NRA Roadshow 2015

Overview of changes
to
NRA Design, MCDRW Series 900

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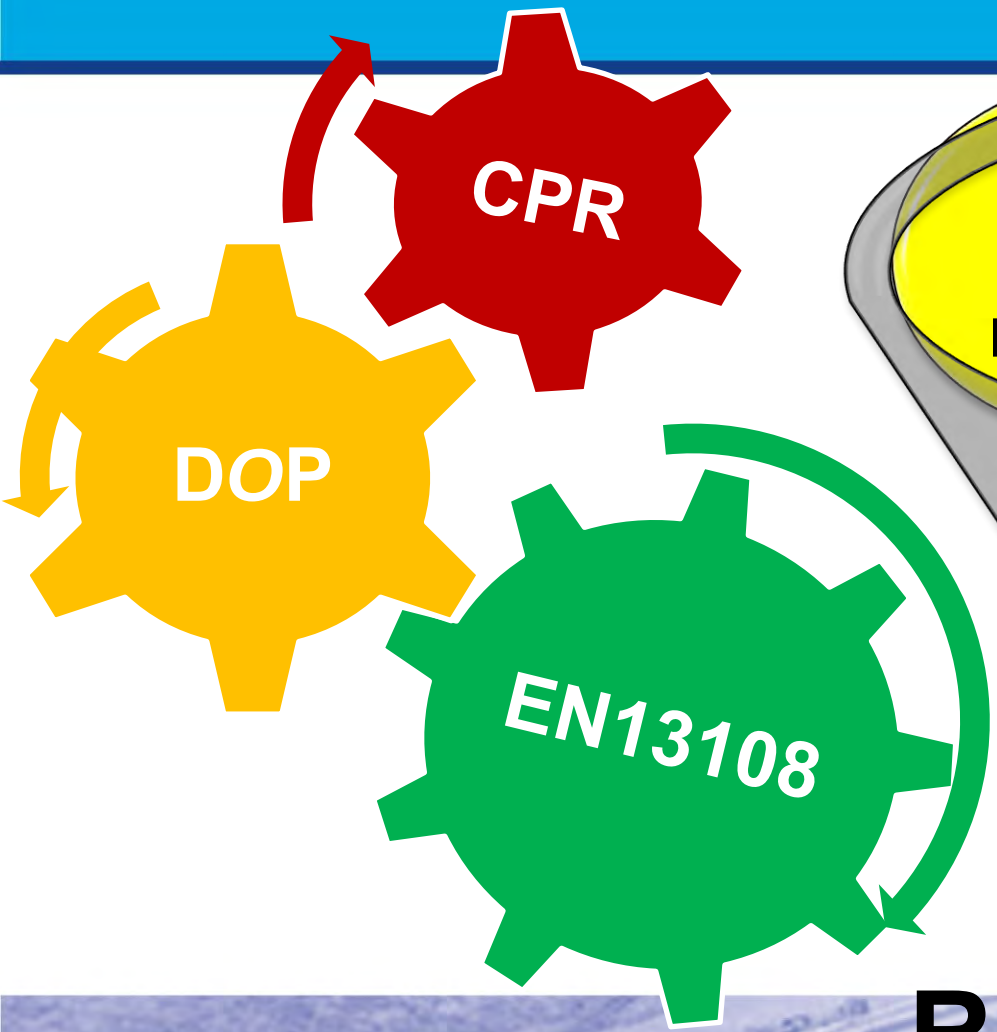
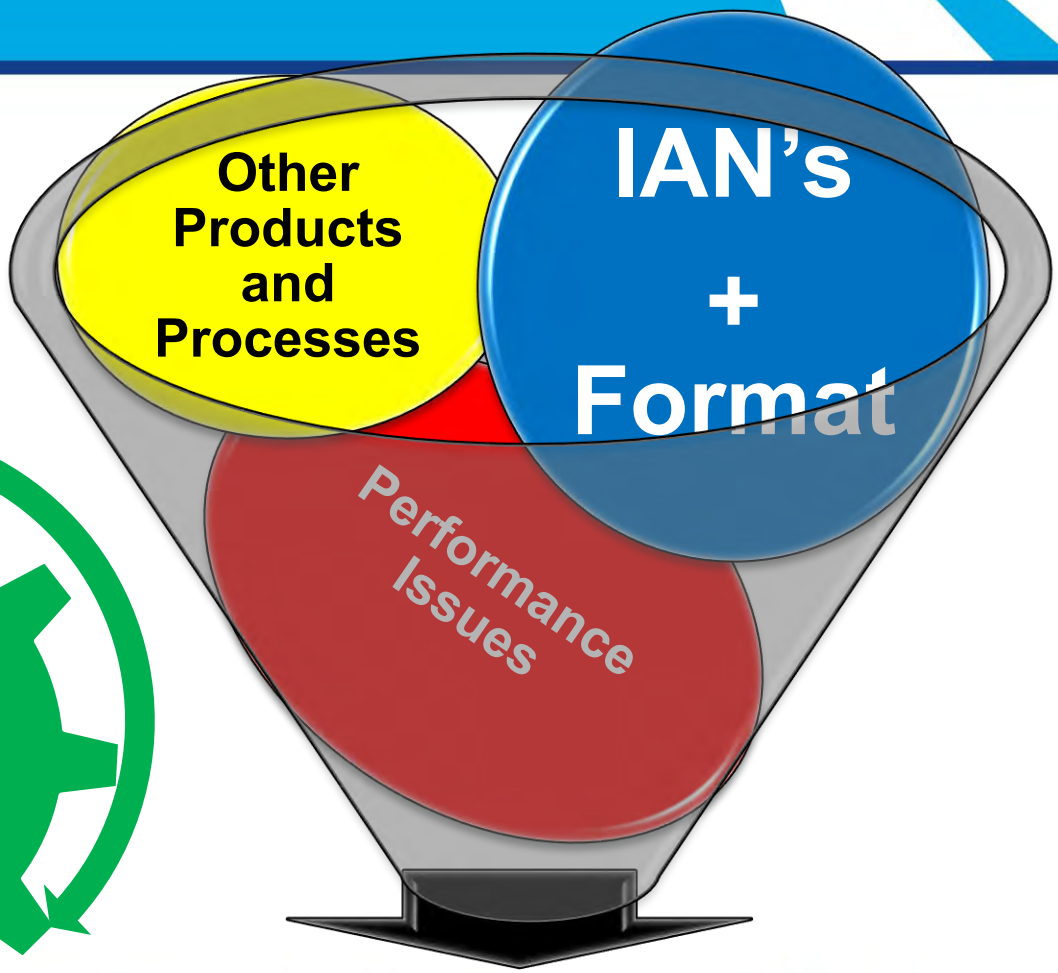
Why Change?

