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

![CE Mark Image]

Any Co Ltd, X Street, Dublin, Ireland
15
001-CPR-2015/01/01

EN 13108-1:2006
Asphalt Concrete
AC 20 dense mix 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>
<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>

Target Binder content 4.9 %
Minimum stiffness 1800 MPa
# Declaration of Performance

No. 001 CFR 2018-01-01

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 1 234 678
   - Fax: +353 1 234 5097
   - Email: anyco@provider.ie

5. Where applicable, name and contact address of the authorised representative whose mandate covers the tasks specified in Article 11(7):
   - N/A

6. System of assessment and verification of consistancy of performance of the construction product as set out in CEE. 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. 0069

8. Declared performance:

<table>
<thead>
<tr>
<th>Essential characteristic</th>
<th>Performance</th>
<th>Harmonised technical specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Adhesion of binder to aggregate</td>
<td></td>
<td>EN 13108-1:2006</td>
</tr>
<tr>
<td>2. Softness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Resistance to permanent deformation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Resistance to fatigue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Skid resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Resistance to abrasion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Reaction to fire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Durable substances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Durability</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.1 Target grading passing sieve

<table>
<thead>
<tr>
<th>Sieve size (mm)</th>
<th>Passing %</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</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>

8.2 Target binder content 4.9% EN 12697-1

8.3 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

8.4 Water sensitivity 175kPa EN 12697-12 Method A

8.5 Maximum temperature 180°C Minimum temperature 180°C EN 12697-26 Annex B

9. The performance of the product identified in points 1 and 2 is in conformity with the declared performance as 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) .................................................. (Signature) ..................................................

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Annex C</th>
<th>Value</th>
<th>Category</th>
<th>Remarks/ Supporting documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grading</td>
<td>n/a</td>
<td>see Mix Formulation</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Binder Content</td>
<td>n/a</td>
<td>see Mix Formulation</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Mix Constituents

<table>
<thead>
<tr>
<th>Name</th>
<th>Source Type</th>
<th>Remarks / Supporting documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate 1</td>
<td>Belgard Limestone</td>
<td>LA, Soundness, Water Absorption and Density, Fines Content test certificates attached</td>
</tr>
<tr>
<td>Aggregate 2</td>
<td>Belgard Limestone</td>
<td>Fines Content test certificates attached</td>
</tr>
<tr>
<td>Aggregate 3</td>
<td>Belgard Limestone</td>
<td></td>
</tr>
<tr>
<td>Aggregate 70/100</td>
<td>Irish Tar and Bitumen Suppliers</td>
<td>EN 12591 PG Bitumen Penetration and Softening Point test certificates attached</td>
</tr>
<tr>
<td>Binder 70</td>
<td>EN 12591 PG Bitumen</td>
<td></td>
</tr>
<tr>
<td>Binder 100</td>
<td>EN 12591 PG Bitumen</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Designation</th>
<th>Target %</th>
<th>Tolerances</th>
<th>Spec. limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.5 mm</td>
<td>1.4 D sieve</td>
<td>100</td>
<td>-2 +0</td>
<td>98 - 100</td>
</tr>
<tr>
<td>20 mm</td>
<td>D Sieve</td>
<td>100</td>
<td>-2 +0</td>
<td>98 - 100</td>
</tr>
<tr>
<td>10 mm</td>
<td>D/2 or char coarse sieve</td>
<td>62</td>
<td>-2 +9</td>
<td>53 - 71</td>
</tr>
<tr>
<td>6.3 mm</td>
<td>1st Optional coarse sieve</td>
<td>47</td>
<td>-2 +9</td>
<td>38 - 56</td>
</tr>
<tr>
<td>2 mm</td>
<td>2mm sieve</td>
<td>30</td>
<td>-7 +7</td>
<td>23 - 37</td>
</tr>
<tr>
<td>0.250 mm</td>
<td>Characteristic fine sieve</td>
<td>13</td>
<td>-5 +5</td>
<td>8 - 18</td>
</tr>
<tr>
<td>0.063 mm</td>
<td>0.063mm sieve</td>
<td>5.5</td>
<td>-3.0 +3.0</td>
<td>2.5 - 8.5</td>
</tr>
<tr>
<td>Binder</td>
<td>Binder</td>
<td>4.9</td>
<td>-0.6 +0.6</td>
<td>4.3 - 5.5</td>
</tr>
</tbody>
</table>

