

Cold recycled bound material (CRBM)

28th June 2023

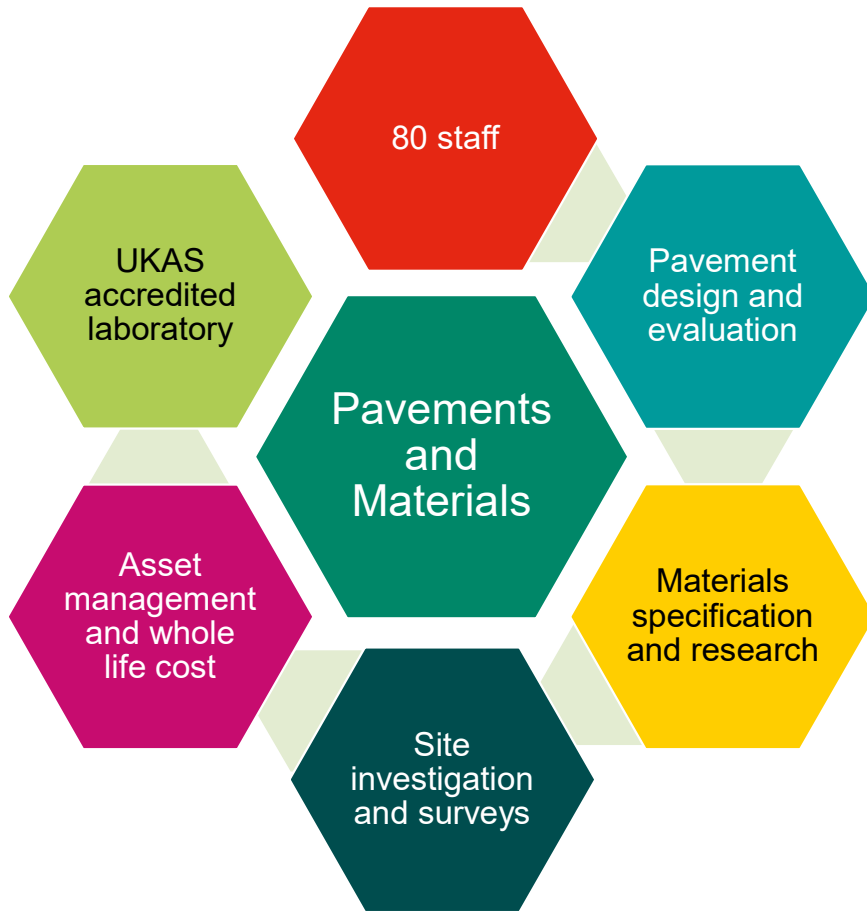
Joe Poulson

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Outline of today's session

1. Introduce the types of Cold Recycled Bound Material
2. CRBM production methods
3. CRBM installation
4. Why use CRBM?
5. CRBM in pavement design
6. In service performance and future updates to the DMRB

AECOM Pavement Design, Asset Management and Operations



We are a one stop shop!



Recent and ongoing pavement projects

National Highways

- Future Specification for Highway Works (SHW)
- Design Manual for Roads and Bridges (DMRB)
- Long term monitoring of innovations on the strategic road network:
 - Cold recycled bound material
 - Warm mix asphalt
 - Geosynthetics