"*We can't solve problems by using the same kind of thinking we used when we created them, we have to start from new."*

Einstein

Why Change





Revised Series 900


Performance Issues

Why Change

- Contract Perspective

- Lack of transparency in test results
- Difficulty in resolving failures in timely manner
- Lack of understanding between “asphalt as a product” and “finished works incorporating an asphalt product”
- Discontinuity between production and site
- Investigation procedures disproportionate to majority of discrepancies

Why Change

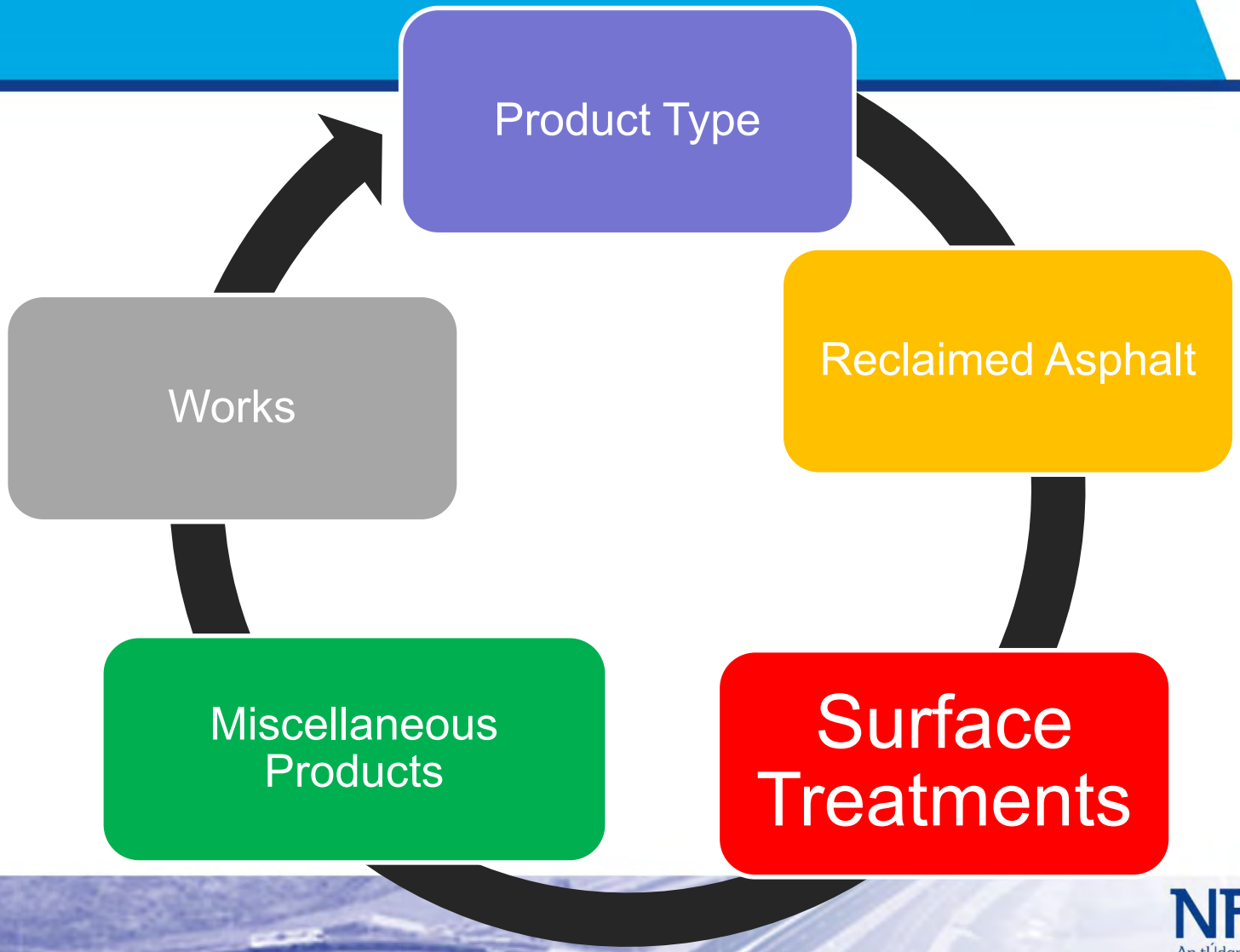
- Design Perspective
  - Ability of site specific design
  - Suite of materials with common approach
  - Better demonstration of value for money in chosen material
  - Analytical vs empirical basis
  - Easier to exploit material properties

