BRINGING BSM TECHNOLOGY TO THE WORLD

TECHNOLOGY UPDATE: RECYCLING TECHNOLOGY/BITUMEN STABILISATION

Introduction to Bitumen Stabilised Materials BSMs / Why Recycle

Kim Jenkins

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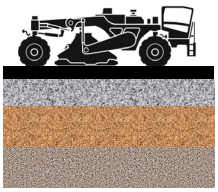
WHAT CAN YOU EXPECT AS A TAKE-AWAY?

- Why create a BSM base layer?
- Pavement Evaluation and Sustainable Solutions
- Project Selection
- Cold Recycling Technology – benefits?
- New methods for Application
- Enviro and Economic Benefits?



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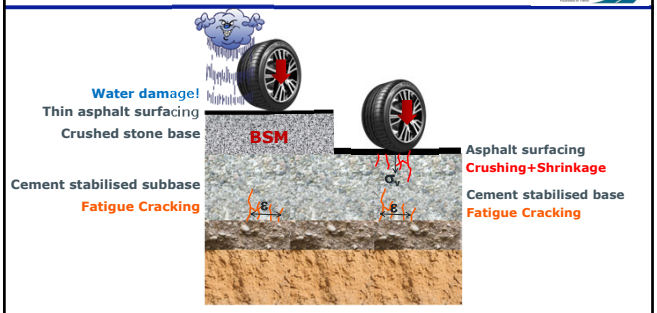
REMEMBER: FAILURE MECHANISMS!!



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GLOBAL ROAD INFRASTRUCTURE

- Approximately 65 million km of global roads, with 20 million km surfaced roads
- Assuming average pavement life of 20 years
  - 1 million kms road need rehab per year
  - No allowance for growth
- Periodic Maintenance (75% asphalt)
  - 15m wide x 50mm thick asphalt
  - Approx. 500 x $10^6 m^3$ RAP generated/yr
  - So, >2x10^9 tons new HMA is needed/yr
- **IS THIS SUSTAINABLE?? NOOOO!!**

Rank	Country	Road length (km)	Surfaced (%)
	WORLD	64 285 009	
1	United States	6 586 610	65
2	India	4 689 943	
3	China	4 237 500	
4	Brazil	1 751 868	12.5
5	Japan	1 210 251	
6	Canada	1 042 300	51
7	Russia	982 000	
8	France	951 200	
9	Australia	822 217	
10	South Africa	750 000	32
11	Spain	681 298	
12	Germany	644 480	98
13	Sweden	572 900	
14	Italy	487 700	
15	Indonesia	437 759	
16	Turkey	426 908	
34	Dem Rep of Congo	153 457	
45	Zimbabwe	97 267	
54	Zambia	91 440	
55	Tanzania	91 049	
70	Madagascar	65 663	
80	Angola	51 429	
72	Namibia	64 189	
98	Mozambique	30 331	
104	Botswana	25 798	

(Wiki, 2017)

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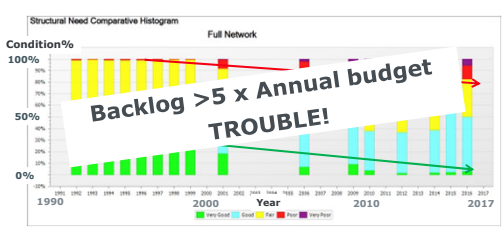
DETERIORATION TRENDS IN ROAD INFRASTRUCTURE



(Southern Africa, 2017)

Do you know: More than 20% of America's roads are in poor condition?

(BBC, 2021)

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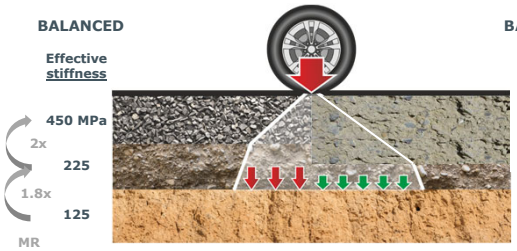
MATERIAL STABILISATION