Transport for London

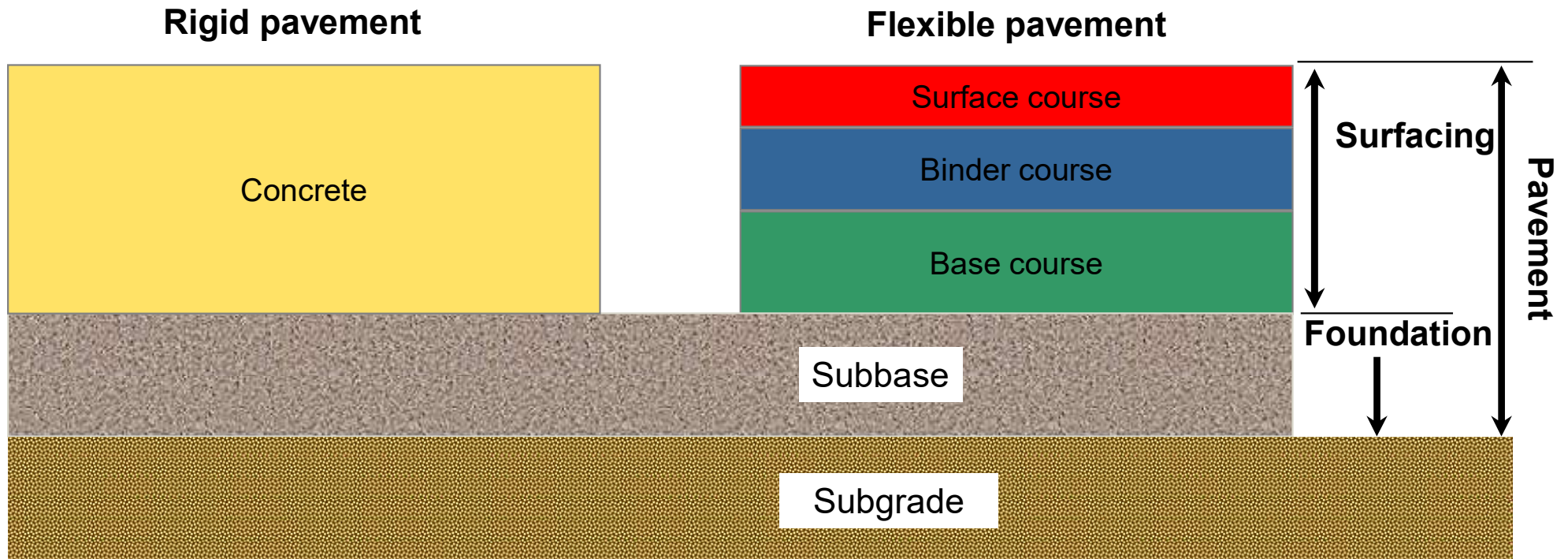
- Research on reflective cracking of asphalt over concrete

Defence Infrastructure Organisation (DIO)

- Updating asphalt standards
- Updating DIO TS06 pavement maintenance manual



What is a typical pavement structure?



Cold recycled bound material (CRBM) is a base course (structural layer), never a surface course.

What's in asphalt?