Why Change

- Understanding DoP and CE Marking

- CE Marking introduced to regulate mixtures (but not the Works)
- Making a declaration and compliance sits with the manufacturer
- Legal requirement with penalties for non compliance
- Families of Products / Processes

Key Changes


Product Type
Reclaimed Asphalt
Surface Treatments
Miscellaneous Products
Works

Key Changes

AC, HRA, SMA, PA	→	Performance Spec; Higher BC
Reclaimed Asphalt	→	Lower Quantities, Min Virgin BC
Surface Treatments	→	Micro Surfacing, Surface Dressing, HFS, Retexturing
Miscellaneous Products	→	Geotextiles, LEBM, PRM, Localised, and ERM.

Works

Key Changes - The Works

- Section 10.1 Asphalt Products

- General
- Preparation
- Works Proposals
- Transport
- Bond Coat
- Weather Conditions
  - Specific to the various products
- Temperature
- Laying
  - **Specific to the various products**

- Joints
- Compaction Control
  - **specific to the various products**
- Performance requirements
  - **specific to the various products**
- Surface Macrotexture
- Trafficking
- Aftercare
- Reinstatement of core holes

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Objective

- Make the Series easier to negotiate.
- Make a clear distinction between products and the works
- ‘As laid’ performance testing needed to confirm that the products supplied are consistent with the declared performance
- The revision is part 1 of a 2 stage process

Objective (Stage 2)

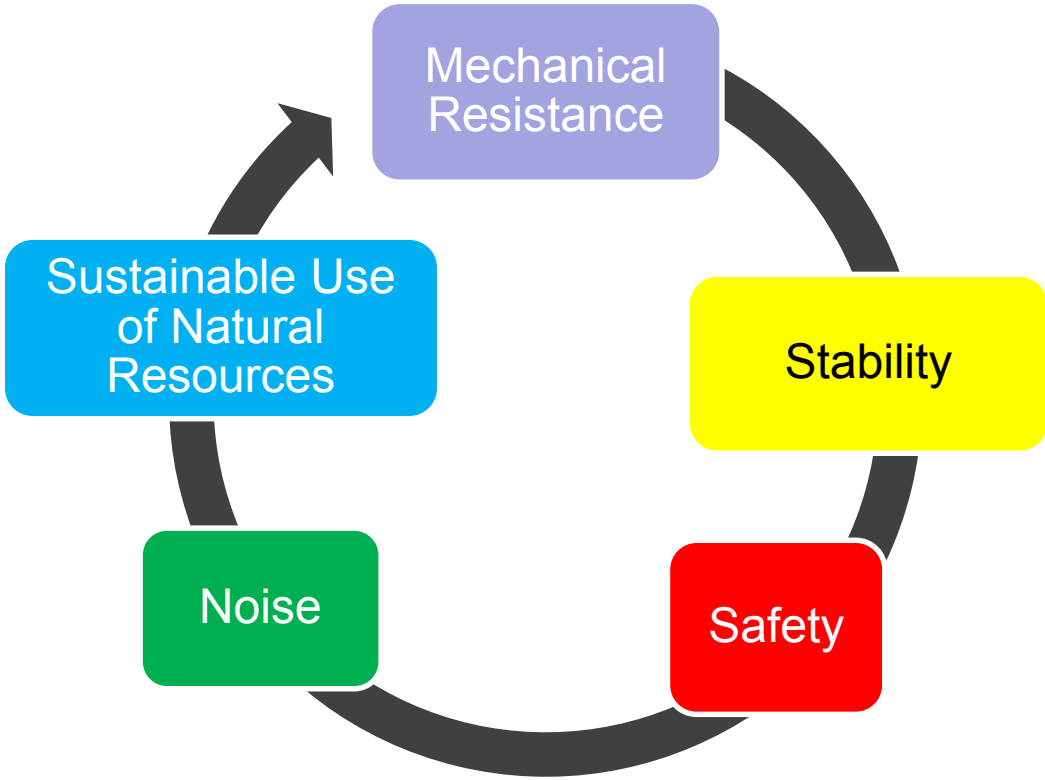
- Testing information gathered from the works
- Assess the data gathered from the works to determine and set future achievable performance criteria
- Also to ensure the products will perform to meet the CPR Basic Requirements for Construction Works which include,