Binder Category EN 13108-1 AC B_{min} 4.8

Minimum void content Vmin 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

Key Changes

NRA Series 900 requirements contain:

- Type Approval Installation Trial (TAIT)
- Declaration of Performance
- ‘Design Working Life’
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.
  - Microsurfacings
  - 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
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).
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)

<table>
<thead>
<tr>
<th>Property of the Binder</th>
<th>EN 1426</th>
<th>EN 13588</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetration at 25°C</td>
<td>0.1 mm</td>
<td>≥ 1.0</td>
</tr>
<tr>
<td>Softening point</td>
<td>°C</td>
<td>≥ 1.0</td>
</tr>
<tr>
<td>Cohesion (pendulum test)</td>
<td>J/cm²</td>
<td>≥ 1.0</td>
</tr>
</tbody>
</table>
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

- Fatting 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**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Location [NRA HD 300 Clause 5.31 (i)]</td>
</tr>
<tr>
<td>2</td>
<td>Traffic Volume. [NRA HD 300 Clause 5.31 (ii) – cv/lane/day]</td>
</tr>
<tr>
<td>3</td>
<td>Site Category and Investigatory Level. [NRA HD 300 Clause 5.31 (iii)]</td>
</tr>
<tr>
<td>4</td>
<td>Description of existing surface. [NRA HD 300 Clause 5.31 (iv)]</td>
</tr>
<tr>
<td>5</td>
<td>Pre-treatment. [NRA HD 300 Clause 5.31 (v) – responsibility, type, design, process]</td>
</tr>
<tr>
<td>6</td>
<td>Length of application if greater than 50m [NRA HD 300 Clause 5.31 (vii)]</td>
</tr>
<tr>
<td>7</td>
<td>Type of binder – if different from Series 900 [Series 900 Clause 7.3.2.1 and NRA HD 300 Clause 5.31 (vii)]</td>
</tr>
<tr>
<td>8</td>
<td>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)]</td>
</tr>
<tr>
<td>9</td>
<td>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)]</td>
</tr>
<tr>
<td>10</td>
<td>Design Working Life. [Series 900 Clause 10.2.4.7, NRA HD 300 Clause 5.31 (ix) – normally 5 years]</td>
</tr>
<tr>
<td>11</td>
<td>Macrotecture [Series 900 Clause 7.3.3.2 and HD 300 Clause 5.31(x)]</td>
</tr>
<tr>
<td>12</td>
<td>Level of fatting up (% area affected – (P_1)) acceptable [Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)]</td>
</tr>
<tr>
<td>13</td>
<td>Level of delamination (% area affected – (P_2)) acceptable [Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)]</td>
</tr>
<tr>
<td>14</td>
<td>Level of fretting (% area affected – (P_3)) acceptable [Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)]</td>
</tr>
<tr>
<td>15</td>
<td>Level of grinning (% area affected – (P_4)) acceptable [Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xi)]</td>
</tr>
<tr>
<td>16</td>
<td>Pull Off test frequency - after curing and at 1 year where applicable [NRA HD 300 Clause 5.31(xi)]</td>
</tr>
</tbody>
</table>
Worked Example

High Friction Surfacing

Visual Assessment and Site Testing

- Carry out assessment of existing pavement (refer to Clauses 5.10 – 5.16)
- Consider available options and associated costs for pavement improvement. Determine most effective treatment (refer to Clauses 5.17 – 5.22)

High friction surfacing approved as suitable treatment? (refer to Clause 5.21)

- [Use of HFS at specified locations – refer to NRA HD 36 Table 4.1]

Specification Appendix Requirements

- Performance Specification (refer to Clauses 5.28 – 5.31)

Does existing road have defects?