Granular layers find balance in a pavement structure



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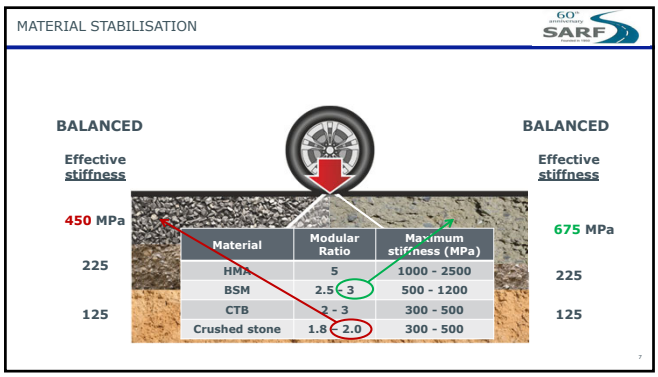
MATERIAL STABILISATION
BALANCED
Effective stiffness
450 MPa
225
125
BALANCED
Effective stiffness
675 MPa
225
125
Material | Modular Ratio | Maximum stiffness (MPa)
HMA | 5 | 1000 - 2500
BSM | 2.5 - 3 | 500 - 1200
CTB | 2 - 3 | 300 - 500
Crushed stone | 1.8 - 2.0 | 300 - 500

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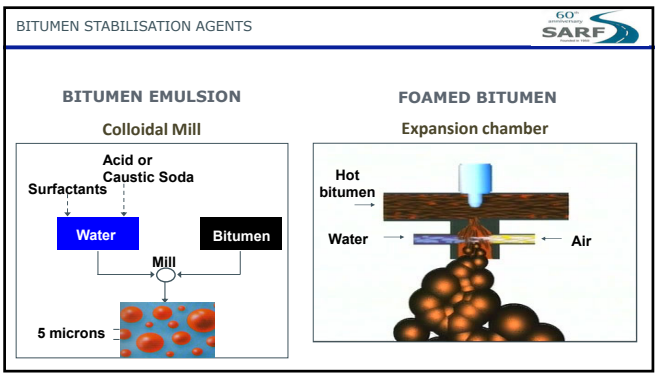
BITUMEN STABILISATION AGENTS
BITUMEN EMULSION
Colloidal Mill
Acid or Caustic Soda
Surfactants
Water
Bitumen
Mill
5 microns
FOAMED BITUMEN
Expansion chamber
Hot bitumen
Water
Air

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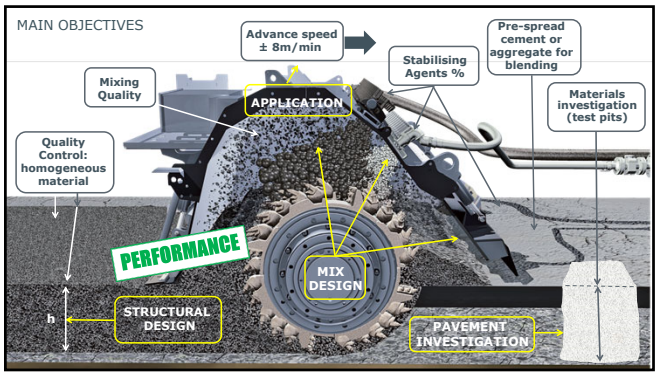
MAIN OBJECTIVES
Advance speed ± 8m/min
Pre-spread cement or aggregate for blending
Stabilising Agents %
Mixing Quality
APPLICATION
Materials investigation (test pits)
Quality Control: homogeneous material
PERFORMANCE
MIX DESIGN
h
STRUCTURAL DESIGN
PAVEMENT INVESTIGATION

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AGGREGATES FOR COLD RECYCLING
In situ Recycling < 50% RAP
Asphalt
In Situ Recycling 1990 onwards

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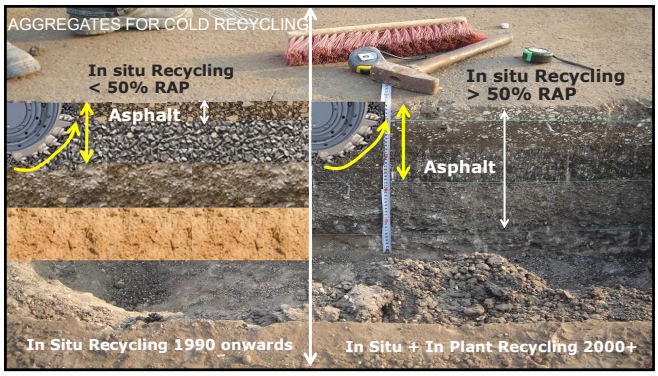
AGGREGATES FOR COLD RECYCLING
In situ Recycling < 50% RAP
Asphalt
In situ Recycling > 50% RAP
Asphalt
In Situ Recycling 1990 onwards
In Situ + In Plant Recycling 2000+