Basic Requirements for Construction Works

Fit for the Intended Use

+

Durable for its expected life



New Series 900 IAN 10 / 14

- 1 – General Requirements and Definitions
- 2 – Preparatory Work
- 3 – Asphalt Concrete Products
- 4 – Hot Rolled Asphalt Products
- 5 – Stone Mastic Asphalt Products
- 6 – Porous Asphalt Products
- 7 – Surface Treatment
- 8 – Miscellaneous Products and Processes
- 9 – Reclaimed Asphalt
- 10 – Works
- 11 – Tables
- 12 - Enquiries

ROAD PAVEMENTS – BITUMINOUS BOUND MATERIALS

Contents

904 Not Used

905 Not Used

906 Dense Base and Binder Course Asphalt Concrete (Recipe Mixtures)

1 Dense base and binder course asphalt concrete recipe mixtures shall be asphalt concrete conforming to IS EN 13108-1, the requirements specified in this Clause and Appendix 7/1. The mixture designation shall be one of the following:

(i)	AC 32 dense base	40/60 rec
(ii)	AC 32 dense base	70/100 rec
(iii)	AC 32 dense bin	40/60 rec
(iv)	AC 32 dense bin	70/100 rec
(v)	AC 20 dense bin	40/60 rec
(vi)	AC 20 dense bin	70/100 rec
(vii)	AC 32 HDM bin	40/60 rec
(viii)	AC 32 HDM base	40/60 rec
(ix)	AC 20 HDM bin	40/60 rec

2 When the mixture designation is not specified in Appendix 7/1, the mixture selected by the Contractor shall be notified to the Employer's Representative prior to its use in the Works.

Composition

3 Evaluation of conformity shall be carried out in accordance with IS EN 13108 -1 which requires specifications to be presented as a grading envelope within which the producer's declared target grading must fall. The grading specification in Table 9/3 gives single point and/or very narrow envelope gradings, which, in combination with the tolerances from IS EN 13108-21 result in overall grading envelopes similar to those previously specified in BS 4987.

4 For base and binder course mixtures, the target and/or minimum binder content is defined in Table 9/3.

5 The aggregate grading of the target composition shall fall within the envelope given in Table 9/3.

Aggregate

6 The coarse aggregate shall consist of crushed rock complying with Clause 901.4.

7 The fine aggregate shall comply with the requirements of IS EN 13043.

8 The fine aggregate shall be either a 0/2 mm or a 0/4 mm aggregate fraction and be of one of the following types:

(a) crushed rock fines produced from coarse aggregate defined in IS EN 13043 or

(b) sand; or

(c) a mixture of a) and b).

9 If added filler is used in dense mixtures it shall consist of crushed rock, crushed slag, hydrated lime, cement (CEM I or CEM II complying with IS EN 197-1).

10 All aggregate shall be in a surface dry condition prior to mixing.

Binder

11 The binder shall be petroleum bitumen of paving grade 40/60 or 70/100 Pen complying with IS EN 12591 as described in Appendix 7/1.

