



TEST REPORT

REPORT NO: E 8779

2009-06-29

Much Asphalt (Pty) Ltd
P.O.Box 15287
Bellair 4006

Attention: Mr. Timothy Gradwell

Dear Sir,

Warm Asphalt Trials Leicester Road

With reference to the samples submitted for testing.

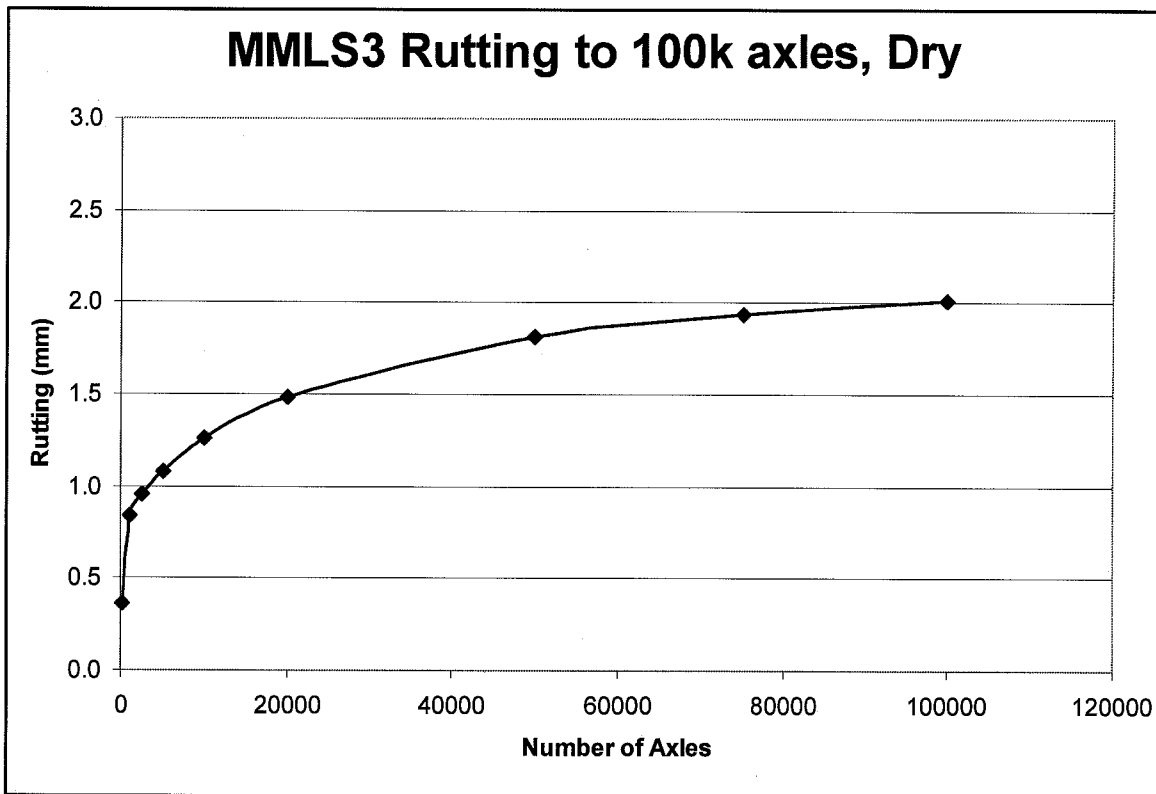
| | |
|--|--|
| Date Received : | 2009-06-15 |
| Date Tested : | 2009-06-17 to 2009-06-23 |
| Material Description : | 2 x ± 100 kg asphalt sample 15 x ± 100 mm dia asphalt briquettes 1 x 5 liter (40/50 + 2% Rediset modified binder) |
| Order Number | - |
| Deviation/Irregularity from test method: | N/A |
| Subcontracted to (*) as indicated : | N/A |
| Total number of pages : | 6 |
| Tests carried out : | Test Methods: |
| MMLS3 Wheel tracking | MMLS3 @ 50 ± 2°C, 7200 load repetitions per hour, wheel pressure 700 kPa, 2.7 kN wheel load, with no lateral wander. Briquettes were cut to a width of 105 mm. Transverse rut measurement were taken at 3 mm intervals. The tests were done dry. Briquettes were compacted at 150 mm diameter on a Troxler SGC to 7 ± 1% void content. |
| Air Permeability | TRH8 Appendix C |
| Modified Lottmann Test | ASTM D4687 |
| Dynamic Creep Modulus | NAT, 40°C, 100 kPa, 0.5Hz, Square wave, 1s loading 1s rest, 30 – 3600 pulses |
| Resilient Modulus | NAT 25°C 5µm horizontal deformation, 120 ms risetime, 1 |
| Modified Lottmann Test | ASTM D4867 |
| Gyratory Compaction | Troxler Superpave Gyratory Compactor, 125°C, 1.25° Angle of gyration, 600 kPa loading, 30 gyr/min |
| Extraction, Bitumen Recovery and Penetration | TMH1 C7b, Din 1996,ASTM D5 |
| Softening Point (R&B) (Recovered) | TMH1 C7b, Din 1996 ASTM D36 |
| SANS 307 | ASTM D5, D36, D2872, D4402 SRT TMA 1. |

