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HIGH-MODULUS ASPHALT "EME" TESTING PROTOCOL

TG1 – BINDER REVISIONS

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OVERVIEW

EME – High Modulus Asphalt

- Performance Requirements

a) Design

b) Process and Acceptance Control

c) Performance feedback

TG1 - BINDER REVISIONS

CONCLUSIONS

SABITA MANUAL 33

- Performance Requirements - **Design**

Property	Test	No. of specimen	Method	Requirements	
				EME Class	
				Class 1	Class2
Workability	Gyratory compactor, air voids after 45 gyrations	3	ASTM D6925	< 10%	< 6%
Durability	Modified Lottman, TSR	6	ASTM D4867M	> 0,80	> 0,80
Resistance to permanent deformation	RSST- CH, 55°C, 5 000 reps	3	AASHTO T320	≤ 1,1% strain	≤ 1,1% strain
Dynamic modulus	Dynamic modulus at 10Hz, 15oC	3	AASHTO TP62	~~>14 Gpa~~ > 16 GPa	~~>14 Gpa~~ > 16 GPa
Fatigue	Beam fatigue test at 10Hz, 10°C, to 50% stiffness reduction	9	AASHTO T321	~~≥10^6 reps @300 µ~~ ≥ 10^6 reps @ 210 µε	~~≥10^6 reps @390 µ~~ ≥ 10^6 reps @ 260 µε
Richness modulus K	Calculation	each		≥ 2,5	≥3,4

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- Being a technology transfer product the brief to the CSIR was to find local test methods and equipment that can be used, matching the French performance requirements.
- The permanent deformation equipment selection was based on the RSST
- The French employ a wheel tracking device.

French wheel tracking test (large device)

Operating principle:

- The test specimen here is a parallelepiped plate 5 cm or 10 cm thick, depending on whether the application thickness of the mix happens to be less than or greater than 5 cm @ 5% Air Voids. This plate is submitted to a one-wheel traffic load (frequency: 1 Hz, load: 5 kN, pressure: 0,6 MPa) under severe temperature conditions (60°C). Max Rut Depth ≤ 7.5 mm

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What are the SA alternatives

1. **MMLS**

- The MMLS are widely distributed in SA at Commercial laboratories
- The equipment is well known and the results can be interpreted.

MMLS Operating Principals

- Tyre Pressure – 2.7 or 2.9kN
- Operational Temperature 50 or 60°C
- Standard is Dry method but can do a Wet test
- 100 000 Cycles
- Operational speed **7 200** load repetitions per hour, but can be reduced to **1 800** to simulate slow traffic loading

MMLS tests results

- National Run 3 MMLS sets 2 on the N3 Candela project and 1 on the BRT project in Pinetown

1. N3 Candela – the MMLS tests were done on 2 in-situ void contents. Mix - EME 2-14

DPG 1 MMLS3 @ 60 ± 2°C, 100,000 load repetitions, 2400 load repetitions per hour, ($^1/_3$ of full speed) wheel pressure 700 kPa, 2.9 kN wheel load, with no lateral wander. Cores were cut to a width of 105 mm. Transverse rut measurement were taken at 3 mm intervals. The tests were done wet.

a) In-situ void 1.7% rut depth measured - 2.46mm

b) In-situ void 3.2% rut depth measured - 2.20mm

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2. BRT – Beviss Road Pinetown – Mix - EME 2 – 20

a) In-situ Void 1.3%, rut depth measured - 1.96mm

DPG 1 MMLS3 @ 50 ± 2°C, 100,000 load repetitions, 2400 load repetitions per hour, wheel pressure 700 kPa, 2.7 kN wheel load, with no lateral wander. Briquettes were gyrated and cut to a width of 105 mm. Transverse rut measurement were taken at 3 mm intervals. The tests were done dry.

As can be seen we have tried out both protocols and both were within acceptable limits

2. HAMBURG

- The Hamburg is not so widely distributed as the MMLS.
- The equipment is much cheaper than the MMLS
- The test is much quicker than the MMLS
- It is a dual purpose test – it measure Rut and Stripping simultaneously

Hamburg Operating Principle

- A pair of samples are tested simultaneously. A sample is typically 26 cm wide, 32 cm long, and 40 mm deep. Its mass is approximately 7.5 kg.
- The samples are submerged under water at 50°C. although the temperature can vary from 25°C to 70°C.
- A steel wheel, 47 mm wide, loads the samples with 705 N The wheel makes 50 passes over each sample per minute.
- The maximum velocity of the wheel is 34 cm/sec in the centre of the sample.
- Each sample is loaded for 20,000 passes or until 20 mm of deformation occur. Approximately 6-1/2 hours are required for a test, and the sample is compacted to 7 ± 1% air voids.
- Max Rut Depth – will depend on the level of road as per the new asphalt design manual – EME will fall under level 3 – 4mm

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PROSESS AND QUALITY CONTROL

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PRODUCTION MIX PERFORMANCE VERIFICATION

STANDARD PRACTICE SHOULD PREVAIL – YES!!

- **PLANT TRIAL** – The manufacturer must prove he can produce the mix as per design. –

WHAT DO WE TEST?