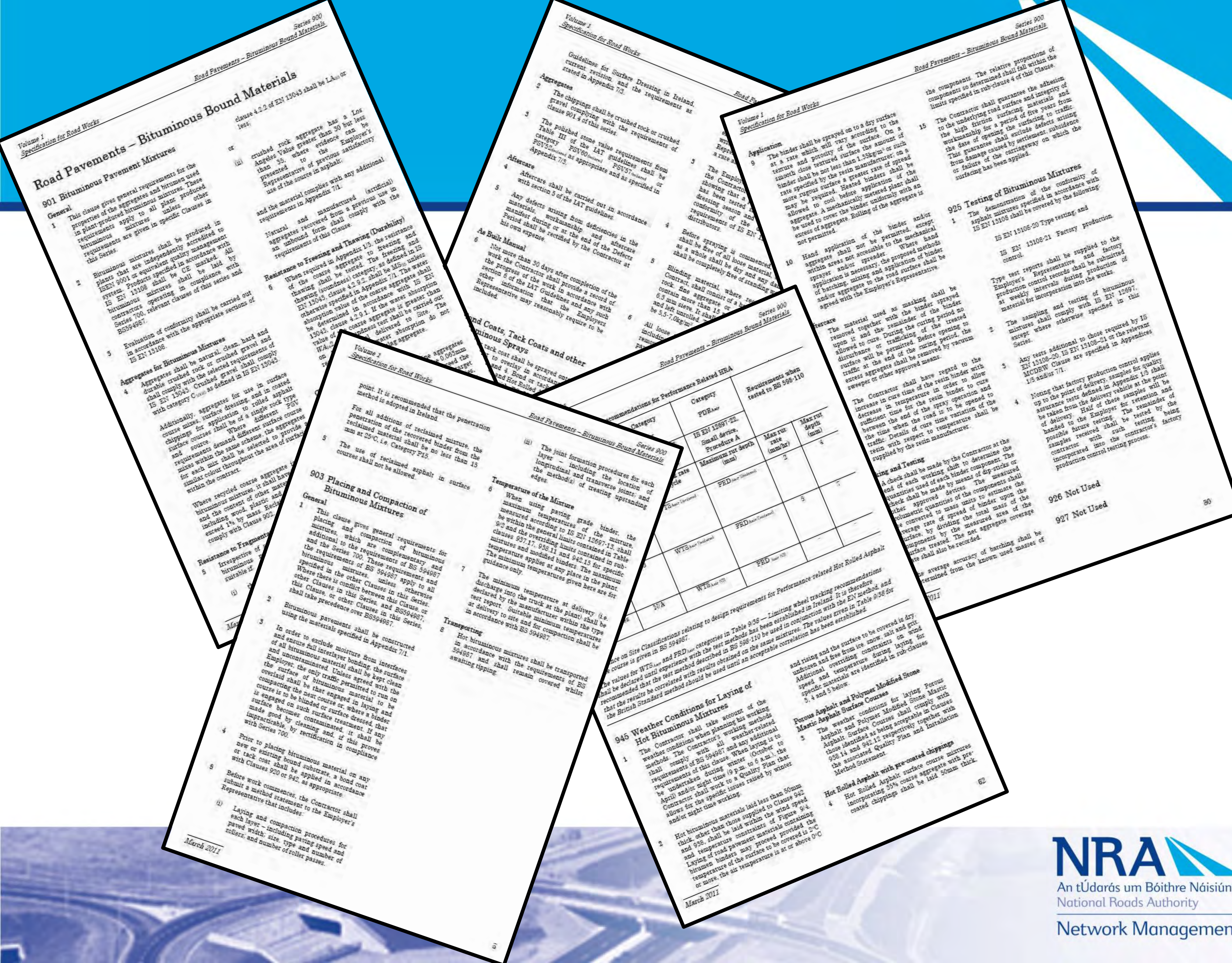
Compaction Control Procedures

12 The compaction level of base and binder course macadams shall be continuously assessed using an indirect density gauge in accordance with BS 594987 Clause 9.4.2 with readings taken at 20m intervals in alternate wheel tracks. Gauge readings shall also be taken at each core location specified in sub clauses 16 and 18. Each gauge shall be individually calibrated on each mixture from each mixing plant and the calibrations shall be continually checked and updated based on correlations between gauge readings and core densities at the same locations.

13 For each location, the in situ void content shall be determined in accordance with IS EN 12697-8 using the bulk density from the gauge reading and a maximum density taken from the mixture type testing data and updated with values from testing in accordance with sub-Clause 15.

14 The average in situ void content calculated from any six consecutive indirect gauge readings shall not exceed 7%.

15 In the event of a failure to meet the requirements in sub-Clause 14, cores shall be taken at each location and void contents determined as described in sub-Clause 20 and the evaluation of the extent of any non conformity shall be based on these. In the event of dispute or discrepancy between the



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New Series 900 IAN 10 / 14

Section 3 Asphaltic Concrete

- 3.1 Mixture Designations – “AC 32 dense base 40/60 des”
- 3.2 Constituent Materials - Binder, Aggregates, Filler, Reclaimed Asphalt, Additives.
- 3.3 Product Composition – General, Compositional Grading, Binder Content, Void Content, Water Sensitivity, Stiffness, Temperature.

