

NRA Pavement Standards Training


Debate and Interaction

Audience Debate on requirements of the
Materials

Panel to ask questions on CE marking, DoP,
Type Testing, etc.

Debate and Interaction

CE Mark

 0050																	
Any Co Ltd, X Street, Dublin, Ireland 15 001-CPR-2015/01/01																	
EN 13108-1:2006 Asphalt Concrete AC 20 dense bin 70/100 — 0001 binder courses																	
Void content:	max. 7,0 % min. 4,0 %																
Water sensitivity	min. 70																
Maximum Temperature of the mixture	180 °C																
Minimum Temperature of the mixture	140 °C																
Grading target composition																	
<table border="1"><thead><tr><th>Sieve size mm</th><th>Passing %</th></tr></thead><tbody><tr><td>31,5</td><td>100</td></tr><tr><td>20</td><td>99</td></tr><tr><td>10</td><td>62</td></tr><tr><td>6,3</td><td>47</td></tr><tr><td>2</td><td>30</td></tr><tr><td>0,250</td><td>13</td></tr><tr><td>0,063</td><td>5,5</td></tr></tbody></table>	Sieve size mm	Passing %	31,5	100	20	99	10	62	6,3	47	2	30	0,250	13	0,063	5,5	
Sieve size mm	Passing %																
31,5	100																
20	99																
10	62																
6,3	47																
2	30																
0,250	13																
0,063	5,5																
Target Binder content	4,9 %																
Minimum stiffness	1 800 MPa																

Debate and Interaction

Declaration of Performance

DECLARATION OF PERFORMANCE
No. 001 CPR 2015-01-01

1. Unique identification code of the product-type:
Asphalt Concrete
AC 20 dense bin 70/100

2. Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11(4):
Asphalt Concrete
AC 20 dense bin 70/100 — 0001

3. Intended use or uses of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer:
For binder courses

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11(5):
Any Co Ltd,
X Street,
Dublin, Ireland
Tel. +353 1 234 5678
Fax: +353 1 234 5679
E-mail: anyco@provider.ie

5. Where applicable, name and contact address of the authorised representative whose mandate covers the tasks specified in Article 12(2):
N / A

6. System of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V:
System 2+

7. In case of the declaration of performance concerning a construction product covered by a harmonised standard:
National Standards Authority of Ireland
Notified body No. 0050

Performed:
the initial inspection of the manufacturing plant and evaluation of factory production control and the continuous surveillance, assessment and evaluation of factory production control under system:
2+

and issued:
the certificate of conformity of the factory production control

8. Declared performance.

Essential characteristics	Performance	Harmonised technical specification																		
1. Adhesion of binder to aggregate 2. Stiffness 3. Resistance to permanent deformation 4. Resistance to fatigue 5. Skid resistance 6. Resistance to abrasion 7. Reaction to fire 8. Dangerous substances 9. Durability		EN 13108-1:2006																		
2, 3, 4, 5, 6, 9	<table border="1"> <thead> <tr> <th colspan="2">Target grading passing sieve</th> </tr> <tr> <th>Sieve mm</th> <th>Passing %</th> </tr> </thead> <tbody> <tr> <td>31,5</td> <td>100</td> </tr> <tr> <td>20</td> <td>99</td> </tr> <tr> <td>10</td> <td>62</td> </tr> <tr> <td>6,3</td> <td>47</td> </tr> <tr> <td>2</td> <td>30</td> </tr> <tr> <td>0,250</td> <td>13</td> </tr> <tr> <td>0,063</td> <td>5,5</td> </tr> </tbody> </table>	Target grading passing sieve		Sieve mm	Passing %	31,5	100	20	99	10	62	6,3	47	2	30	0,250	13	0,063	5,5	EN 12697-2
Target grading passing sieve																				
Sieve mm	Passing %																			
31,5	100																			
20	99																			
10	62																			
6,3	47																			
2	30																			
0,250	13																			
0,063	5,5																			
1, 2, 3, 4, 5, 6, 9	Target binder content 4,9%	EN 12697-1																		
1, 2, 4, 5, 9	Minimum and maximum void content $V_{\min} 4,0; V_{\max} 7,0$	EN 12697-8; EN 12697-6 procedure B SSD; EN 12697-5 procedure A in water																		
1, 9	Water sensitivity $IITSR_{70}$	EN 12697-12 Method A																		
1, 2, 3, 4, 9	Maximum Temperature 180 °C Minimum temperature 140 °C																			
2, 9	Minimum Stiffness $S_{\min} 1800$	EN 12697-26 Annex B																		

9. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by:

.....
(Name and function)

.....
(Place and date of issue) (Signature)

Figure NG 0/1 – Example DoP

Debate and Interaction

Assessment and Verification of Constancy of Performance

For Series 900 products, two types of AVCP

- 2+ - The manufacturer and the notified body have responsibilities.
 - All bituminous mixtures
 - All bituminous binders
 - Aggregates with a declared PSV of 50+
 - Microsurfacing
 - Surface dressing
 - Geotextiles
- 4 - The manufacturer has sole responsibility.
 - Aggregates with a declared PSV of less than 50
 - All other constituents

Deft Type

Type Testing Report number: TP100

in accordance with EN 13108-20:2006

Mix Type: EN 13108- 1 AC Design mix
Production Plant Name: Any Co Ltd Plant
Product code/ Material name: AC 20 dense bin 70/100
Mix Validation Method: Production Validation EN 13108-20 Clause 6.5 3b

Declared Conformity Categories reference EN 13108-20, Annex B, Table B.1

Parameter	Annex C	Value	Category	Remarks/ Supporting documents
Grading	n/a	see Mix Formulation	-	-
Binder Content	n/a	see Mix Formulation	-	-

Mix Constituents

Name	Source	Type	Remarks / Supporting documents
Aggregate 1	Belgard	Limestone	LA, Soundness, Water Absorption and Density, Fines Content test certificates attached
Aggregate 2	Belgard	Limestone	
Aggregate 3	Belgard	Limestone	
Binder 70/100	Irish Tar and Bitumen Suppliers	EN 12591 PG Bitumen	Penetration and Softening Point test certificates attached
Permissible range of properties ref.	EN 13108-1 AC		
Control methods reference	EN13108		

Mix Formulation

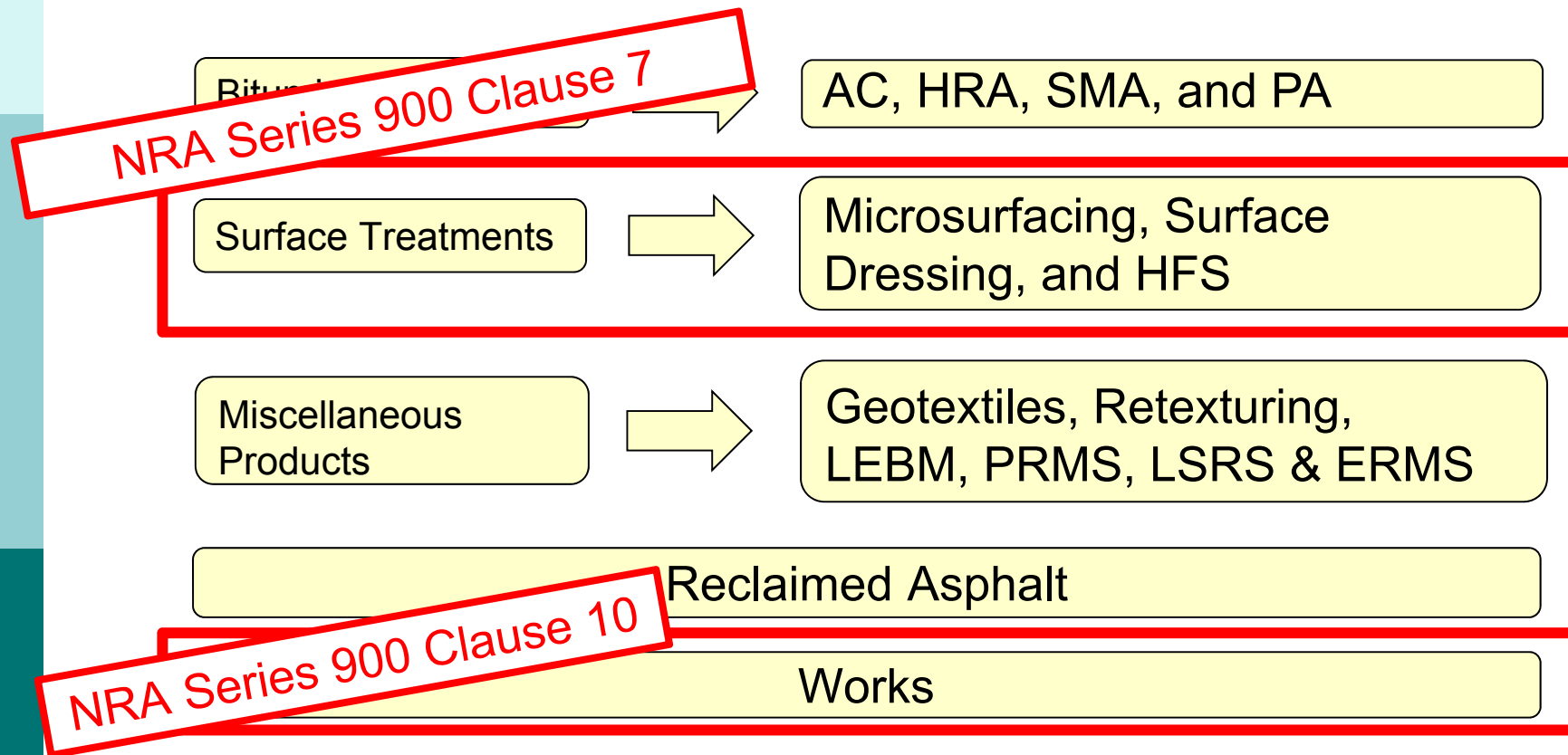
Reference for Targets	EN 13108			
Reference for Tolerance	BS EN 13108-21:2006 Table A.1 Large Aggregate Mix			
Sieve	Designation	Target %	Tolerances	Spec. limits
31.5 mm	1.4 D sieve	100	-2 +0	98 - 100
20 mm	D Sieve	99	-9 +5	90 - 100
10 mm	D/2 or char coarse sieve	62	-9 +9	53 - 71
6.3 mm	1st Optional coarse sieve	47	-9 +9	38 - 56
2 mm	2mm sieve	30	-7 +7	23 - 37
0.250 mm	Characteristic fine sieve	13	-5 +5	8 - 18
0.063 mm	0.063mm sieve	5.5	-3.0 +3.0	2.5 - 8.5
Binder	Binder	4.9	-0.6 +0.6	4.3 - 5.5
Binder Category EN 13108-1 AC	B _{min} 4.8			
Minimum void content	V _{min} 4,3	EN 12697-8; EN 12697-6 procedure B SSD; EN 12697-5 procedure A in water		
Maximum void content	V _{max} 6,7	EN 12697-8; EN 12697-6 procedure B SSD; EN 12697-5 procedure A in water		
Water sensitivity	76%	EN 12697-12 Method A		
Maximum Temperature	176°C			
Minimum Temperature	142°C			
Stiffness	1830 Mpa	EN 12697-26 Annex B		
Additional Information	None			
Declaration of Performance Ref	-			