Coarse aggregate



30 - 70%

£15 - £50 /T

Fine aggregate



20 - 40%

£15 - £50 /T

Filler



< 9%

Bitumen



4 - 8%

Additives



0 - 1%

Surface course

Binder course

Base course

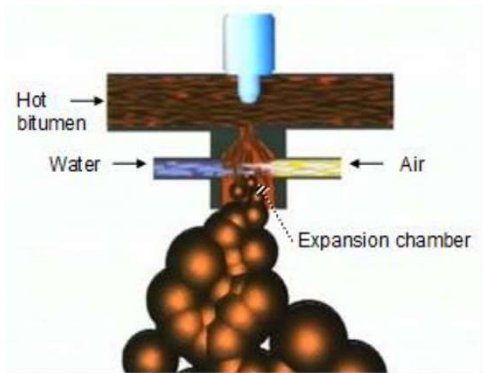
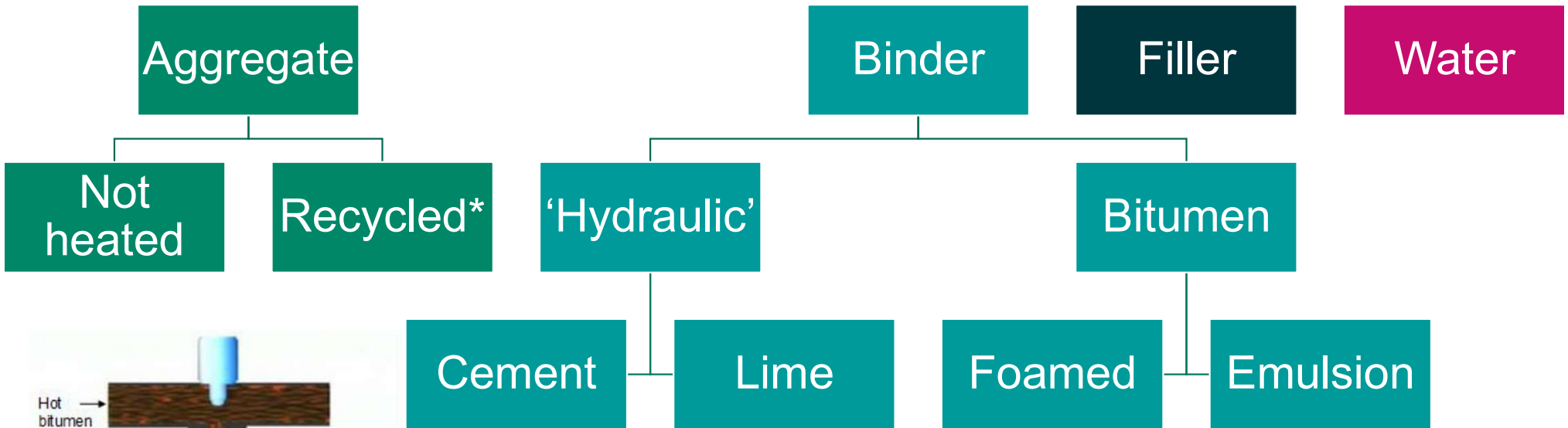


Smaller aggregate

Larger aggregate







£600 - £1000+ /T

What is Cold Recycled Bound Material (CRBM)?



*Normally

CRBM families

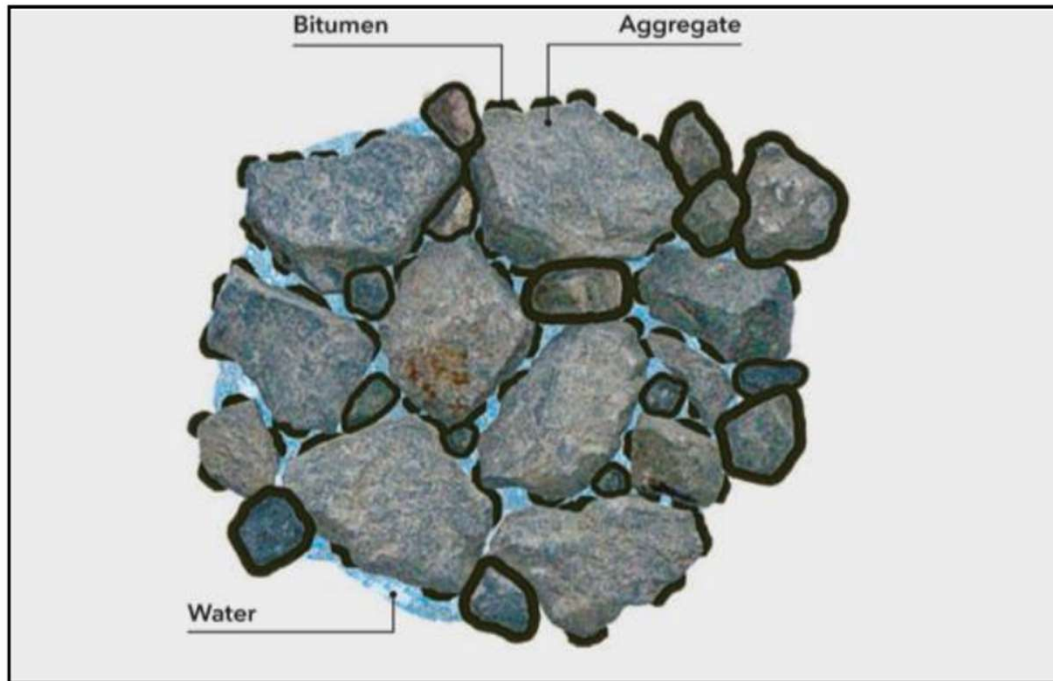
	No bitumen	Bitumen
Lime	<p>Slow Hydraulic (SH)</p> 	<p>Slow Viscoelastic (SVE)</p>  
Cement	<p>Quick Hydraulic (QH)</p> 	<p>Quick Viscoelastic (QVE)</p>  