- YES
- Detail pre-treatment to surface (refer to Clause 5.31 (viii))

- NO
- Compile information for Contract Specification (refer to Clause 5.21)

Choose duration of ‘Design working Life’, requirements for macrotexture and permitted defects (refer to Clause 5.31 (ix) – (xii))

Choose PSV and AAV of aggregate (refer to Clause 5.31 (viii) and NRA HD 36)

Specification Appendices

- Prepare Specification Appendix 7/11 (refer to Clauses 5.28 – 5.31)

Contract

- Prepare Contract Documents → Tender → Award Tender

Works

- Commence Works → Works in accordance with NRA Series 900

Figure 5.1 – Process Flowchart for High Friction Surfacing
Worked Example
High Friction Surfacing - Assessment

Visual Assessment and Site Testing

- Carry out assessment of existing pavement (refer to Clauses 5.10 – 5.16)

Consider available options and associated costs for pavement improvement. Determine most effective treatment (refer to Clauses 5.17 – 5.22)

High friction surfacing approved as suitable treatment
(refer to Clause 3.31)

[Use of HFS at specified locations – refer to NRA HD 36 Table 4.1]

Visual Assessment and Site Testing

- Carry out assessment of existing pavement (refer to Clauses 5.10 – 5.16)

- Does existing road have defects?

  NO

  Compile Information for Contract Specification (refer to Clause 5.31)

  Choose duration of ‘Design Working Life’, requirements for macrotexture and permitted defects (refer to Clause 5.31 (iii) – (vi))

  Choose PSV and AAV of aggregate (refer to Clause 5.31 (viii) and NRA HD 36)

  Prepare Specification Amendments/713 (refer to Clauses 5.28 – 5.31)

  Prepare Contract Documents → Tender → Award Tender

- YES

  Detail pre-treatment to surface (refer to Clause 5.31 (v))

  Choose duration of ‘Design Working Life’, requirements for macrotexture and permitted defects (refer to Clause 5.31 (iii) – (vi))

  Choose PSV and AAV of aggregate (refer to Clause 5.31 (viii) and NRA HD 36)

  Prepare Specification Amendments/713 (refer to Clauses 5.28 – 5.31)

  Prepare Contract Documents → Tender → Award Tender

- Confirm Works → Works in accordance with NRA Series 909

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

<table>
<thead>
<tr>
<th>Type</th>
<th>PSV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buses and Coaches</td>
<td></td>
</tr>
<tr>
<td>2-axle rigid</td>
<td>OGV1</td>
</tr>
<tr>
<td>3-axle rigid</td>
<td></td>
</tr>
<tr>
<td>3-axle articulated</td>
<td>OGV2</td>
</tr>
<tr>
<td>4-axle rigid</td>
<td></td>
</tr>
<tr>
<td>4-axle articulated</td>
<td></td>
</tr>
<tr>
<td>5-axle articulated</td>
<td></td>
</tr>
<tr>
<td>6 (or more) - axle articulated</td>
<td></td>
</tr>
</tbody>
</table>
**Worked Example**  
**High Friction Surfacing - Assessment**

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

<table>
<thead>
<tr>
<th>Site category and definition</th>
<th>Investigatory Level at 50km/h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.30</td>
</tr>
<tr>
<td>A Motorway</td>
<td></td>
</tr>
<tr>
<td>B Dual carriageway non-event</td>
<td></td>
</tr>
<tr>
<td>C Single carriageway non-event</td>
<td></td>
</tr>
<tr>
<td>G1 Gradient 5-10% longer than 50m</td>
<td></td>
</tr>
<tr>
<td>G2 Gradient &gt;10% longer than 50m</td>
<td></td>
</tr>
<tr>
<td>K Approaches to traffic signals, pedestrian crossings</td>
<td></td>
</tr>
<tr>
<td>Q Approaches to and across major and minor junctions,</td>
<td></td>
</tr>
<tr>
<td>R Roundabout</td>
<td></td>
</tr>
<tr>
<td>S1 Bend radius &lt;250m – dual carriageway</td>
<td></td>
</tr>
<tr>
<td>S2 Bend radius &lt;250m – single carriageway</td>
<td></td>
</tr>
</tbody>
</table>
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/frettng.
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

- Macrotecture $\rightarrow$ 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 (xii)]
14. Level of fretting (% area affected – P3) acceptable [Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xiii)]
15. Level of grinning (% area affected – P4) acceptable [Series 900 Clause 7.3.3.1 and HD 300 Clause 5.31 (xiv)]
16. Pull Off test frequency - after curing and at 1 year where applicable [NRA HD 300 Clause 5.31(xvii)]
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.
Worked Example
High Friction Surfacing - Suitability

Consider available options and associated costs for pavement improvement. Determine most effective treatment (refer to Clauses 5.17 – 5.22)
## Worked Example
### High Friction Surfacing - Suitability