NRA Pavement Standards Training

Surface Treatments – Requirements for Constituent
Materials and Product Composition

Surface Treatments

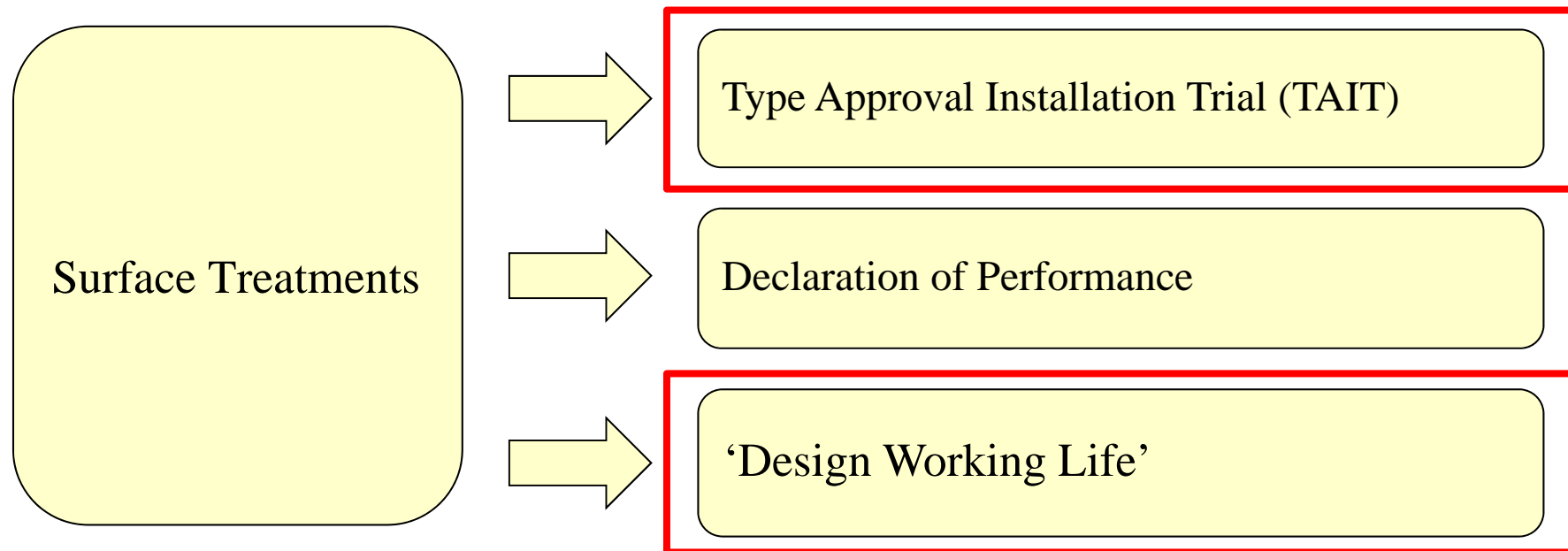
Introduction



Surface Treatments

Key Changes

NRA Series 900 requirements contain:



Surface Treatments

Key Changes

Type Approval Installation Trial (TAIT):

- A defined section where the product has been installed using Factory Production Control (FPC)
 - Demonstrates the characteristics of the product complies with the declared characteristics.
 - Subjected to an in service performance assessment after a period of one year.
 - Provides parameters that limit the application of the product (families).
- Requirements per harmonised standards.
 - Microsurfacing
 - Surface Dressing
- Provisional TAIT (prTAIT) for products that do not have a harmonised standard → NRA HD 301
 - High Friction Surfacing

Surface Treatments

Key Changes

Design Working Life:

- The period for which a product/system is to be used for its intended purpose without repair being necessary.
 - Typically required to be five years
- Defects are measured and site is assessed annually for:
 - Surface defects by visual assessment
 - Macrotexture
- Producer/Contractor responsible to carry out assessment and maintain the performance requirements. Purchaser monitors.

Surface Treatments

Microsurfacing Requirements

Microsurfacing is a slurry surfacing with larger aggregate sizes

7.1.1.1 Binder

Binder shall be polymer modified cationic bituminous emulsion.

7.1.1.2 Aggregate

Specified in Appendix 7/10 → Per NRA HD 36



Surface Treatments

Microsurfacing Requirements

7.1.2.1 Product Types

Two layer system or one layer system with a machine integrated bond coat application.

7.1.3.1 Defects determined by visual inspection

Defects include:

- Bleeding, fattening up and tracking
- Delamination
- Corrugation, bumps and ridges
- Groups of small defects or repetitive defects

7.1.3.3 Surface Shear Strength

The performance of the product's bond to the substrate is to be evaluated and recorded. (surface shear strength test : prCEN/TS 12697-51).

Surface Treatments

Surface Dressing Requirements (RSD)

7.2.1 General

Recipe Surface Dressing (RSD) designed by the Employer [NRA HD 300; Clause 7.2.2 and Appendix 7/21]

7.2.2.1.1 Binder

Binder shall be in accordance with Table 15 (minimum peak cohesion for PmB)

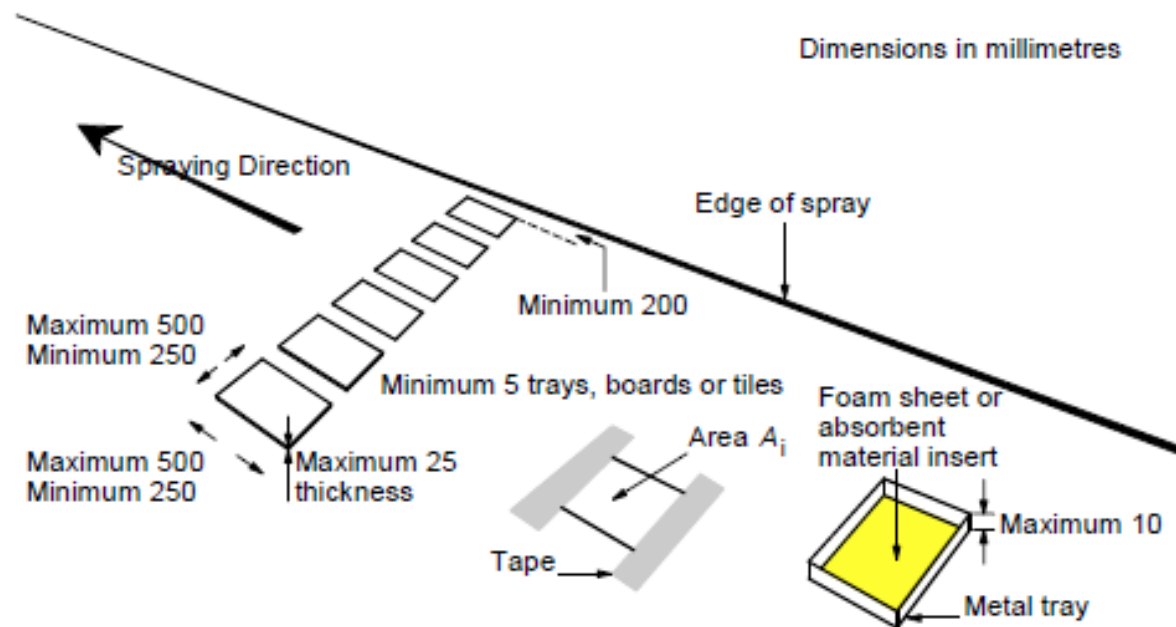
hEN reference			EN 13808					
Table column reference			1	2	3	4	5	6
Use			Bond Coat	Tack Coat	Surface Dressing	Surface Dressing	Surface Dressing	Surface Dressing
Grade			C65BP 3	C40B 4	C69B3	C69BP 3	C72BP 3	C72BP 3
Test	Test Method	Unit						
Properties of the Binder								
Sample for test			Bituminous Phase of the emulsion		Residual Binder by Distillation	Bituminous Phase of the emulsion	Bituminous Phase of the emulsion	Bituminous Phase of the emulsion
Penetration at 25°C	EN 1426	0,1mm			≤ 270 (Class 6)	≤ 270 (Class 6)	≤ 270 (Class 6)	≤ 270 (Class 6)
Softening point	EN 1427	°C			DV (Class 1)	DV (Class 1)	≥ 39 (Class 7)	≥ 39 (Class 7)
Cohesion (pendulum test)	EN 13588	J/cm ²	≥ 1,0		-	≥ 1,0	≥ 1,2	≥ 1,4

Surface Treatments

Surface Dressing Requirements

7.2.2.2 Composition Recipe Surface Dressing

- Employer design information including the product type shall be provided in Appendix 7/21
- Additional requirements (Clauses 10.2.3.1.3 and 10.2.3.1.4):
 - Accuracy of distribution of both binder and aggregates.
 - Tolerances on rates of spread of chippings



Surface Treatments

Surface Dressing Requirements (SDP)

7.2.1 General

Surface Dressing Product (End Performance) designed and installed by the Producer. [CE marked and comply with Clause 7.2.3 and Appendix 7/3]

7.2.3 Surface Dressing Product (End Performance)

- Requirements for constituents and composition
- Additional requirements for Works (Clause 10.2.3.2)
- Designer responsible for the intended use as set out in this Clause and contained in Appendix 7/3 for the 'Design Working Life'
- Producer responsible for:
 - CE Marking
 - Performance requirements - macrotexture and levels of defects
 - Initial stability - capable of withstanding the normal traffic for the site when first opened
 - TAIT documentation & evidence the period for which the performance characteristics have been retained

Surface Treatments

High Friction Surfacing Requirements

7.3.1.1 Binder

- Cold binders (principally thermosetting products):
 - Epoxy resin; Bitumen extended epoxy resin; Polyurethane; Polyurea; and Methyl methacrylate.
- Hot binders (thermoplastic products):
 - Rosin ester and Hydrocarbon resin.
- The binder shall comply with the requirements of Table 23a.