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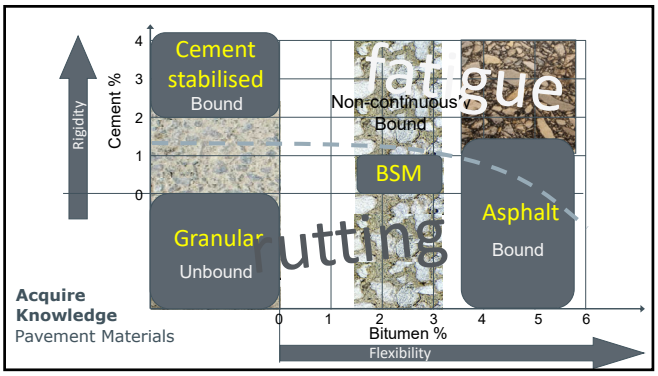
Rigidity
Cement %
4
3
2
1
0
Cement stabilised
Bound
Non-continuous
Bound
BSM
Granular
Unbound
Asphalt
Bound
fatigue
cutting
0
1
2
3
4
5
6
Bitumen %
Flexibility
Acquire Knowledge
Pavement Materials

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EVOLUTION OF BSM TEST METHODS

Compaction

1990

2010+

Testing

ITS

Triaxial

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COLD RECYCLING

In Place

How to select?

In Plant

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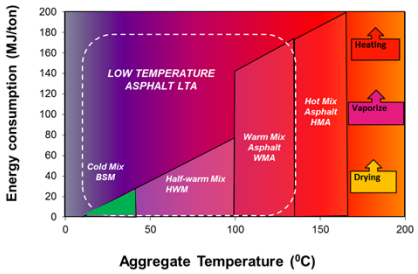
THE ENVIRONMENT



(Jenkins, 2000)

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BRINGING BSM TECHNOLOGY TO THE WORLD

PROJECT SELECTIONS & EXAMPLES

In Situ Recycling Project Examples

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SUITABLE PROJECTS FOR BSM TECHNOLOGY

- Long answer and a short answer….
- The short answer is anywhere and everywhere!
- BSM technology can be used on any project
  - rehabilitation, upgrade or greenfields;
  - where you have existing or new material available that includes;
    - RAP, Crushed Stone & Gravel
  - that has a CBR in excess of 40%
- Long answer…
- You will in all cases first need to do a careful and detailed project pre investigation to ensure that the implementation of BSM technology has the required benefits for all role players.

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ASPHALT OVERLAY VS IN SITU BSM

150mm in situ BSM + 40mm HMA

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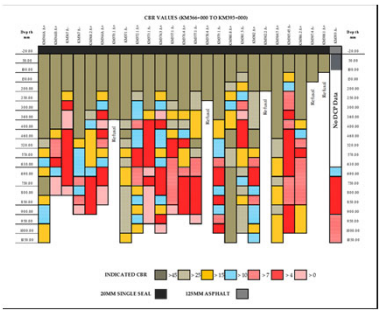
REALITY



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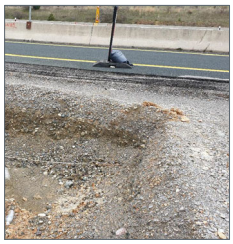
MILL AND FILL (INLAY) VS IN SITU BSM



150mm in situ BSM + 40mm HMA

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REALITY

170mm

225mm

165mm

165mm

270mm

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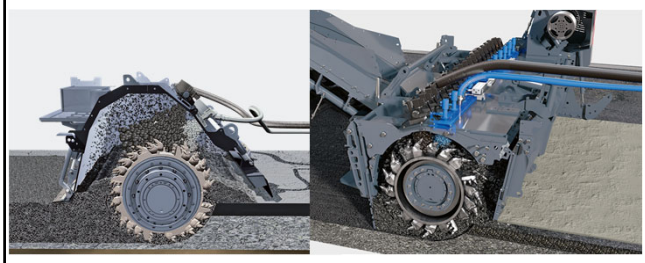
REALITY



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GET THE FULL PICTURE

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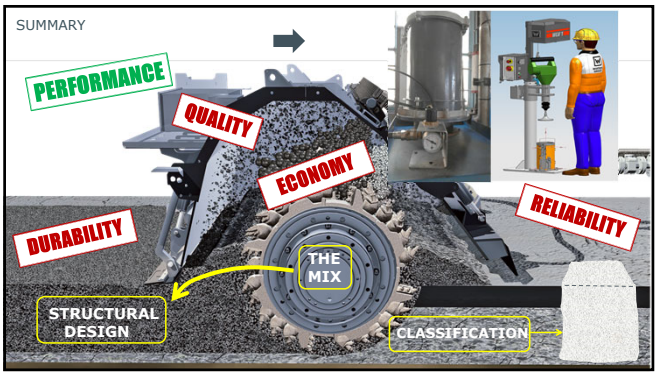
SUMMARY



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