Rigid material (like HBM)

Flexible material (like asphalt)

Photo: Wirtgen

CRBM – What it looks like (QVE)



Bitumen “Spot Welds” between Aggregate Particles

Photo: Wirtgen

CRBM - How is it made?

Ex situ 'Clause 948'



Photos: Wirtgen, OCL and SPL.

In situ 'Clause 947'



In situ 'down cut' process

Recent innovation, recycling machine feeds directly into a paving machine, removing the need to 'grade' the material to level.



Photos: AECOM and Wirtgen.

—
In situ 'down cut' process



Photo: Wirtgen

CRBM installation



Photos: AECOM and SPL

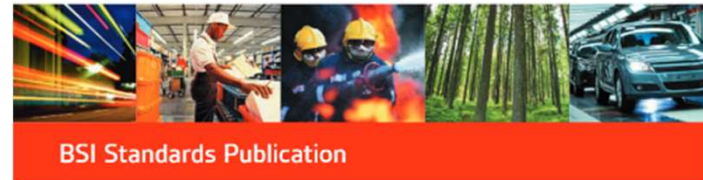
Standards – BS 9228

Aspects covered:

- Materials
- Mix design
- Production
- Installation
- End product testing

It doesn't cover pavement design elements.

BS 9228:2021



Recycling of roads and other paved areas using bitumen emulsion, foamed bitumen or hydraulic material — Materials, production, installation and product type testing — Specification

bsi.

Why use CRBM?

Treatment of tar bound material

Decarbonisation

- ~90% recycled content
- No heating
- Less or no transport costs and emissions
- Less binder / cement

Cost benefits

Proven performance

Potential limitations with CRBM

Availability

- For ex situ, there may be limited available material locally unless you set up a dedicated plant.

Product

- Protect it and overlay it as soon as possible.
- Early life trafficking (~24 hours) can cause deformation.
- Where there is cement, this needs to cure (apply a bond coat to retain water).

Seasonality

- Cold weather will disrupt the curing process.
- Rain will disrupt the curing process.

Design of CRBM QVE to DMRB CD 226

CD 226 refers to TRL 611.

Max 30 million standard axles (msa). Minimum asphalt thickness 20 mm.