7.3.1.2 Aggregates

- Manufactured or natural from a single source and free from foreign matter.
- PSV and AAV requirements stated in Table 23b and Table 23c unless otherwise specified in Appendix 7/11.

Surface Treatments

High Friction Surfacing Requirements

7.3.3.1 Defects determined by visual inspection

- Fattening up
- Delamination
- Fretting
- Grinning

10.2.4.5 Laying

- In-situ bond to the substrate test at time of installation per pull-off test in accordance with ASTM 1583



Debate and Interaction

Audience Debate on requirements of the
Surface Treatment Materials

NRA Pavement Standards Training

End of Part 5

NRA Pavement Standards Training

Worked Example: High Friction Surfacing

From Perspective of:
Designer/Compiler, Producer, Contractor
and Employer's Representative

Pavement Standards Training

Worked Example 2 - High Friction Surfacing

Part 1 - Completing Appendix 7/11 as a
Designer/Compiler

Worked Example

Part 2 - Who's Responsible?

Who is responsible for defining the high friction surfacing requirements and completing Sheet 1 of the Appendix 7/11?

**High Friction Surface Requirements →
The Designer/Compiler**

Consult the DMRB

Conduct assessments as appropriate

Complete Contract Specific Documents

Appropriate for the **INTENDED USE** and **DURABLE** for its expected **LIFE**

Worked Example

High Friction Surfacing - Appendix 7/11

- 1 Location [*NRA HD 300 Clause 5.31 (i)*]
- 2 Traffic Volume. [*NRA HD 300 Clause 5.31 (ii) – cv/lane/day*]
- 3 Site Category and Investigatory Level. [*NRA HD 300 Clause 5.31 (iii)*]
- 4 Description of existing surface. [*NRA HD 300 Clause 5.31 (iv)*]
- 5 Pre-treatment. [*NRA HD 300 Clause 5.31 (v) – responsibility, type, design, process*]
- 6 Length of application if greater than 50m [*NRA HD 300 Clause 5.31 (vi)*]
- 7 Type of binder – if different from Series 900 [*Series 900 Clause 7.3.2.1 and NRA HD 300 Clause 5.31 (vii)*]
- 8 Minimum declared PSV of chippings – if different from Series 900 requirements. [*Series 900 Clause 7.3.2.2, and Table 23b, and NRA HD 300 Clause 5.31 (viii)*]
- 9 Maximum AAV of chippings – if different from Series 900 requirements. [*Series 900 Clause 7.3.2.2, Table 2 Table 23b, and NRA HD 300 Clause 5.31 (viii)*]
- 10 Design Working Life. [*Series 900 Clause 10.2.4.7, NRA HD 300 Clause 5.31 (ix) – normally 5 years*]
- 11 Macrotexture [*Series 900 Clause 7.3.3.2 and HD 300 Clause 5.31(x)*]
- 12 Level of fatting up (% area affected – P₁) acceptable [*Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)*]
- 13 Level of delamination (% area affected – P₂) acceptable [*Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)*]
- 14 Level of fretting (% area affected – P₃) acceptable [*Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)*]
- 15 Level of grinning (% area affected – P₄) acceptable [*Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)*]
- 16 Pull Off test frequency - after curing and at 1 year where applicable [*NRA HD 300 Clause 5.31(xii)*]