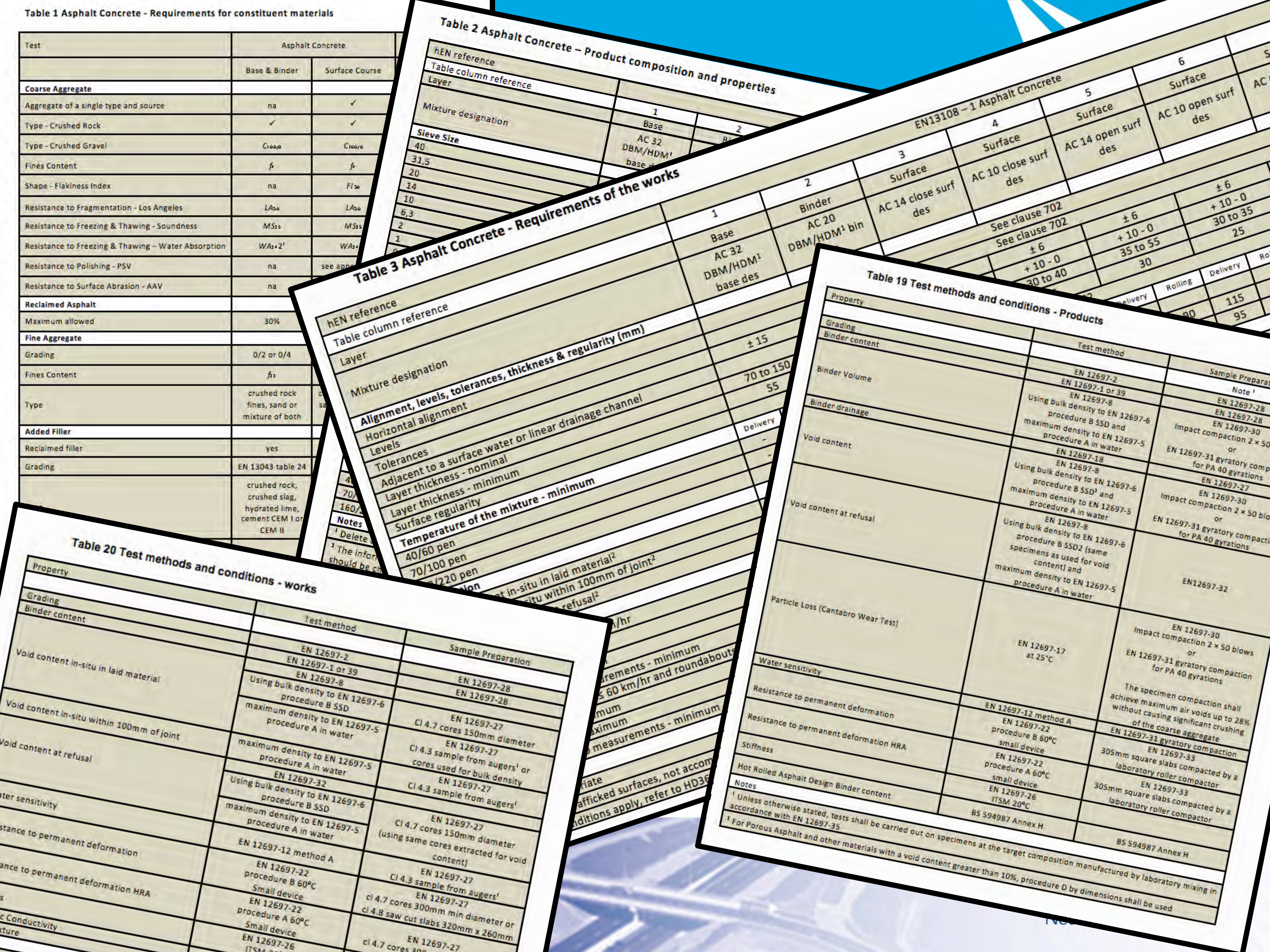

Table 1 Asphalt Concrete - Requirements for constituent materials

Test	Asphalt Concrete	
	Base & Binder	Surface Course
Coarse Aggregate		
Aggregate of a single type and source	na	✓
Type - Crushed Rock	✓	✓
Type - Crushed Gravel	$C_{100/0}$	$C_{100/0}$
Fines Content	f_4	f_4
Shape - Flakiness Index	na	FI_{30}
Resistance to Fragmentation - Los Angeles	LA_{30}	LA_{30}
Resistance to Freezing & Thawing - Soundness	MS_{35}	MS_{35}
Resistance to Freezing & Thawing – Water Absorption	$WA_{24}2$[1]	WA_{24} [illegible]
Resistance to Polishing - PSV	na	see app[illegible]
Resistance to Surface Abrasion - AAV	na	[illegible]
Reclaimed Asphalt		
Maximum allowed	30%	[illegible]
Fine Aggregate		
Grading	0/2 or 0/4	[illegible]
Fines Content	f_{22}	[illegible]
Type	crushed rock fines, sand or mixture of both	[illegible]
Added Filler		
Reclaimed filler	yes	[illegible]
Grading	EN 13043 table 24	[illegible]
	crushed rock, crushed slag, hydrated lime, cement CEM I or CEM II	[illegible]

Table 2 Asphalt Concrete – Product composition and properties

Table 3 Asphalt Concrete - Requirements of the works

Table 19 Test methods and conditions - Products

Property	Test method	Sample Preparation
Grading		
Binder content		Note[1]
Binder Volume	EN 12697-2 EN 12697-1 or 39 EN 12697-8 Using bulk density to EN 12697-6 procedure B SSD and maximum density to EN 12697-5 procedure A in water	EN 12697-28 EN 12697-28 EN 12697-30 Impact compaction 2 × 50 or EN 12697-31 gyratory comp for PA 40 gyrations
Binder drainage	EN 12697-18	
Void content	EN 12697-8 Using bulk density to EN 12697-6 procedure B SSD[1] and maximum density to EN 12697-5 procedure A in water	EN 12697-27 EN 12697-30 Impact compaction 2 × 50 blo or EN 12697-31 gyratory compacti for PA 40 gyrations
Void content at refusal	EN 12697-8 Using bulk density to EN 12697-6 procedure B SSD2 (same specimens as used for void content) and maximum density to EN 12697-5 procedure A in water	EN12697-32
Particle Loss (Cantabro Wear Test)	EN 12697-17 at 25°C	EN 12697-30 Impact compaction 2 × 50 blows or EN 12697-31 gyratory compaction for PA 40 gyrations The specimen compaction shall achieve maximum air voids up to 28% without causing significant crushing of the coarse aggregate
Water sensitivity	EN 12697-12 method A	EN 12697-31 gyratory compaction
Resistance to permanent deformation	EN 12697-22 procedure B 60°C small device	EN 12697-33 305mm square slabs compacted by a laboratory roller compactor
Resistance to permanent deformation HRA	EN 12697-22 procedure A 60°C small device	EN 12697-33 305mm square slabs compacted by a laboratory roller compactor
Stiffness	EN 12697-26 ITSM 20°C	
Hot Rolled Asphalt Design Binder content	BS 594987 Annex H	BS 594987 Annex H