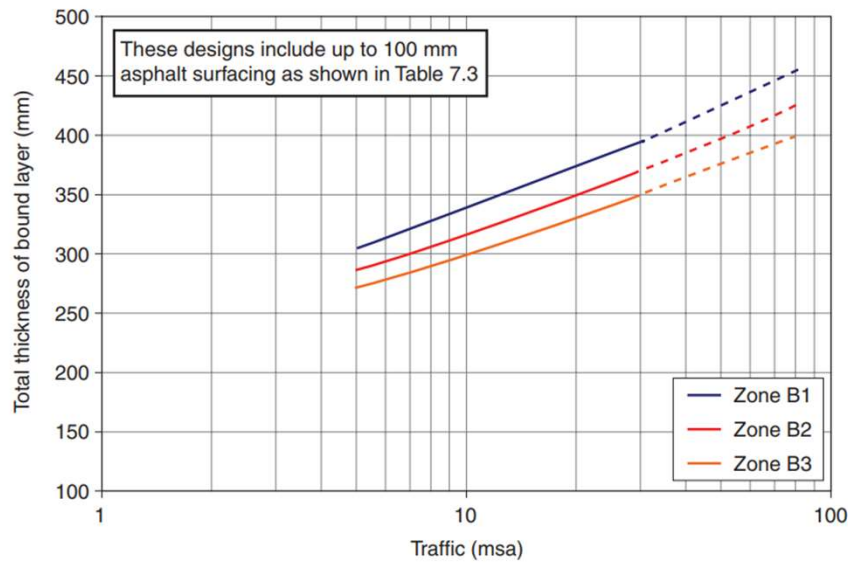
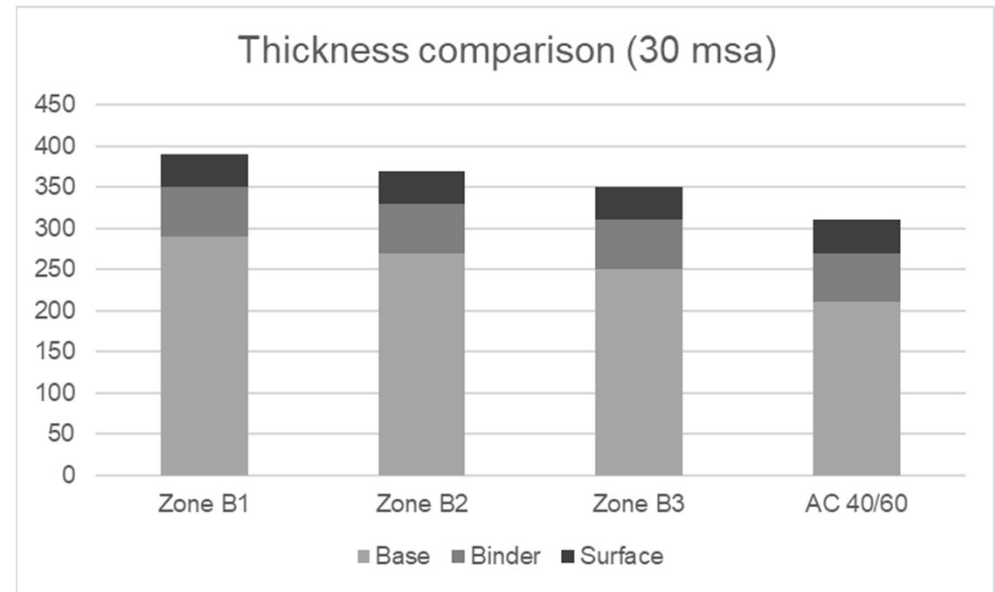


Figure 7.8 Design curves for bitumen bound cold recycled material (Foundation Class 2)



CRBM In service performance review and DMRB updates

Context

Most roads on the SRN have more than 30 msa traffic over a 40-year period. DMRB limits CRBM to 30 msa due to lack of empirical evidence (road trials).

Cold recycled designs using TRL report 611

- 5.2 Pavement designs containing cold recycled base material shall only be used for a design traffic of 30 msa or less.

Objectives

1. Review existing condition based on survey data.
2. Based on findings from the review:
 - a) Establish a new upper msa limit for CRBM.
 - b) Develop standard designs for 30 msa and beyond.