Worked Example

High Fric

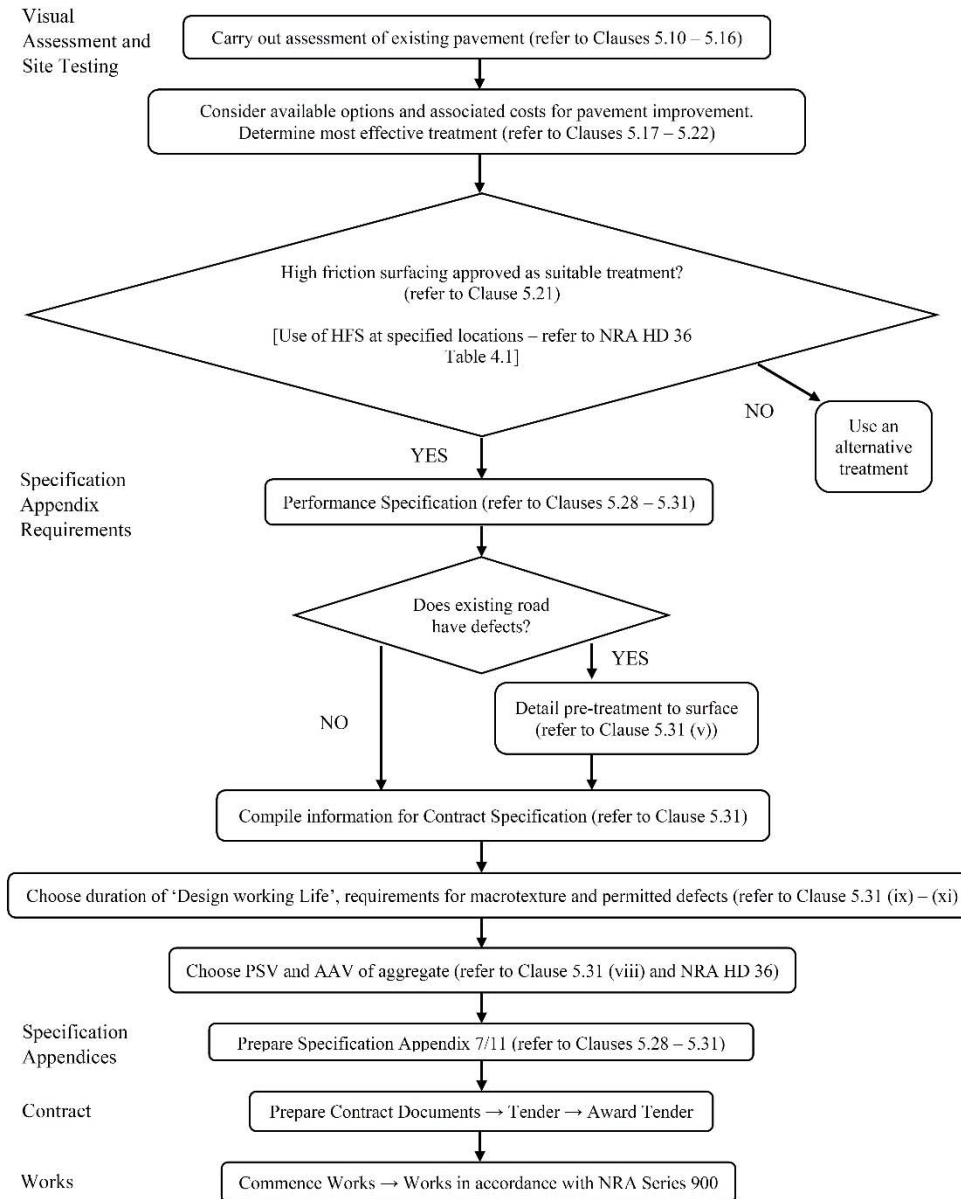


Figure 5.1 – Process Flowchart for High Friction Surfacing

Worked Example

High Friction Surfacing - Assessment

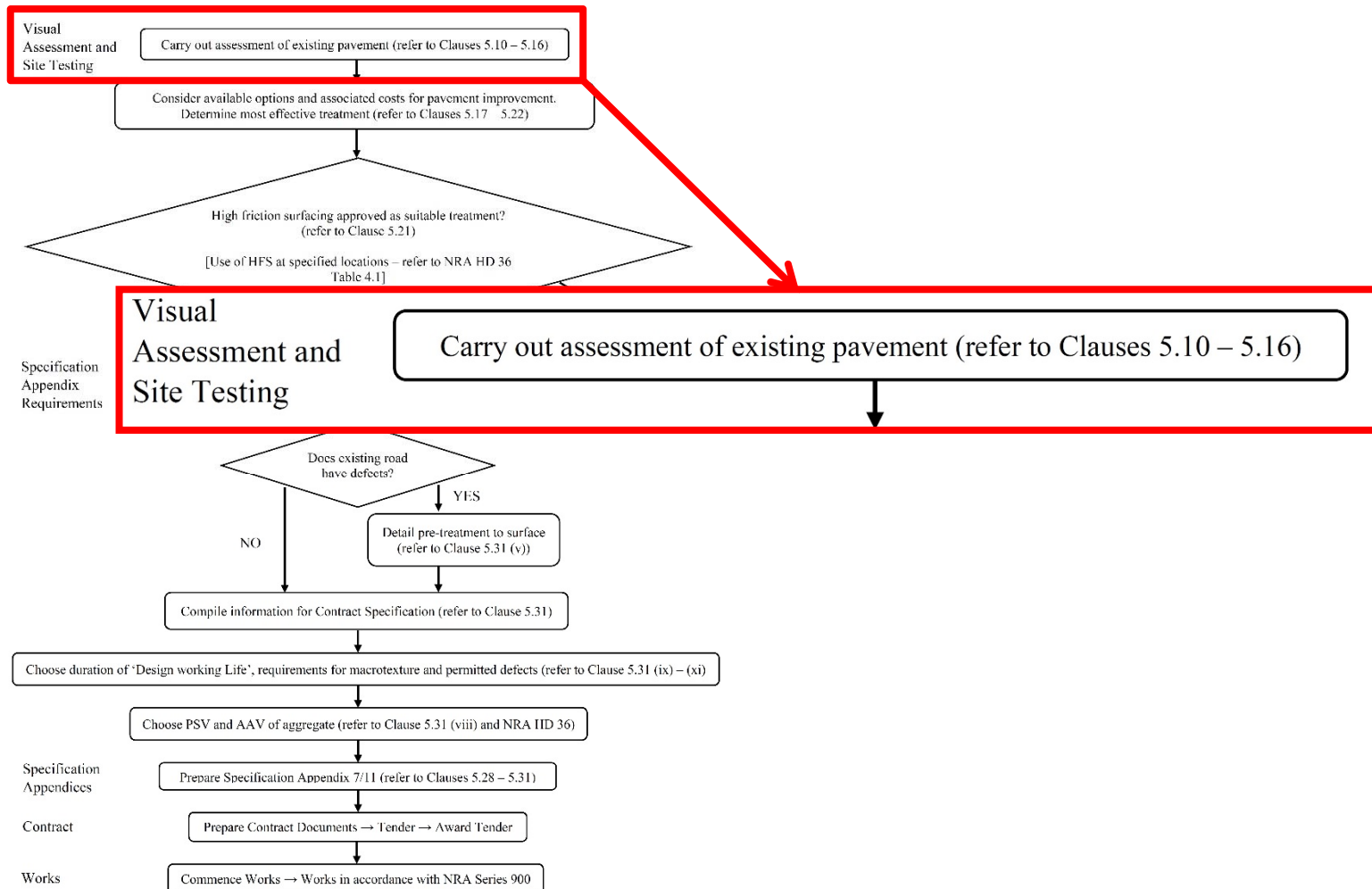


Figure 5.1 – Process Flowchart for High Friction Surfacing

Worked Example









High Friction Surfacing - Assessment

- An assessment of the existing pavement includes:
 - Traffic volume calculations
 - Determining the site category
 - Visual assessment
 - Macrotexture measurements

Worked Example

High Friction Surfacing - Assessment

Design Traffic → NRA HD 24

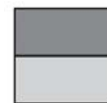
	Buses and Coaches	PSV
	2-axle rigid	OGV1
	3-axle rigid	
	3-axle articulated	OGV2
	4-axle rigid	
	4-axle articulated	
	5-axle articulated	
	6 (or more) -axle articulated	

Worked Example

High Friction Surfacing - Assessment

- Site category → NRA HD 28
 - Investigatory level → NRA HD 28

Site category and definition		Investigatory Level at 50km/h							
		0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65
A	Motorway								
B	Dual carriageway non-event								
C	Single carriageway non-event								
G1	Gradient 5-10% longer than 50m								
G2	Gradient >10% longer than 50m								
K	Approaches to traffic signals. pedestrian crossings								
Q	Approaches to and across major and minor junctions,								
R	Roundabout								
S1	Bend radius <250m – dual carriageway								
S2	Bend radius <250m – single carriageway								



Traffic > 250 commercial vehicles / lane/ per day
 Traffic < 250 commercial vehicles/lane/ per day

Worked Example

High Friction Surfacing - Assessment

Visual Assessment → NRA HD 300

When inspecting the road surface the extent of any of the following structural defects should be assessed:

- i) Cracking (may include alligator cracking, edge cracking and breakup).
- ii) Rutting/wheel tracking.
- iii) Heterogeneity/variability (may include pavement deformation, surface distortion).

When inspecting the road surface extent of any of the following surface defects should be assessed:

- i) Bleeding.
- ii) Fatting up.
- iii) Ravelling/fretting.
- iv) Patching (may include potholes).

The Purchaser will need to assess the level of any defects and decide if, and to what extent, pre-treatment is required. The responsibility of which party designs the pre-treatment is explained in Clause 3.36 (v) below.

The visual assessment should also note the condition of the existing road drainage. Refer to NRA HD 30 and NRA HD 31 for assistance on this issue.

Worked Example

High Friction Surfacing - Assessment

- Macrotexture → IS EN 13036-1 (Sand Patch Test)
 - Existing surface shall be between 0,5 mm to 2,0 mm unless verified by prTAIT



Worked Example

High Friction Surfacing - Appendix 7/11

- 1 Location [*NRA HD 300 Clause 5.31 (i)*] **R157 Dunboyne Bypass South, Ch 0+000 to Ch 0+070**
- 2 Traffic Volume. [*NRA HD 300 Clause 5.31 (ii) – cv/lane/day*] **2000 cvd**
- 3 Site Category and Investigatory Level. [*NRA HD 300 Clause 5.31 (iii)*] **G2, 0.50**
- 4 Description of existing surface. [*NRA HD 300 Clause 5.31 (iv)*] **General grit, macrotexture = 0.8 mm**
- 5 Pre-treatment. [*NRA HD 300 Clause 5.31 (v) – responsibility, type, design, process*]
- 6 Length of application if greater than 50m [*NRA HD 300 Clause 5.31 (vi)*]
- 7 Type of binder – if different from Series 900 [*Series 900 Clause 7.3.2.1 and NRA HD 300 Clause 5.31 (vii)*]
- 8 Minimum declared PSV of chippings – if different from Series 900 requirements. [*Series 900 Clause 7.3.2.2, Table 23a and Table 23b, and NRA HD 300 Clause 5.31 (viii)*]
- 9 Maximum AAV of chippings – if different from Series 900 requirements. [*Series 900 Clause 7.3.2.2, Table 23a and Table 23b, and NRA HD 300 Clause 5.31 (viii)*]
- 10 Design Working Life. [*Series 900 Clause 10.2.4.7, NRA HD 300 Clause 5.31 (ix) – normally 5 years*]
- 11 Macrotexture [*Series 900 Clause 7.3.3.2 and HD 300 Clause 5.31(x)*]
- 12 Level of fatting up (% area affected – P₁) acceptable [*Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)*]
- 13 Level of delamination (% area affected – P₂) acceptable [*Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)*]
- 14 Level of fretting (% area affected – P₃) acceptable [*Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)*]
- 15 Level of grinning (% area affected – P₄) acceptable [*Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)*]
- 16 Pull Off test frequency - after curing and at 1 year where applicable [*NRA HD 300 Clause 5.31(xii)*]

Worked Example

High Friction Surfacing - Next Step

What is the next step in the decision process?

- A. Evaluate alternatives and determine the most effective treatment type.
- B. Detail design of pre-treatment works based on proprietary HFS product.
- C. Specify aggregate requirements of high friction surfacing.