- **Inputs and outputs as per the quality control with the addition of.**
  - **Durability – Modified Lottman**
  - **Dynamic modulus**
  - **Resistance to Permanent Deformation – not the RSST – MMLS / Hamburg –**
  - **This will take about a week.**

WE DO NOT TEST FOR FATIGUE, IT WILL TAKE TOO LONG –

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PAVING / ROAD TRIAL: –

- The paving contractor must prove he can place and compact the mix successfully.

WHAT DO WE TEST?

- **Inputs and outputs, but this time we don't do the performance tests again – you might want to move the Rut test to here instead of during the plant trial.**

❖ **DENSITY, JOINT ATENTION – RIDE-ABILITY!!**

Contrary to what you believe, this mix needs as little as possible field voids – the French developed this mix as a low void mix - **2% or less** – currently in SA we work at a **max 4%** - we need to reconsider.

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QUALITY CONTROL

WHAT DO WE TEST AND HOW DO WE APPROVE THE MIX ON THE ROAD?

- We cannot test the performance tests as Control or Acceptance testing – take too long and we don't have enough equipment or laboratories to do it.
- Suitable intervals must be agreed upon for rechecking performance requirements.

CONTROL YOUR INPUT TO ASSURE OUTPUT

INPUTS

1. Aggregates
   a) Virgin
   b) RA
2. Bitumen
   a) Virgin
   b) RA Bitumen

OUPUTS - VERIFICATIONS

- Combined mix gradation
- Binder content
- Richness Modulus
- Workability – Void content after gyratory compaction.
- Field Densities

HOW MANY?

- Standard number per day Lot size – results as per design with allowable mix tolerances

THAT IS IT!

WHAT MORE DO YOU NEED TO TEST?

PERFORMANCE FEEDBACK

- SOUTH COAST ROAD –CONSRTUCTED SEPT 2011
- EME 2-20

HOT OF THE PRESS 06-11-15

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LTPP SURVEY OCTOBER 15

- **6. Conclusions and recommendations**
- The performance of the EME trial section on South Coast Road has been successfully monitored over a period of four years. The performance monitoring was performed with respect to visual condition assessments, profile and texture measurements and FWD measurements. Based on the results contained in this report, the following conclusions can be drawn:
- □ It was estimated that during the four years monitoring period, the EME LTPP section carried approximately **19 million E80s without significant structural damage;**
- □ The LTPP monitoring results suggest that EME can withstand heavy traffic loading. This indicates that EME could provide an optimum solution for the design of heavily trafficked roads, and
- □ It is recommended that EME should be encouraged to be used on heavily trafficked roads in South Africa and elsewhere.

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OTHER PROJECTS

- **R104** – Rayton To Bronkhorstspruit.
- Sanral LTPP Section Constructed Jun 2013.
- Prof Wynand Steyn – reported that they are in process to compile a report.
- The sections are looking good visually.

EME HYBRID – LTPP Site HiMA

(Highly Modified Asphalt) – 35/50 Modified with EVA.

- **MAIN ROAD 448 / M7** Trials Constructed Aug 2011.
- Still in very good condition with no visual destress.

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- **N3** EB Cloete to Candela Completed May 2015 – all looks good

TG 1 BINDER REVISIONS

The latest revision of the TG 1-Third Edition - July 2015 is out and is available from the SABITA website.

- **Be assured every change was made after careful research and consideration.**
- **These guidelines are put in place to assist the South African industry and to assure that we use only top quality products in our industry.**
- **Please make sure you adjust all your pro forma documentation with the correct data. We are still seeing documents that specify the 2nd edition 2007 but have the values of the first edition.**
- **I don't have enough time to go through all the changes. Here are some of the changes made to the Homogeneous Modified binder guidelines.**
- **Some of the changes may seem insignificant but could have a major impact.**

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Property	Unit	Test Method	Class		
Before Ageing			**A-E1**	**A-E2**	**A-P1**
Softening Point	°C	MB-17	55-65	65-85	63-73
Elastic Recovery @ 15°C	%	MB-4	> 50	> 60	30 **– 50**
Dynamic Viscosity @ 165°C	Pa.s	MB-18	≤0,6	≤0,6	≤0,55
Storage Stability @ 180°C	°C	MB-6	≤5	≤5	≤5
Flash Point	°C	ASTM D92	≤230	≤230	≤230
After Ageing (RTFOT)					
Mass Change	%	MB-3	≤1,0	≤1,0	≤1,0
Softening Point (Min) ~~Difference~~	°C	MB-17	**53**	**63**	**61**
Elastic Recovery @ 15°C	°C	MB-4	>40	>50	-

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CONCLUSIONS

- EME – THE MIX OF THE FUTURE, MAKE TIME TO UNDERSTAND IT.
- PERFORMANCE BASED ASPHALT MIXES ARE HERE.
- IT WILL TAKE TIME TO ADJUST EMBRACE IT, IT IS THE RIGHT WAY TO GO.
- TECHNICAL GUIDELINES AND SPECIFICATION CHANGES ARE ALL FOR THE BETTER STAY IN TOUCH WITH THIS DYNAMIC INDUSTRY OF OURS

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Thank You For Your Attention

Questions