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The results of the MMLS testing are as follows:

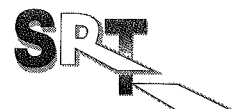
| | | |
|--|--------------------------|-------------|
| Laboratory Number | B6081 | |
| Sample Number | P2652 | |
| Date Sampled | | |
| Mix Identification | T | |
| Mix Type/Layer | Type D, 10% RAP, 1% Lime | |
| Binder Type | 40/50 + 2% Rediset | |
| MMLS3 Data | | |
| Average Voids of Cores (%) | | 6.5 |
| Average Rut depth after 100 k repetitions (μ) (mm) | | 2.01 |
| Standard Deviation (σ) (mm) | | 0.217 |
| COV (%) | | 10.8 |
| $\mu + 2\sigma$ (95% Probability level) (mm) | | 2.45 |

A graphical representation of the rut resistance of the mix is as follows:



The above graph was drawn from the following data:

| | | | | | | | | | |
|-----------------|------|------|------|------|-------|-------|-------|-------|--------|
| Number of Axles | 100 | 1000 | 2500 | 5000 | 10000 | 20000 | 50000 | 75000 | 100000 |
| Rut Depth (mm) | 0.36 | 0.84 | 0.95 | 1.08 | 1.26 | 1.49 | 1.81 | 1.93 | 2.01 |



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The individual briquette data are as follows:

| Test Position | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 | 0800 | Average |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|---------|
| Briquette Number | 6 | 2 | 7 | 5 | 8 | 3 | 4 | |
| Briquette Height (mm) | 60.0 | | | | | | | |
| BRD | 2.318 | 2.317 | 2.321 | 2.322 | 2.321 | 2.321 | 2.320 | |
| TMRD | 2.481 | | | | | | | |
| Void Content (%) | 6.6 | 6.6 | 6.4 | 6.4 | 6.4 | 6.4 | 6.5 | 6.5 |
| Rut Depth (mm) | 2.38 | 2.14 | 1.93 | 1.78 | 1.92 | 1.80 | 2.12 | 2.01 |

We can refer you to the interim guidelines presented by Professor Hugo at the November 2009 RPF held in Pretoria for an interpretation of the results. A copy can be forwarded to you if required.

The results of the rest of the tests on asphalt, performed by SRT are as follows:

| | | | |
|--|----------------------------------|------|------|
| Laboratory Number | B6081 | | |
| Sample Number | P2652 | | |
| Date Sampled | # | | |
| Mix Type | Type D, 1% Hydrated Lime, 10% RA | | |
| Binder Grade | 40/50 + 2.0% Rediset | | |
| Modified Lottmann Test (TSR) | 82.3 | | |
| Air Permeability @ 7% Voids ($\times 10^{-8} \text{cm}^2$) | 0.58 | | |
| Dynamic Creep Modulus (MPa) | 34.4 | 23.5 | 18.2 |
| Average | 25.4 | | |
| Voids after 300 Gyration @ 125°C (%) | 1.6 | | |
| Resilient Modulus (MPa) | 3964 | 4349 | 3538 |
| Average | 3964 | | |
| Recovered Penetration (d.mm) | 33 | | |
| Recovered Softening Point (R&B) (°C) | 54.2 | | |

