Areas – Specification for transport, laying, compaction and type test protocols. BS 594987:2010. London: British Standards Institution.

British Standards Institution (2006). Code of practice for the use of cationic bitumen emulsions on roads and other paved areas. BS 434-2:2006. London: British Standards Institution.

5.4 Other Publications:

Department of Transport (2009). Traffic Signs Manual Chapter 8: Temporary Traffic Measures and Signs for Road Works.

Local Government Management Services Board (2010). Guidance for the Control and Management of Traffic at Road Works – Second Edition

6. ENQUIRIES

- 6.1 All technical enquiries or comments on this document, or any of the documents listed as forming part of the NRA DMRB, should be sent by e-mail to infoDMRB@nra.ie, addressed to the following:

Head of Network Management, Engineering Standards & Research
National Roads Authority
St Martin's House
Waterloo Road
Dublin 4



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Pat Maher
Head of Network Management,
Engineering Standards & Research