A. Evaluate alternatives and determine the most effective treatment type

Worked Example

High Friction Surfacing - Suitability

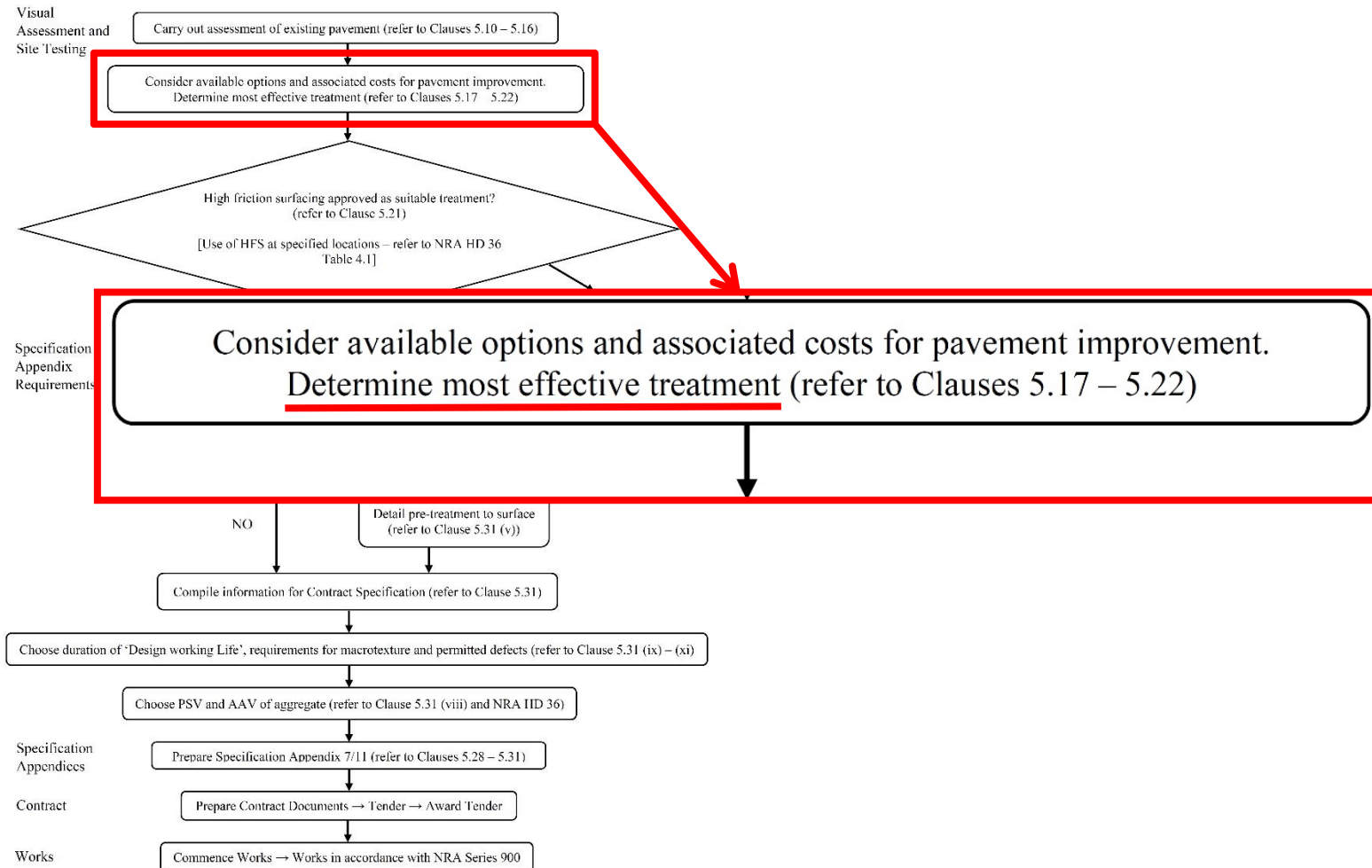


Figure 5.1 – Process Flowchart for High Friction Surfacing

Worked Example

High Friction Surfacing - Suitability

Site category and definition (see NRA HD 28)		IL	Minimum PSV required for given IL, traffic level and type of site						
			Traffic (Commercial Vehicles per Lane per Day) at opening						
			<250	251-500	501-750	751-1000	1001-2000	2001-3000	Over 3000
G1	Gradient 5-10% longer than 50m	0.40	55						
		0.45		60	60	65	65	68+	68+
		0.50		65	68+	68+	H / 70+	H / 70+	H / 70+
G2	Gradient >10% longer than 50m	0.40	55						
		0.45		60	60	65	65	68+	68+
		0.50		65	68+	68+	H / 70+	H / 70+	H / 70+
K	Approaches to traffic signals, pedestrian crossings	0.50	65						
		0.55		68+	H / 70+	H / 70+	H / 70+	H / 70+	H / 70+
Q	Approaches to and across major and minor junctions	0.40	60						
		0.45		60	65	65	68+	68+	68+
R	Roundabout	0.45	60						
		0.50		65	65	68+	68+	68+	68+
S1	Bend radius <250m – dual carriageway	0.45	60						
		0.50		65	68+	H / 70+	H / 70+	H / 70+	H / 70+
S2	Bend radius <250m – single carriageway	0.45	60						
		0.50		65	68+	H / 70+	H / 70+	H / 70+	H / 70+

Worked Example

High Friction Surfacing - Suitability

- Treatment options to assess in addition to high friction surfacing may include the following options:
 - Measures to reduce the risk and/or stresses
 - Minor roadway realignment
 - Improved signage, road markings or lighting
 - Pavement reconstruction and pavement overlay with high PSV aggregate.
 - Microsurfacing or surface dressing with a high PSV aggregate bonded with a binder capable of withstanding the braking forces
- Determine the most effective option

Worked Example

High Friction Surfacing - Suitability

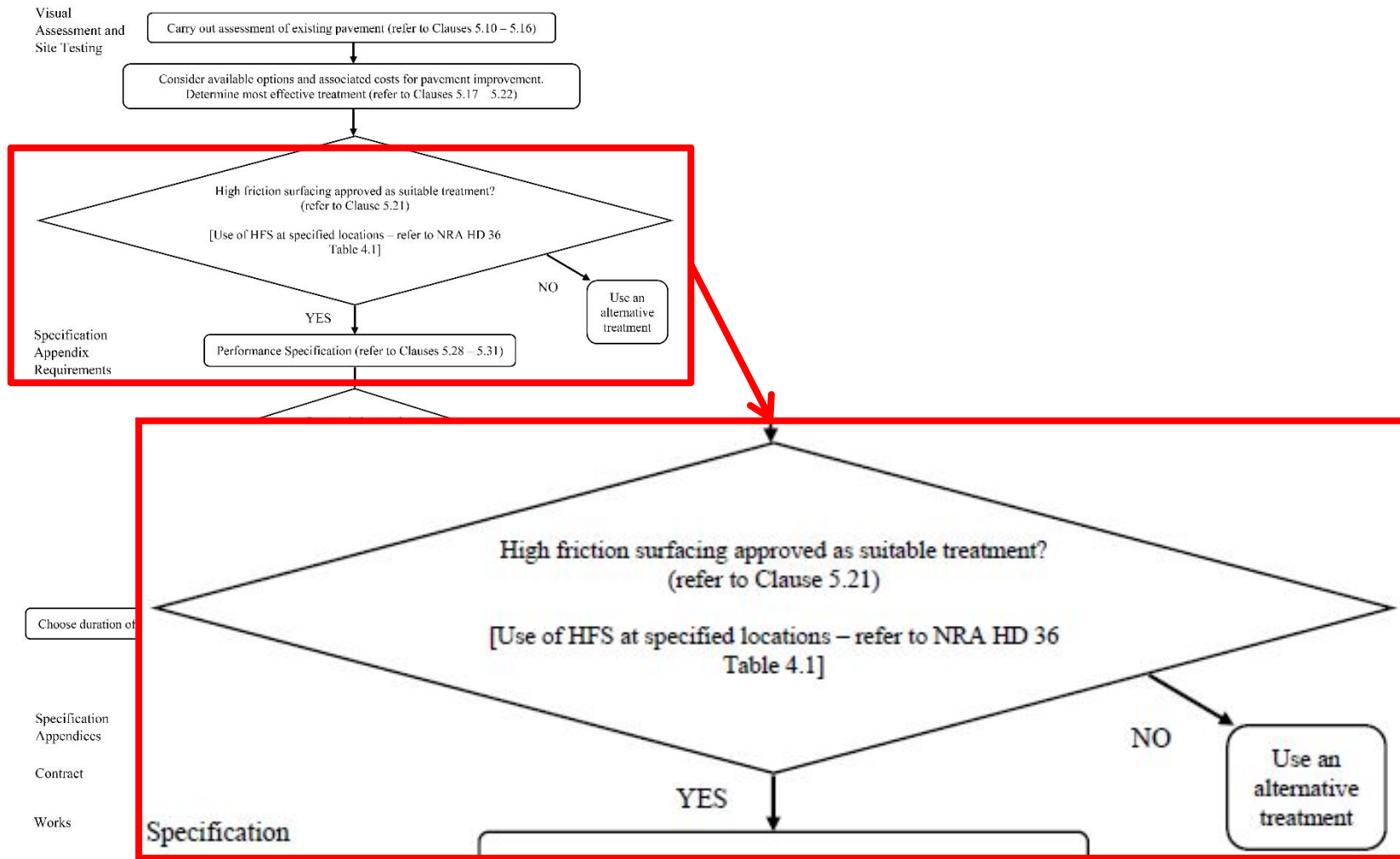


Figure 5.1 – Process Flowchart for High Friction Surfacing

Worked Example

High Friction Surfacing – Pre-Treatment

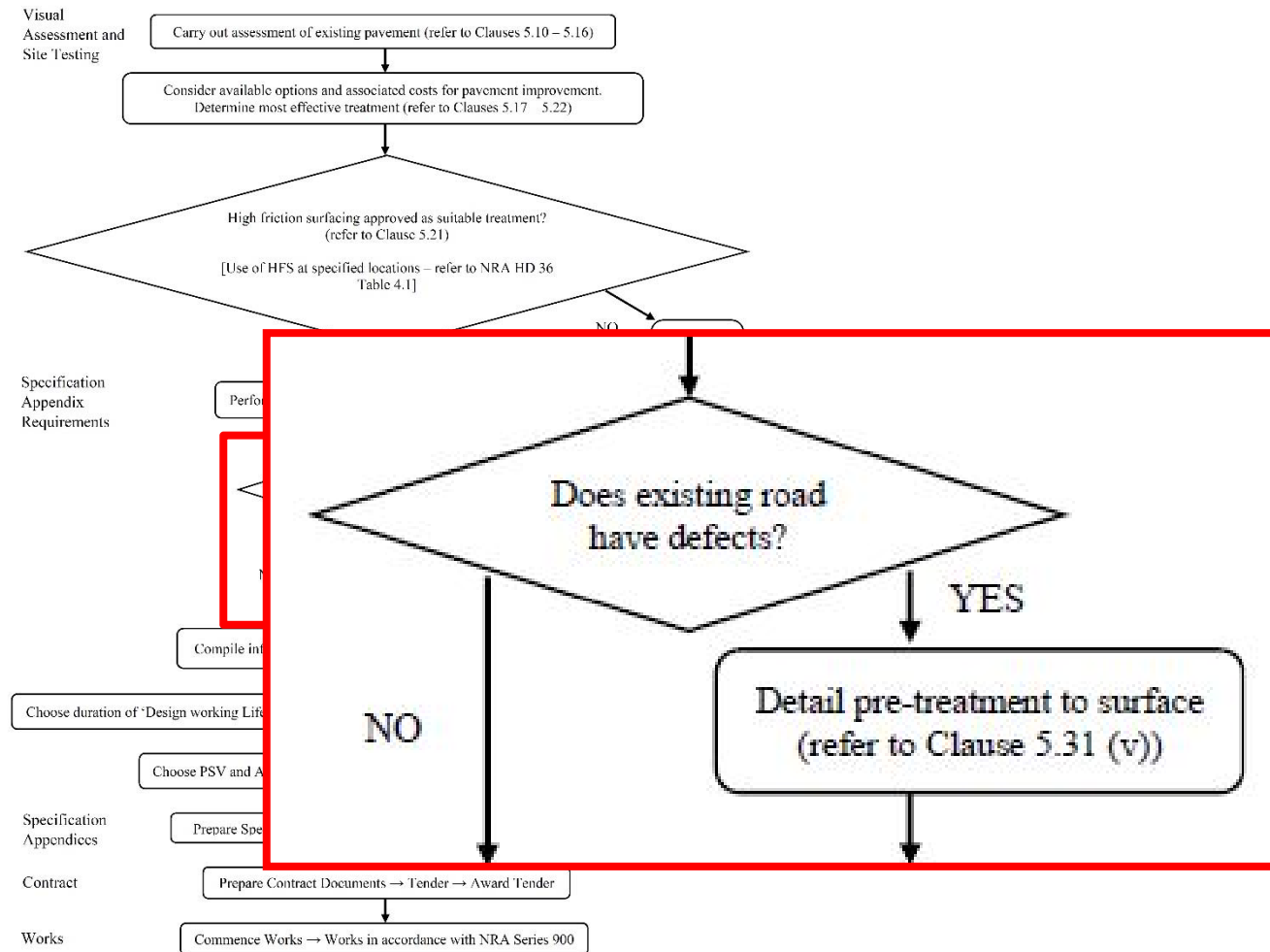


Figure 5.1 – Process Flowchart for High Friction Surfacing

Worked Example

High Friction Surfacing - Pre-Treatment

- Pre-treatment of the existing may include:
 - Surface and structural defect repairs
 - High pressure washing
 - Fine milling
 - Shot blasting
 - Gritting
- Responsible party for Works? Purchaser or Contractor?