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

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 – Contract Requirements

Visual Assessment and Site Testing
- Carry out assessment of existing pavement (refer to Clauses 5.10 – 5.16)
- Consider available options and associated costs, pavement improvement. Determine most effective treatment (refer to Clauses 5.17 – 5.22)

High friction surfacing approved as suitable treatment? (Refer to Clause 5.31)

Compile information for Contract Specification (refer to Clause 5.31)

Does existing road have defects?
- YES
  - Design pavement to surface (refer to Clause 5.31 (vi))
  - Compile information for Contract Specification (refer to Clause 5.31)

- NO
  - Choose duration of ‘Design working life’, requirements for maintenance and permitted defects (refer to Clause 5.21 (ix) – (x))
  - Choose PSV and AAV of aggregate (refer to Clause 5.31 (viii) and NRA HD 36)
  - Specification Appendix
  - Prepare Specification Appendix 7/1 (refer to Clauses 5.28 – 5.31)
  - Contract
  - Prepare Contract Documents – Tender – Award Tender
  - Works
  - Commence Works – Works in accordance with NRA Series 900

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesive strength 1</td>
<td>≥ 1.7 MPa</td>
<td>IS EN 1542</td>
</tr>
<tr>
<td>Elongation at break point for epoxy, methyl methacrylate, and polyurethane cold binders 1</td>
<td>≥ 30%</td>
<td>IS EN ISO 527-1</td>
</tr>
<tr>
<td>Tensile strength of epoxy, methyl methacrylate, and polyurethane cold binders 2</td>
<td>≥ 10.5 MPa</td>
<td>IS EN ISO 527-1</td>
</tr>
<tr>
<td>Tensile strength of hot binders</td>
<td>As declared</td>
<td>BS 6319-7</td>
</tr>
<tr>
<td>Softening point of hot binders</td>
<td>≥ 90 °C</td>
<td>BS 2000-58</td>
</tr>
<tr>
<td>Flow resistance of hot binders @ 60 °C</td>
<td>≤ 1 mm</td>
<td>BS 2499-3</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance to Polishing - PSV 1</td>
<td>PSV 70+</td>
<td>EN 1097-8</td>
</tr>
<tr>
<td>Resistance to Surface Abrasion - AAV 2</td>
<td>Declared</td>
<td>EN 1097-8 Annex A</td>
</tr>
</tbody>
</table>
Worked Example
High Friction Surfacing – Contract Requirements

- ‘Design Working Life’
  - 5 years normally

- Minimum performance requirements
  - Macrotexture

<table>
<thead>
<tr>
<th>Technical requirement</th>
<th>Reference</th>
<th>Unit</th>
<th>Minimum level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macrotexture minimum for broadcast systems</td>
<td>IS EN 13036-1 (or IS EN ISO 13473-1)</td>
<td>mm</td>
<td>( \geq 0.7 ) for individual measurement and ( \geq 1.0 ) mean</td>
</tr>
<tr>
<td>Macrotexture minimum for screeded systems</td>
<td></td>
<td>mm</td>
<td>( \geq 0.5 ) for individual measurement and ( \geq 0.8 ) mean</td>
</tr>
</tbody>
</table>

- Visual defects

<table>
<thead>
<tr>
<th>Defect</th>
<th>Reference</th>
<th>Unit</th>
<th>Defects in the inside wheel track (^1)</th>
<th>Defects in the outside wheel track (^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P_1 ) – fatting up</td>
<td>IS EN 12272-2</td>
<td>%</td>
<td>( \leq 0.5 )</td>
<td>( \leq 2 )</td>
</tr>
<tr>
<td>( P_2 ) – delamination</td>
<td>IS EN 12274-8 (^2)</td>
<td>%</td>
<td>( \leq 0.5 )</td>
<td>( \leq 2 )</td>
</tr>
<tr>
<td>( P_3 ) – fretting</td>
<td>IS EN 12272-2</td>
<td>%</td>
<td>( \leq 3 )</td>
<td>( \leq 6 )</td>
</tr>
<tr>
<td>( P_4 ) – grinning</td>
<td>IS EN 12274-8 (^2)</td>
<td>%</td>
<td>( \leq 3 )</td>
<td>( \leq 6 )</td>
</tr>
</tbody>
</table>
Worked Example
High Friction Surfacing - Contract Requirements