Notes
[1] Unless otherwise stated, tests shall be carried out on specimens at the target composition manufactured by laboratory mixing in accordance with EN 12697-35
[2] For Porous Asphalt and other materials with a void content greater than 10%, procedure D by dimensions shall be used

Table 20 Test methods and conditions - works

Other Documents

- **HD 23 Pavement Design and Maintenance General Information**
- HD 24 Traffic Assessment
- HD25 /26 Pavement and Foundation Design
- **HD 300 Design of Bituminous Mixtures, Surface Treatments, and Misc Products / Processes**
- HD 28 Management of Skid Resistance
- **HD 30 Pavement Asset Repair and Renewal – Scheme Approval**
- **HD 31 Pavement Asset Repair and Renewal Principles**
- **HD 36 Surface Materials for New and Maintenance Construction**
- **HD 37 Bituminous Mixtures, Surface Treatments Materials and Techniques**
- **HD 301 Approval of Specific Products Manual**

Other Documents

- Series 000, and Series 100 incl Notes for Guidance
- Series 700 and NG Series 700 Notes for Guidance
- NG Series 900 Notes for Guidance
- Method of Measurement Series 700,
- RCD's / 700 /1 and 6

"Anyone who has never made a mistake has never tried anything new." *Einstein*

Thank you

Questions?

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Specific changes
to
NRA Design, MCDRW Series 900

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Design Issues
Empirical Mixes

In 1939 Road Research Laboratory in UK carried out a trial of 700 mixes with differing compositions

This lead to BS1241 for tar macadams in 1945 and BS 1621 for bitumen macadams in 1950

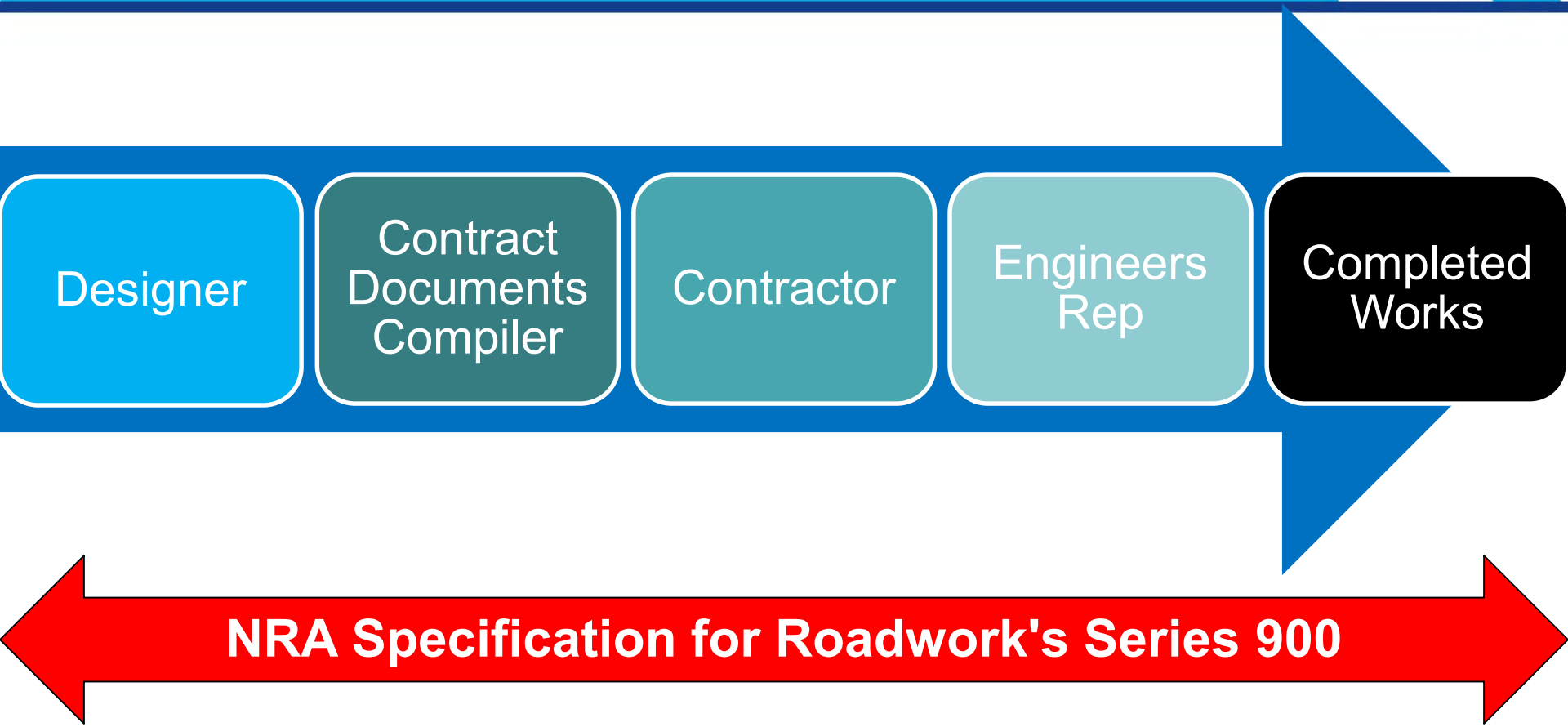
The specifications evolved into BS 4987 and BS594 upon which current NRA 900 series is based