Worked Example

High Friction Surfacing - Appendix 7/11

- 1 Location [*NRA HD 300 Clause 5.31 (i)*] **R157 Dunboyne Bypass South, Ch 0+000 to Ch 0+070**
- 2 Traffic Volume. [*NRA HD 300 Clause 5.31 (ii) – cv/lane/day*] **2000 cvd**
- 3 Site Category and Investigatory Level. [*NRA HD 300 Clause 5.31 (iii)*] **G2, 0.50**
- 4 Description of existing surface. [*NRA HD 300 Clause 5.31 (iv)*] **General grit, macrotexture = 0.8 mm**
- 5 Pre-treatment. [*NRA HD 300 Clause 5.31 (v) – responsibility, type, design, process*] **Pressure wash for general cleanliness by Contractor**
- 6 Length of application if greater than 50m [*NRA HD 300 Clause 5.31 (vi)*]
- 7 Type of binder – if different from Series 900 [*Series 900 Clause 7.3.2.1 and NRA HD 300 Clause 5.31 (vii)*]
- 8 Minimum declared PSV of chippings – if different from Series 900 requirements. [*Series 900 Clause 7.3.2.2, Table 23a and Table 23b, and NRA HD 300 Clause 5.31 (viii)*]
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- 12 Level of fatting up (% area affected – P₁) acceptable [*Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)*]
- 13 Level of delamination (% area affected – P₂) acceptable [*Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)*]
- 14 Level of fretting (% area affected – P₃) acceptable [*Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)*]
- 15 Level of grinning (% area affected – P₄) acceptable [*Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)*]
- 16 Pull Off test frequency - after curing and at 1 year where applicable [*NRA HD 300 Clause 5.31(xii)*]

Worked Example

High Friction Surfacing – Contract Requirements

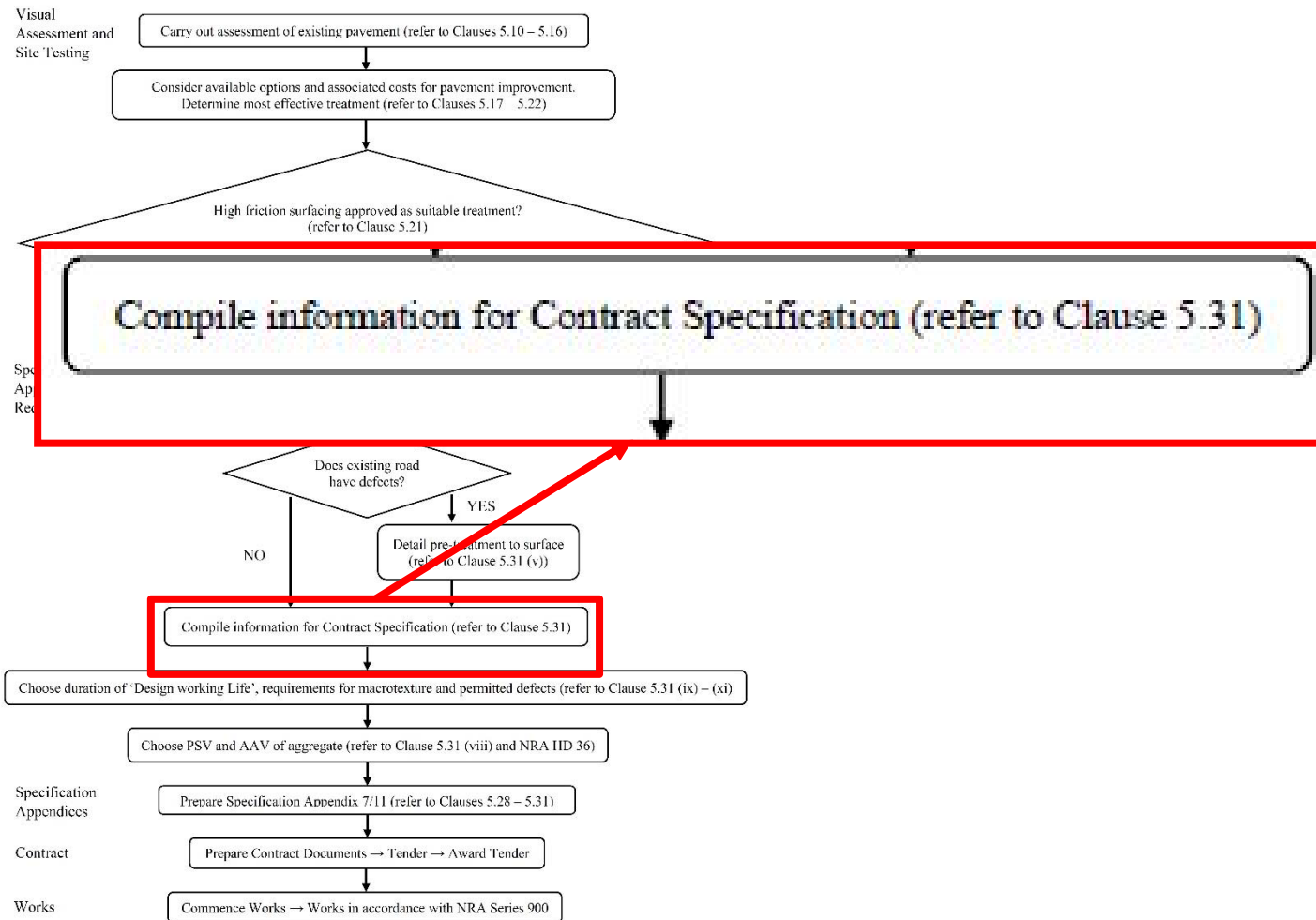


Figure 5.1 – Process Flowchart for High Friction Surfacing

Worked Example

High Friction Surfacing - Contract Requirements

What are some additional contract requirements to specify for high friction surfacing?

- A. Length of high friction surfacing.
- B. Binder and aggregate requirements.
- C. Performance requirements.
- D. End product testing requirements.

ALL OF THE ABOVE

Worked Example

High Friction Surfacing - Contract Requirements

- Length of application → NRA HD 36
 - Minimum length = 50m
- Binder requirements → NRA Series 900, Clause 11, Table 23a

Adhesive strength ¹	≥ 1,7 MPa	IS EN 1542
Elongation at break point for epoxy, methyl methacrylate, and polyurethane cold binders ¹	≥ 30%	IS EN ISO 527-1
Tensile strength of epoxy, methyl methacrylate, and polyurethane cold binders ²	≥ 10,5 MPa	IS EN ISO 527-1
Tensile strength of hot binders	As declared	BS 6319-7
Softening point of hot binders	≥ 90 °C	BS 2000-58
Flow resistance of hot binders @ 60 °C	≤ 1 mm	BS 2499-3

- Aggregate requirements → NRA Series 900, Clause 11, Table 23b

Resistance to Polishing - PSV ¹	PSV ₇₀₊	EN 1097-8
Resistance to Surface Abrasion - AAV ²	Declared	EN 1097-8 Annex A

Worked Example

High Friction Surfacing – Contract Requirements

- ‘Design Working Life’
 - 5 years normally
- Minimum performance requirements
 - Macrotexture

Technical requirement	Reference	Unit	Minimum level
Macrotexture minimum for broadcast systems	IS EN 13036-1 (or IS EN ISO 13473-1)	mm	≥ 0.7 for individual measurement and ≥ 1.0 mean
Macrotexture minimum for screeded systems			≥ 0.5 for individual measurement and ≥ 0.8 mean