In service performance – structural condition and surface history

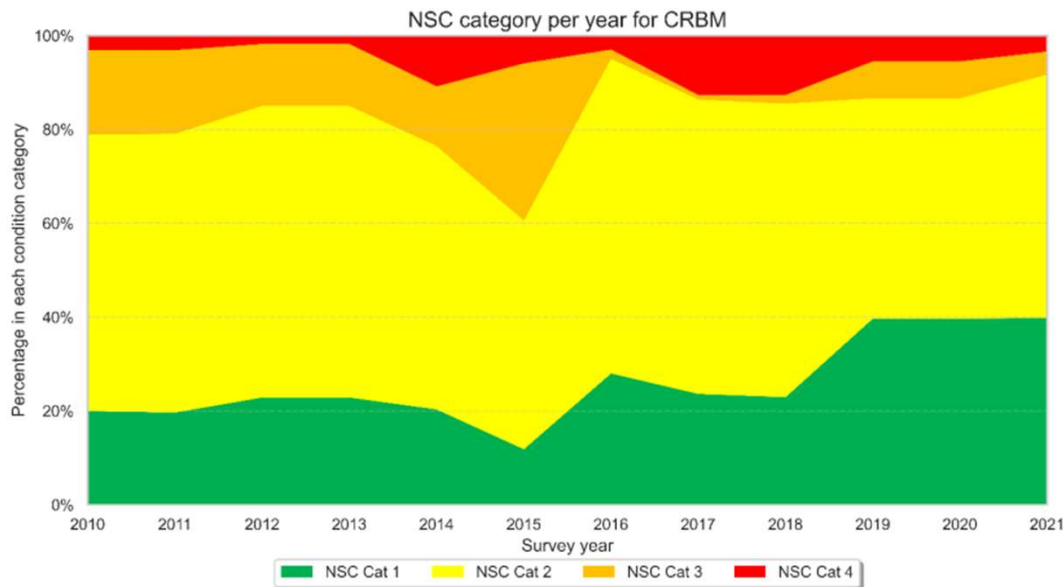
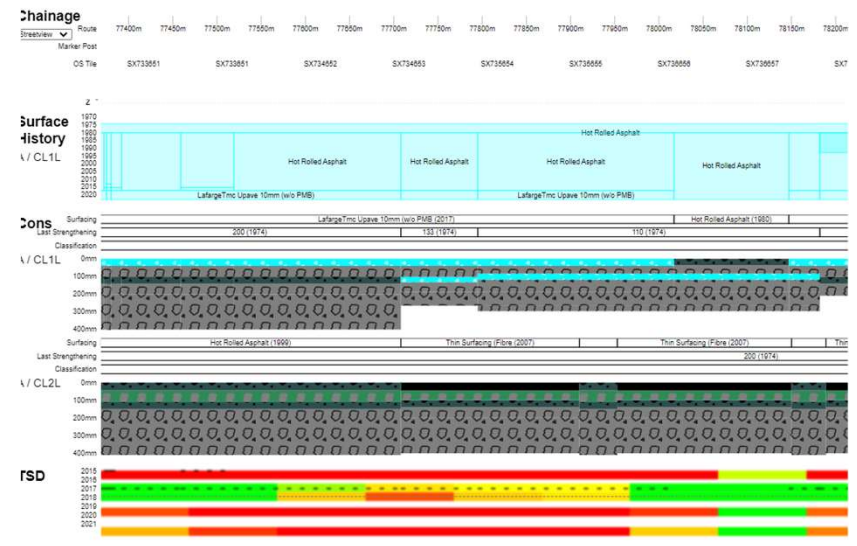


Figure 3.1 - NSC Category per year for 100 m sub-lengths of CRBM



In service performance – structural integrity and surface condition

Age (years)	NSC Category of site (2021)				Number of times lengths of site (%) resurfaced			Avg. surfacing life (years)
	1	2	3	4	Zero	Once	Twice	
20	89%	11%	0%	0%	0%	86%	14%	14
17	15%	72%	7%	5%	0%	50%	50%	8
15	55%	45%	0%	0%	100%	0%	0%	15
16	95%	5%	0%	0%	100%	0%	0%	16
13	49%	38%	9%	4%	90%	10%	0%	11
-	61%	34%	3%	2%	29%	48%	23%	11



In service performance – findings

Cumulative traffic (msa)	Current indicative CRBM condition	Outline design life expectation (msa) ^[1]
34	'Satisfactory' structural condition.	30 msa on bound FC3
35		80 msa on unbound FC2
32		80 msa on unbound FC2
19		<30 msa on bound FC3

Recommendation – Upper limit on msa can be increased from 30 msa.

Thanks for listening.

Questions?

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