Design Issues
Empirical vs Analytical Design

Based on experience accumulated in practice vs engineering principles of performance

Limited in scope to the circumstances included in the trial vs theoretical analysis of mechanical properties capable of dealing with any design situation

The Process


Designer
Contract Documents Compiler
Contractor
Engineers Rep
Completed Works
NRA Specification for Roadwork's Series 900

Specific Responsibilities
Designer

Traffic loading ; Constraints Study

Consult the DMRB

Select appropriate materials

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

Specific Responsibilities
Contract Documents Compiler

Complete Contract Specific Documents

Completes Appendices to the Specification 1/5, 7/1 etc

How the Works meet the designers requirements

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

Specific Responsibilities
Contractor

Find a Producer

Demonstrate the material is compliant

Organise the works & arrange for insitu testing to be completed

Fit for INTENDED USE & DURABLE for EXPECTED LIFE

Specific Responsibilities
Producer

- Type Testing per design
- Declare the Performance of the design based on the mechanical properties of that design (not just the B/C and Grading)
- CE Mark the product.
- Test Results
- TAIT's

Specific Responsibilities
Employers Representative

Oversees Translation of the Designers requirements into the end product

Documentation demonstrating material compliance

Perceptible Properties

Pavement performance consistent with Certification

Fit for its **intended Use** & **Durable** for **Expected** Life

HD 23/15 Use of Vol 7

- Volume 7 of the NRA DMRB consists of a Series of Linked Documents
- Mandatory with regard to Pavement Assessment
- HD 23 provides an introduction and a clear chart of the Contents of each part of Volume 7.

HD 37 Bituminous Mixtures, Surface Treatments and Misc Products and Processes

- Introduction
- Geotextiles and Geotextile
- Pavements
- Broken Chippings

- Not a Technical Document
- Provides General Information associated with individual Products / Processes
- To allow the designer to make an informed choice

HD 300 Design of Bituminous Mixtures, Surface Treatments and Misc Products and Processes

- Introduction
- Bituminous Mixtures
- Microsurfacing
- Surface Dressing
- High Friction Surfacing
- Low Energy Bound Mixtures
- Geotextiles and Geotextile-related Products
- Retexturing
- Permanent Repair Material Systems and Localised Repair Material Systems
- Emergency Repair Material Systems
- References
- Enquiries

- Having chosen the appropriate product / process for the Pavement design
- This Document sets out technical design of the product.
- In terms of its essential requirements

HD 301 Approval of Specific Products

- Introduction
- High Friction Surfacing
- Low Energy Bound Mixtures
- Retexturing
- Permanent Repair Material Systems and Localised Repair Material Systems
- References
- Enquiries
- Non Harmonised Standards
- Approval Process
- prTAITS

HD 30 Pavement Asset Repair and Renewal Scheme Approval

- Introduction
- Pavement Asset Repair and Renewal Scheme Approval Process
- Selection of PARR Schemes
- Data Collection
- Pavement Asset Repair and Renewal Proposal
- Procurement
- Monitoring of the Pavement Repair and Renewal Works
- **Close Out of PARR Schemes**
- Emergency and Isolated Pavement Repairs
- References
- Enquiries
- **Appendix**
- Template for the PARR Scheme Proposal
- Short Form PARR Proposal for Emergency and Isolated Pavement Repairs
- Templates for NRA Regional Management Consents and Approvals
- **Templates for PARR Scheme Close Out Information**

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HD 31 Pavement Asset Repair and Renewal Principles

- Introduction
- Review of Data from the NRA Pavement Asset Management System
- Visual Inspection Report
- Scheme Level Surveys and Investigations
- Interpretation and Analysis of Data
- Pavement Surface Treatment Options
- Structural Strengthening of the Pavement
- Pavement Drainage
- References
- Enquiries
-

- **Appendix**
- NRA Pavement Asset Management System
- Falling Weight Deflectometer Surveys and Analysis
- Coring and Trial Pits
- Dynamic Cone Penetrometer
- Laboratory Testing
- Ground Penetrating Radar
- Carriageway Pavement Defect Types

Key Message

Consistency	Looking for consistency in the design /made / laid / performance cycles of pavements
Data Gathering	Gathering the as laid information will help to determine future specification needs
Testing	Testing of the works is imperative to feed in to the information loop

Everybody has a role

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Thank you

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