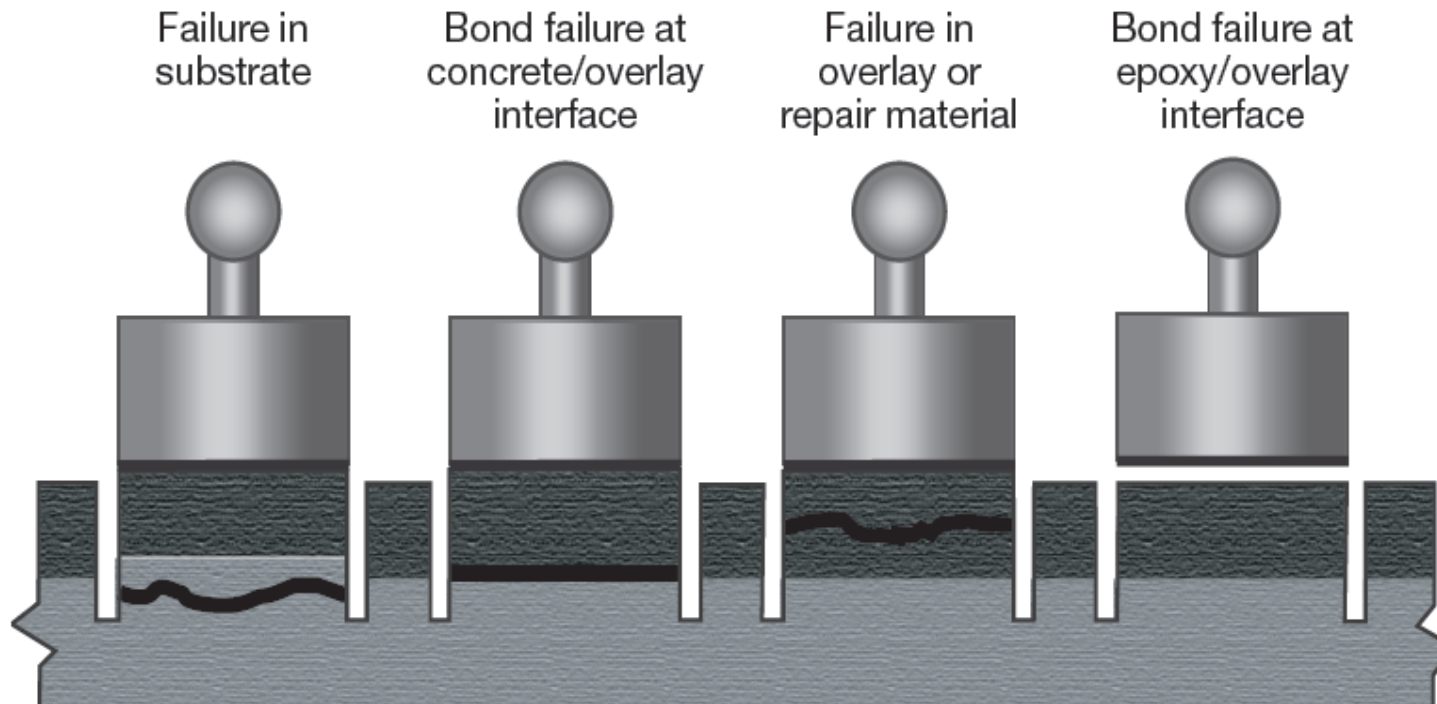
- Visual defects

Defect	Reference	Unit	Defects in the inside wheel track ¹	Defects in the outside wheel track ¹
P_1 – fatting up	IS EN 12272-2	%	≤ 0.5	≤ 2
P_2 – delamination	IS EN 12274-8 ²	%	≤ 0.5	≤ 2
P_3 – fretting	IS EN 12272-2	%	≤ 3	≤ 6
P_4 – grinning	IS EN 12274-8 ²	%	≤ 3	≤ 6

Worked Example

High Friction Surfacing - Contract Requirements

Pull-off test – Indicator of Works



Worked Example

High Friction Surfacing - Appendix 7/11

- 1 Location [NRA HD 300 Clause 5.31 (i)] **R157 Dunboyne Bypass South, Ch 0+000 to Ch 0+070**
- 2 Traffic Volume. [NRA HD 300 Clause 5.31 (ii) – cv/lane/day] **2000 cvd**
- 3 Site Category and Investigatory Level. [NRA HD 300 Clause 5.31 (iii)] **G2, 0.50**
- 4 Description of existing surface. [NRA HD 300 Clause 5.31 (iv)] **General grit, macrotexture = 0.8 mm**
- 5 Pre-treatment. [NRA HD 300 Clause 5.31 (v) – responsibility, type, design, process] **Pressure wash for general cleanliness**
- 6 Length of application if greater than 50m [NRA HD 300 Clause 5.31 (vi)] **70m**
- 7 Type of binder – if different from Series 900 [Series 900 Clause 7.3.2.1 and NRA HD 300 Clause 5.31 (vii)] **N/A**
- 8 Minimum declared PSV of chippings – if different from Series 900 requirements. [Series 900 Clause 7.3.2.2, Table 23a and Table 23b, and NRA HD 300 Clause 5.31 (viii)] **N/A**
- 9 Maximum AAV of chippings – if different from Series 900 requirements. [Series 900 Clause 7.3.2.2, Table 23a and Table 23b, and NRA HD 300 Clause 5.31 (viii)] **N/A**
- 10 Design Working Life. [Series 900 Clause 10.2.4.7, NRA HD 300 Clause 5.31 (ix) – normally 5 years] **5 years**
- 11 Macrotexture [Series 900 Clause 7.3.3.2 and HD 300 Clause 5.31(x)] **Min. 0.7 mm**
- 12 Level of fatting up (% area affected – P₁) acceptable [Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)] **≤ 0.5 inside, ≤ 2.0 outside**
- 13 Level of delamination (% area affected – P₂) acceptable [Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)] **≤ 0.5 inside, ≤ 2.0 outside**
- 14 Level of fretting (% area affected – P₃) acceptable [Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)] **≤ 3.0 inside, ≤ 6.0 outside**
- 15 Level of grinning (% area affected – P₄) acceptable [Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)] **≤ 3.0 inside, ≤ 6.0 outside**
- 16 Pull Off test frequency - after curing and at 1 year where applicable [NRA HD 300 Clause 5.31(xii)] **N/A**

Pavement Standards Training

Worked Example 2 - High Friction Surfacing

Part 2 - Producing High Friction Surfacing

Worked Example

Producing the Mixture - Who's Responsible?

High friction surfacing design and production → The Producer

Provide product and declare the Performance (DoP)

In progress

provisional Type Approval Installation Trial (prTAIT)

In progress

Monitor performance levels

Produce HFS system in accordance with NRA Series 900 so that it is Appropriate for the **INTENDED USE** and **DURABLE** for its expected **LIFE**

Worked Example

Producing the System - Introduction

In terms of the Producer, focus on:

- Clause 11 look-up tables containing the requirements for the constituents
- Requirements for prTAIT
- Requirements to complete Specification Appendices

Worked Example

Producing the System - Product Requirements

Table 23a High Friction Surfacing – Requirements for binders

Table 23b High Friction Surfacing – Requirements for manufactured aggregates

Table 23c High Friction Surfacing – Requirements for natural aggregates

Physical Property	Physical Property	Physical Property Natural Aggregate	Test Method
Adhesive	Bauxite		
Elongation	Resistance	Resistance to Polishing - PSV ¹	PSV ₇₀₊
methyl methacrylate cold binder	Resistance AAV ²	Resistance to Surface Abrasion - AAV ²	Declared
Tensile strength	Particle Density	Particle Density	Declared
methacrylate binders ²	Resistance - Water Absorption	Resistance to Freezing & Thawing - Water Absorption	WA ₂₄ 1,0
Tensile strength	Particle Angularity	Particle Angularity	Blocked shape (not flakes)
Softening	Sieve Size	Sieve Size	
Flow resistance	4	4	
Notes	3,35	3,35	
¹ Test speed	1,18	1,18	
² Preparation	0,60	0,60	
	Mineralogical Aggregate	Mineralogical Aggregate	
	Diasporic	Diasporic	
	Chemical Manufacture	Chemical Manufacture	
	Al ₂ O ₃	Al ₂ O ₃	
	Fe ₂ O ₃	Fe ₂ O ₃	
	SiO ₂	SiO ₂	
	K ₂ O+Na ₂ O	K ₂ O+Na ₂ O	
	TiO ₂	TiO ₂	
	Notes	Notes	
	¹ The test is carried out on aggregate passing a 10mm sieve and retained on a 7,2mm grid sieve	¹ The test is carried out on aggregate passing a 10mm sieve and retained on a 7,2mm grid sieve	
	² The test is carried out on aggregate passing a 14mm sieve and retained on a 10,2mm grid sieve	² The test is carried out on aggregate passing a 14mm sieve and retained on a 10,2mm grid sieve	

Worked Example

Producing the Mixture – HFS prTAIT

High friction surfacing requires a prTAIT:

- Provisional TAIT (prTAIT) for products that do not have a harmonised standard
- Requirements per NRA HD 301
- A defined section where the product has been installed using Factory Production Control (FPC)
- Demonstrates the characteristics of the product complies with the declared characteristics.
- Subjected to an in service performance assessment after a period of one year. Assessed annually thereafter to determine ‘design working life’.
- Provides parameters that limit the application of the product (prTAIT families).

Worked Example

Producing the Mixture - HFS prTAIT Requirements

- Requirements for Works
 - Bond to substrate
 - Target rate of spread of binder for cold applied broadcast systems
 - Target rate of spread of aggregate for cold applied broadcast systems
 - Tolerance on rate of spread of aggregate for cold applied broadcast systems
 - Target application rate for screeded systems
 - Tolerance on application rate for screeded systems
 - Tolerance on target binder content

Worked Example

Producing the Mixture - HFS prTAIT Requirements

- Works Requirements for Cold Applied Broadcast Systems

Parameter	Requirement
Target rate of spread of binder	$\geq 1.35 \text{ kg/m}^2$
Tolerance on rate of spread of binder	$\pm 10\%$
Target rate of spread of aggregate	As declared (kg/m^2)
Tolerance on rate of spread of aggregate	$\pm 15\%$

Worked Example

Producing the Mixture - prTAIT Families

- 2 Traffic Volume. [NRA HD 300 Clause 5.31 (ii) – cv/lane/day] **2000 cvd**
- 3 Site Category and Investigatory Level. [NRA HD 300 Clause 5.31 (iii)] **G2, 0.50**

Column	1	2	3	4	5	6	7
Line	Parameters that limit the application of a prTAIT	Site Categories ¹					
1		G1, S1		G2, S2		K	
2	Traffic Category (cv/lane/day)	≤ 1000	> 1000	≤ 750	> 750	≤ 500	> 500
3	Type of High Friction Surfacing	Cold Broadcast / Cold Screeded / Hot Screeded					
4	Types of Aggregate	Natural / Manufactured					
5	prTAIT family	1	2 ²	3	4 ²	5	6 ²
Notes							
¹ Site categories as defined in NRA HD 28.							
² Previously successful prTAITs may be applied to other site in accordance with Clause 2.25.							