The results of the tests on the bitumen sample are as follows:

| | | |
|--|--------------------|---------------|
| Laboratory Number | B6082 | Specification |
| Sample Number | Rediset Bitumen | SANS 307 |
| Date Sampled | # | |
| Binder Grade | 40/50 + 2% Rediset | 40/50 |
| Tests Before RTFOT | | |
| Penetration (d.mm) | 50 | 40 - 50 |
| Softening Point (R&B) (°C) | 48.1 | 49 - 59 |
| Dynamic Viscosity @ 60°C (Pa.s) | 316 | 220 - 400 |
| Dynamic Viscosity @ 135°C (Pa.s) | 0.364 | 0.27 - 0.65 |
| Spot Test | 40* | 30 Max |
| Tests After RTFOT | | |
| Mass Change (%) | -0.154 | 0.3 Max |
| Retained Penetration (% of original) | 62 | 60 Min |
| Softening Point (R&B) (°C) | 53.2 | 52 Min |
| Difference in Softening Point (R&B) (°C) | 5.1 | 7 Max |
| Dynamic Viscosity @ 60°C (% of Original) | 151 | 300 Max |

* The presence of the modifier could lead to a false ring. The result should be used with caution.

No submission form received.

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Attached, please find an "Air Permeability at 7% Voids Report", as well as a "Gyratory Compaction Graph"

We wish to thank you for your valued support and if you require any further information please feel free to contact us.

Yours faithfully



C.H. Loots
Regional Manager

Everything possible is done to ensure that tests are representative and are performed accurately, and that reports and conclusions are quoted correctly. SRT or its officials can in no way be held liable for consequential damage or loss due to any error made in carrying out the tests, nor for any erroneous statement or opinion contained in a report based on such tests. If a test report is published or reproduced by the client, it will be done in full, without any omission. This report relates only to the samples received. If the report is referred to as an INTERIM REPORT it is not fit for publication.

SPECIALISED ROAD TECHNOLOGIES

GYRATORY COMPACTION GRAPH

Client : Much Asphalt (Pty) Ltd.