Pull-off test – Indicator of Works
## Worked Example
### High Friction Surfacing - Appendix 7/11

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

---

NRA
National Roads Authority

ARUP
Pavement Standards Training

Worked Example 2 - High Friction Surfacing

Part 2 - Producing High Friction Surfacing
High friction surfacing design and production → The Producer

Provide product and declare the Performance (DoP)

provisional Type Approval Installation Trial (prTAIT)

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

In progress
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
### Table 23a High Friction Surfacing – Requirements for binders

<table>
<thead>
<tr>
<th>Physical Property Natural Aggregate</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance to Polishing - PSV²</td>
<td>PSV70⁴ - EN 1097-8</td>
</tr>
<tr>
<td>Resistance to Surface Abrasion - AAV²</td>
<td>Declared - EN 1097-8 Annex A</td>
</tr>
<tr>
<td>Particle Density</td>
<td>Declared - EN 1097-6</td>
</tr>
<tr>
<td>Resistance to Freezing &amp; Thawing</td>
<td>WA₉₁,0 - EN 1097-6</td>
</tr>
<tr>
<td>Particle Angularity</td>
<td>Blocked shape (not flakes) - Visual Assessment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Property Natural Aggregate</td>
<td>EN933-1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Test split</td>
</tr>
<tr>
<td>2 Prepare</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mineralogical Aggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve Size</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical Manufactured Aggregate</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al₂O₃</td>
<td>The test is carried out on aggregate passing a 10mm sieve and retained on a 7,2mm grid sieve</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>≤ 4.5%</td>
</tr>
<tr>
<td>SiO₂</td>
<td>≤ 12.5%</td>
</tr>
<tr>
<td>K₂O + Na₂O</td>
<td>≤ 0.5%</td>
</tr>
<tr>
<td>TiO₂</td>
<td>≤ 4.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 The test is carried out on aggregate passing a 10mm sieve and retained on a 7,2mm grid sieve</td>
</tr>
<tr>
<td>2 The test is carried out on aggregate passing a 14mm sieve and retained on a 10,2mm grid sieve</td>
</tr>
</tbody>
</table>
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**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target rate of spread of binder</td>
<td>≥1.35 kg/m²</td>
</tr>
<tr>
<td>Tolerance on rate of spread of binder</td>
<td>±10%</td>
</tr>
<tr>
<td>Target rate of spread of aggregate</td>
<td>As declared (kg/m²)</td>
</tr>
<tr>
<td>Tolerance on rate of spread of aggregate</td>
<td>±15%</td>
</tr>
</tbody>
</table>
### 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

<table>
<thead>
<tr>
<th>Column</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Parameters that limit the application of a prTAIT</td>
<td>Site Categories¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G1, S1</td>
<td>G2, S2</td>
<td>K</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Traffic Category (cv/lane/day)</td>
<td>≤1000</td>
<td>&gt;1000</td>
<td>≤750</td>
<td>&gt;750</td>
<td>≤500</td>
<td>&gt;500</td>
</tr>
<tr>
<td>3</td>
<td>Type of High Friction Surfacing</td>
<td>Cold Broadcast / Cold Screeded / Hot Screeded</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Types of Aggregate</td>
<td>Natural / Manufactured</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>prTAIT family</td>
<td>1</td>
<td>2²</td>
<td>³</td>
<td>4²</td>
<td>5</td>
<td>6²</td>
</tr>
</tbody>
</table>

**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
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
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:

<table>
<thead>
<tr>
<th>Product Characteristics</th>
<th>Test Method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile adhesion/adhesive strength (Pull Off Test)</td>
<td>ASTM 1583</td>
<td>≥ 0.5 N/mm² (at 20±2°C)</td>
</tr>
</tbody>
</table>

- Failure in substrate
- Bond failure at concrete/overlay interface
- Failure in overlay or repair material
- Bond failure at epoxy/overlay interface
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
- Miscellaneous Products → Geotextiles, Retexturing, LEBM, PRMS, LSRS & ERMS
- Reclaimed Asphalt
- Works

NRA Series 900 Clause 8
NRA Series 900 Clause 10
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
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
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
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 2m$^2$
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

- 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
edward.winterlich@tii.ie
NRA Pavement Standards Training