Table 2C.1 – Limiting number of prTAITs and defining families for High Friction Surfacing

Worked Example

High Friction Surfacing - Appendix 7/11

- The Producer completes Sheet 2 of Appendix 7/11 with:
 - A copy of IS EN ISO 9001 certificate
 - Declaration of the 'Design Working Life'
 - Proposed binder and bond coat
 - Source of aggregate and associated DoP and CE marking
 - Works proposal for each site
 - Statement of relevant experience and expertise
 - Product/system storage at and transport to site
 - Weather requirements for installation of HFS
 - Time period between completion of works and opening to traffic

Pavement Standards Training

Worked Example 2 – High Friction Surfacing

Part 3 – Installing and Checking the Works

Worked Example

The Works - Who's Responsible?

Installing and in situ testing → The Contractor

Procure a suitable HFS system

Demonstrate the system is compliant

Organise and undertake the Works & arrange for testing to be completed

Appropriate for INTENDED USE & DURABLE for EXPECTED LIFE

Worked Example

The Works - Who's Responsible?

Monitoring the Works for the Employer → The Employer's Rep.

Oversee Translation of the Designers requirements into the end product

Seek documentation demonstrating material compliance

Conduct checks to ensure surface treatment performance consistent with Series 900

Appropriate for INTENDED USE & DURABLE for EXPECTED LIFE

Worked Example

The Works - Introduction

In terms of the Contractor, focus on:

- The detail within Clause 10 of Series 900; what's in the Clause and what's new
- Documentation of prTAIT requirements
- Requirements for in situ testing

Worked Example

The Works - Specification Requirements

Requirements for the Works (High Friction Surfacing)

- Works Proposals → Contractor to submit to ER
- Existing Surface → Repair Works and Cold Milling
- Transport → As demonstrated by prTAIT
- Weather Conditions → Surface temp, rain, etc.
- Laying → Bond to substrate
- Trafficking and aftercare → Use of surface by 'live' traffic
- Performance → Satisfaction of 'design working life' against defects

Worked Example

The Works - prTAIT Certificate and Appendix 7/11

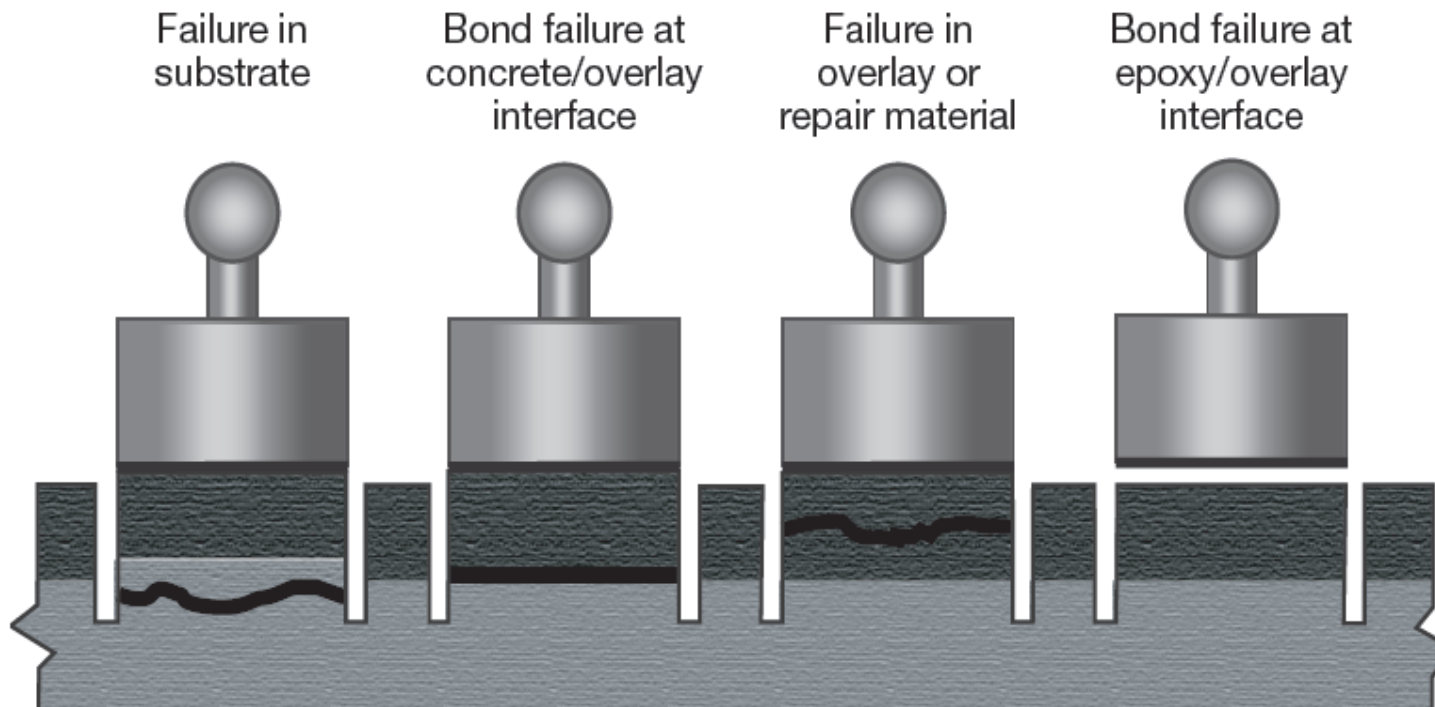
- Contractor to document prTAIT by completing Appendix 7/11:
 - Product company name and address
 - Location of prTAIT and reference number
 - prTAIT family
 - Proprietary name
 - Description of product/system
 - Storage and transportation requirements
 - Rate and tolerance of spread of both binder and aggregate
 - Macrotexture depth and visual assessment results after 1 year
 - Period for which the performance characteristics have been retained
 - Constraints on application for the product/system including:
 - Time of year
 - Temperature
 - Weather

Worked Example

The Works - In-Situ Testing

The Contractor shall demonstrate the system's bond to the substrate:

Product Characteristics	Test Method	Requirement
Tensile adhesion /adhesive strength (Pull Off Test)	ASTM 1583	$\geq 0.5 \text{ N/mm}^2$ (at $20 \pm 2^\circ\text{C}$)



Worked Example

Conclusion

This section of the Workshop has:

- Outlined roles and responsibilities of the various parties
- Summarised the key changes and reasons for changing
- Carried out a worked example in completing Appendix 7/11
- Outlined the issues for a Producer to be aware of
- Outlined the requirements for the Contractor and the role of the ER during the Works

Debate and Interaction

Audience Debate on requirements of the
Surface Treatment contract documents process

NRA Pavement Standards Training

End of Part 6

NRA Pavement Standards Training

Summary of Other Parts of Series 900
and Future Developments

NRA Specification for Road Works

Series 900: Miscellaneous Products and Processes

Bituminous Mixtures → AC, HRA, SMA, and PA

Surface Treatments → Microsurfacing, Surface Dressing, and HFS

NRA Series 900 Clause 8

Miscellaneous Products → Geotextiles, Retexturing, LEBM, PRMS, LSRS & ERMS

Reclaimed Asphalt

NRA Series 900 Clause 10

Works

NRA Specification for Road Works

Series 900: Miscellaneous Products and Processes

Clause 8

- Clause 8.1: Low Energy Bound Mixtures (LEBM)
- Clause 8.2: Retexturing
- Clause 8.3: Geotextiles and Geotextile-related products
- Clause 8.4: Permanent Repair Material Systems (PRMS)
- Clause 8.5: Localised Surface Repair Systems (LSRS)
- Clause 8.6: Emergency Repair Material Systems (ERMS)

Clause 10

- Clause 10.3 – ‘Works’ for Miscellaneous Products and Processes

NRA Specification for Road Works

Series 900: Miscellaneous Products and Processes

Low Energy Bound Mixtures (LEBM)

- Update to advice in IAN 01/11 → NRA Series 900, NRA HD 300
- What are LEBM?
 - Produced ex situ or in situ
 - Subbase, base and binder course material



NRA Specification for Road Works

Series 900: Miscellaneous Products and Processes

Retexturing

- Aim to restore adequate levels of micro and/or macrotexture and thereby skid resistance
- Different techniques:
 - Bush Hammering
 - Shot Blasting
 - Grooving/Grinding
 - Longitudinal Scabbling
 - Water Jetting



Selection of treatment shall be in accordance with Table 25b

NRA Specification for Road Works

Series 900: Miscellaneous Products and Processes

Geotextiles and Geotextile-related products

- Part of pavement structure but NOT between binder and surface course
- Intended Uses:
 - Reinforcement at low strain
 - Barrier, Sealing and prevention of water penetration
 - Stress Absorption
- Types:
 - Steel meshes
 - Geogrid products
 - Geocomposites

Figure 7.1 – Process Flowchart for the use of Geotextile and Geotextile-related Products

NRA Specification for Road Works

Series 900: Miscellaneous Products and Processes

PRMS & LSRS



Maximum area of repair is approximately 2m²

Future Developments

What's to Come – NRA DMRB

NRA DMRB

- NRA HD 37 and NRA HD 301 to be published
- Updated NRA HD 25-26
 - based on an analytical approach utilising new Series 900 materials and site trials
- Updated to NRA HD 300
 - an analytical approach to surface dressing design based on site trials
 - updates based on site trials (HFS, LEBM)
- Updated NRA HD 39
 - footway design

Future Developments

What's to Come – NRA MCDRW

NRA MCDRW

- Updates to NRA Series 900 based on 'to be recorded' testing information

NRA IAN

- NRA IAN on mastic asphalt
- NRA IAN on crack repair and joint repair for existing joints

NRA (Other)

- 'Best Practice Guide' for Pavement Works on Site

Development of NRA MCDRW Series 900: Reforms, Challenges and Safety

REVIEW

- **New Pavement Specifications and Standards**

Key Points and what we set out to achieve...

1. **Higher quality** materials to **improve durability**
2. **Consistency** at all stages – manufacturing through to inclusion in the works
3. **Improve safety** concerns
4. Address **performance issues**
5. It is **Part 1 of a 2 stage process**

Close of Workshop

Summary

Comments to
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NRA Pavement Standards Training