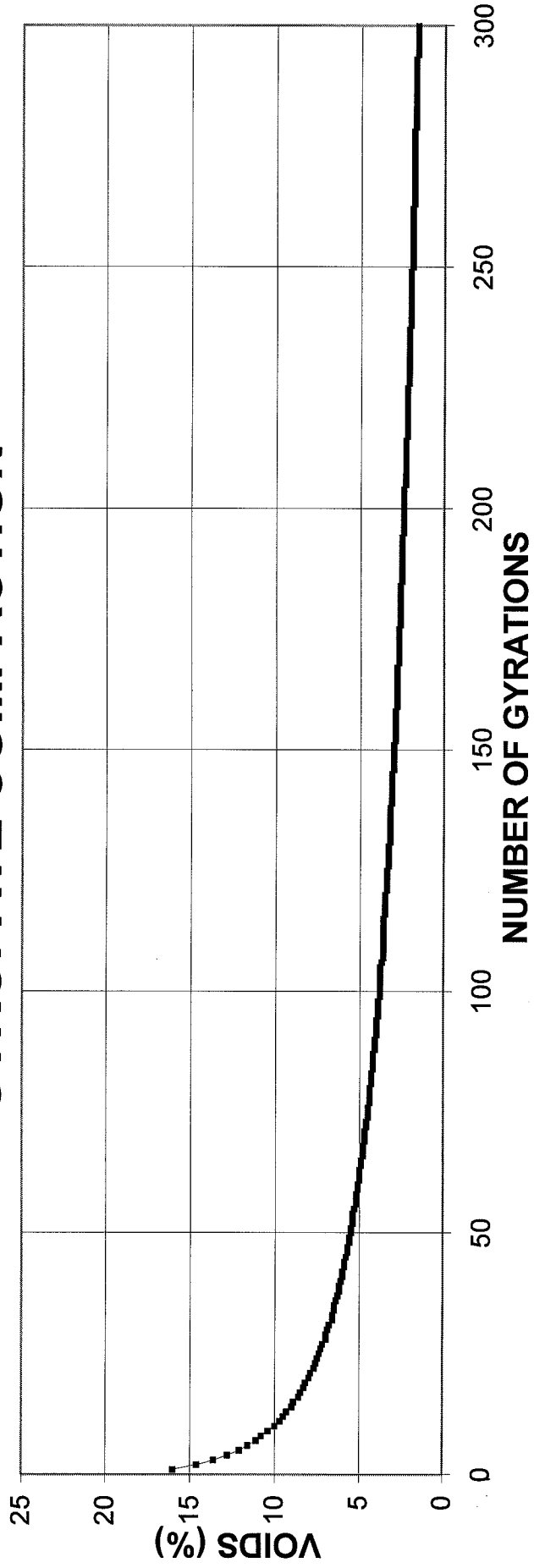
Report Number : E8779

Project : Warm Mix Trials - Leicester Road

Date : 2009-06-29

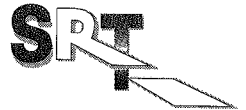
| | | | |
|------------------------|--------------------|------------------------------------|-------|
| Laboratory Number | B6081 | Voids after 300 gyrations (%) | 1.6 |
| Sample Number | P2652 | Compaction after 300 gyrations (%) | 98.4 |
| Mix Type / Content (%) | Type D + 10% RA | Compaction Temp. (°C) | 125 |
| Binder Type | 40/50 + 2% Rediset | BRD after 300 Gyration | 2.441 |
| Gyratory Number | G160 | TMRD | 2.481 |

GYROPAVE COMPACTION



For SRT:

[Signature]
Branch Manager



SPECIALISED ROAD TECHNOLOGIES

Air Permeability @ 7% Voids Report

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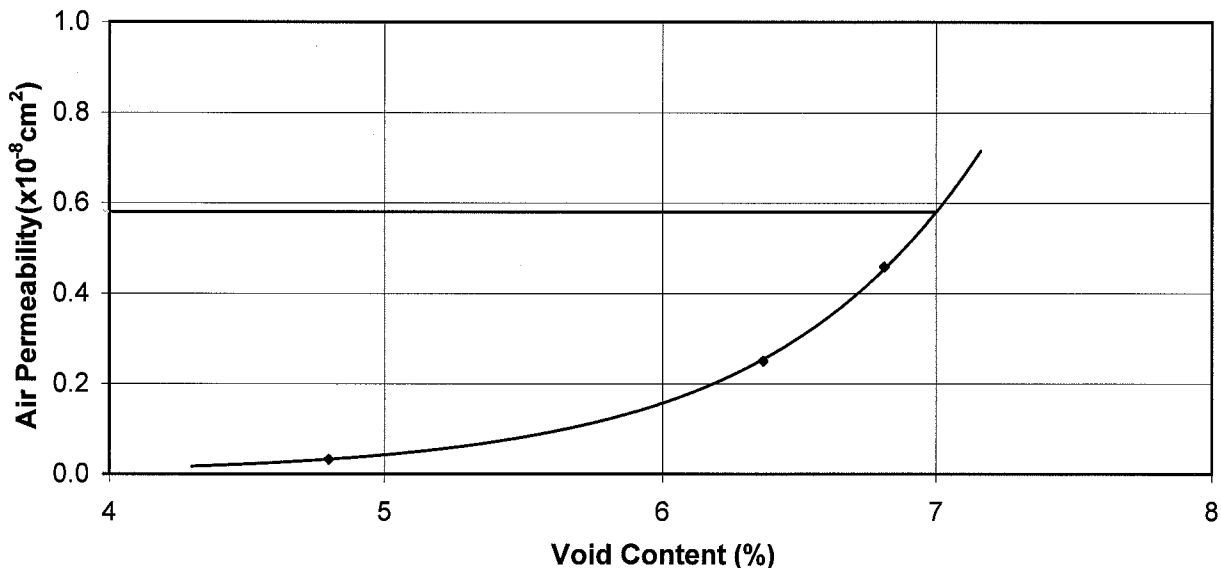
Project : Warm Mix Trials-Leicester Road

Date : 2009-06-29

| Lab. Number | Sample Number | Mix Type | Specimen Number | BRD | TMRD (Rice's) | Voids (%) | Air Permeability ($\times 10^{-8} \text{ cm}^2$) |
|-------------|---------------|------------------|-----------------|-------|---------------|-----------|--|
| B6081 | P2652 | Type "D" | 30 | 2.312 | 2.481 | 6.8 | 0.459 |
| | | 1% Lime+10% RA | 35 | 2.323 | | 6.4 | 0.251 |
| | | 40/50+2% Rediset | 75 | 2.362 | | 4.8 | 0.033 |

Result @ 7% Voids : 0.580 ($\times 10^{-8} \text{ cm}^2$)

Air Permeability vs Voids



Comment: An exponential fit was used.

For SRT:


Branch Manager