Update of SABITA Manual 33(EME)

RPF Port Elizabeth (July 2nd and 3rd)

Mahendren Manicum

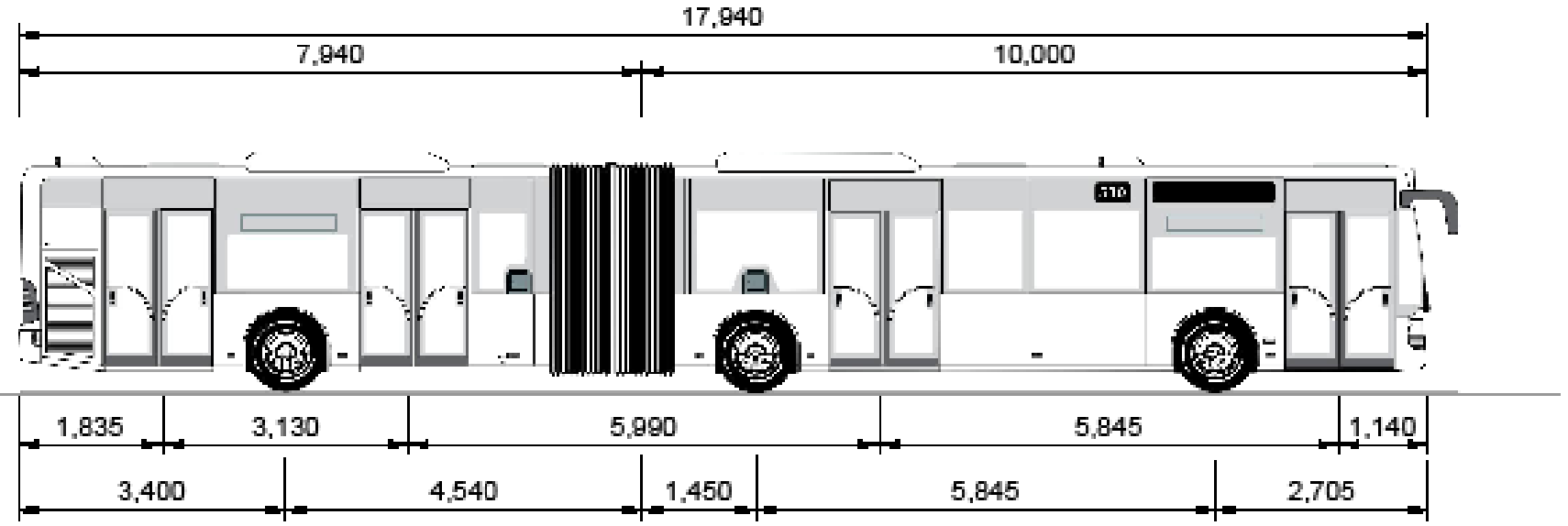
EME Demand

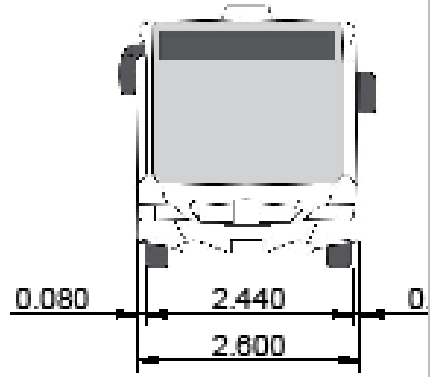
- eThekwini BRT: 12 000 tonnes
- N3 Corridor Upgrade: +_ 52 000 tonnes
- Cape Town ?

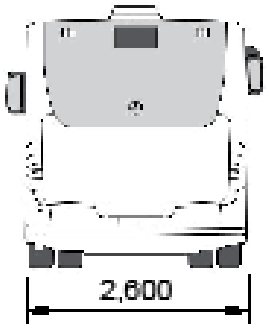
Design Vehicle

- Design Vehicle Specifications

3 AXLE BUS







LOCK TO LOCK TIME = 5.00s
MAX. WHEEL ANGLE = 48.6°

Design Axle Loading

- Steer Axle = 7 245 kg
- Centre Axle = 10 000 kg
- Drive Axle = 13 000 kg

E80 per Bus = 10 (assuming n = 4.2)

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Design Traffic

- Phase 1 Cumulative Traffic

	Phase 1			
	Corridor 1	Corridor 3	Corridor 9	Corridor 1,3,9
Years	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's
2035	35.0400	35.0400	26.2800	96.3600
2045	52.5600	52.5600	39.4200	144.5400
Typical Pavement Design	B	B	B	C / D
Typical Pavement Class	60	60	60	100 / 140

- Phase 2 Cumulative Traffic

	Phase 2	
	Corridor 5	Corridor 7
Years	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's
2035	33.2880	33.2880
2045	50.8080	50.8080
Typical Pavement Design	B	B
ES class	60	60

ES30 (10 to 30 million E80's)

ES100 (30 to 100 million E80's)

>ES100 (>100 million E80's)

Assumptions:

- Optimal flow rate from year 2015 (0% growth Rate)
- 10 E80s per Bus

Design Traffic

- Phase 3 Cumulative Traffic

	Phase 3						
	Corridor 4	Corridor 8	Corridor 1,8	Corridor 1,3,4	Corridor 1,3,4,9	Corridor 5,8	Corridor 8,9
Years	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's
2035	19.7100	23.6520	58.6920	89.7900	116.0700	56.9400	49.9320
2045	30.6600	36.7920	89.3520	135.7800	175.2000	87.6000	76.2120
Typical Pavement Design	A	A	B	C / D	E	B	B
ES class	30	30	60	100 / 140	180	60	60

- Phase 4 Cumulative Traffic

	Phase 4			
	Corridor 6	Corridor 1,6,8	Corridor 3,6	Corridor 5,6,8
Years	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's	Cumulative traffic x10^6 E80's
2035	18.6150	77.3070	53.6550	75.5550
2045	29.5650	118.9170	82.1250	117.1650
Typical Pavement Design	A	C / D	B	C
ES class	30	100 / 140	60	100

Assumptions:

- Optimal flow rate from year 2015 (0% growth Rate)

ES30 (10 to 30 million E80's)

ES100 (30 to 100 million E80's)

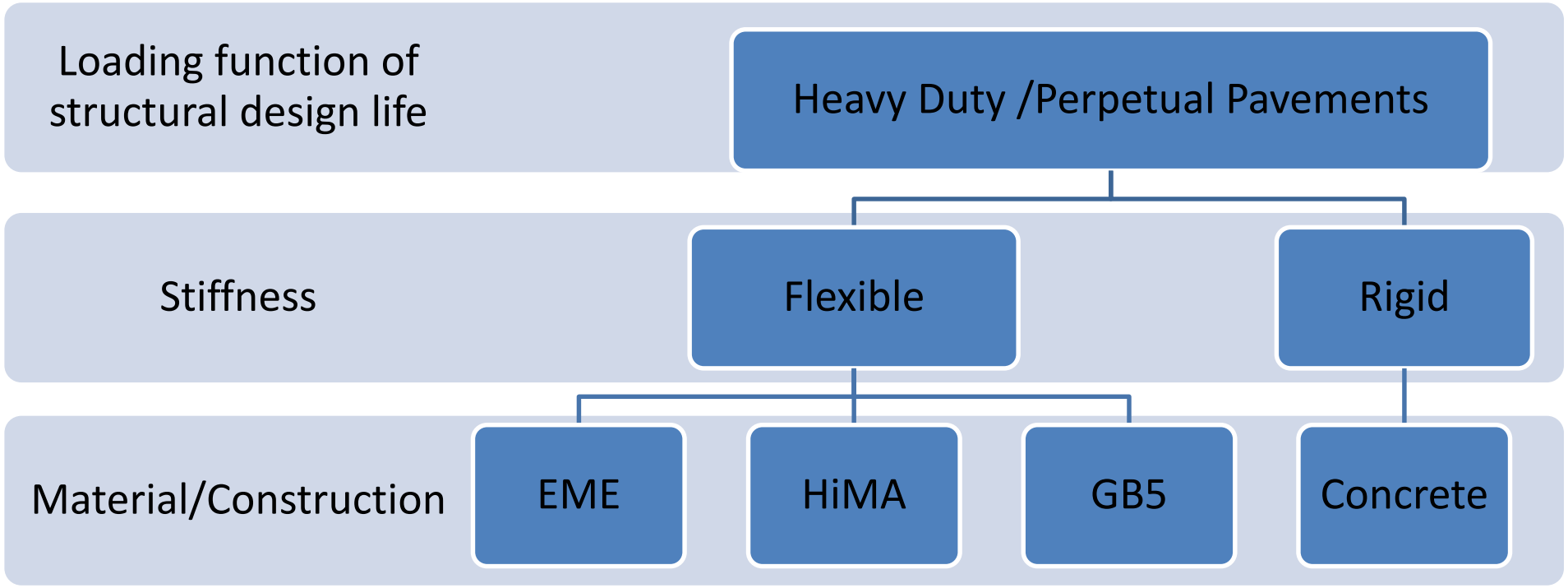
>ES100 (>100 million E80's)

First there was the word…..

Thanks to Colas for their selfless and continued support in transferring EME to SA.

- EME is an option for heavy duty pavements

Heavy Duty Pavements: The thinking in 2011



Time to look beyond primary load distributing layers for heavy duty / perpetual….

Primary Heavy Duty Layer	Progress since 2011
EME	National Guideline published Guideline now being updated
GB5	Agrement Certification acquired
HiMA	Desktop Study complete Mix Design Stage still to commence
Hybrids	Hybrids have been designed and paved
Concrete	??
Block Paving	Options available

More 10/20 pen producers in Durban

- Engen advised that they are now producing 10/20 pen binder at Durban Refinery…..with conditions for orders……..
- Looking forward to PG characterization test results from Engen….
- Can the bitumen reactor in Cape Town give a 10/20 pen binder…..when….

HiMA – NATIONAL TRIALS :

DURBAN –

OLD SOUTH COAST ROAD

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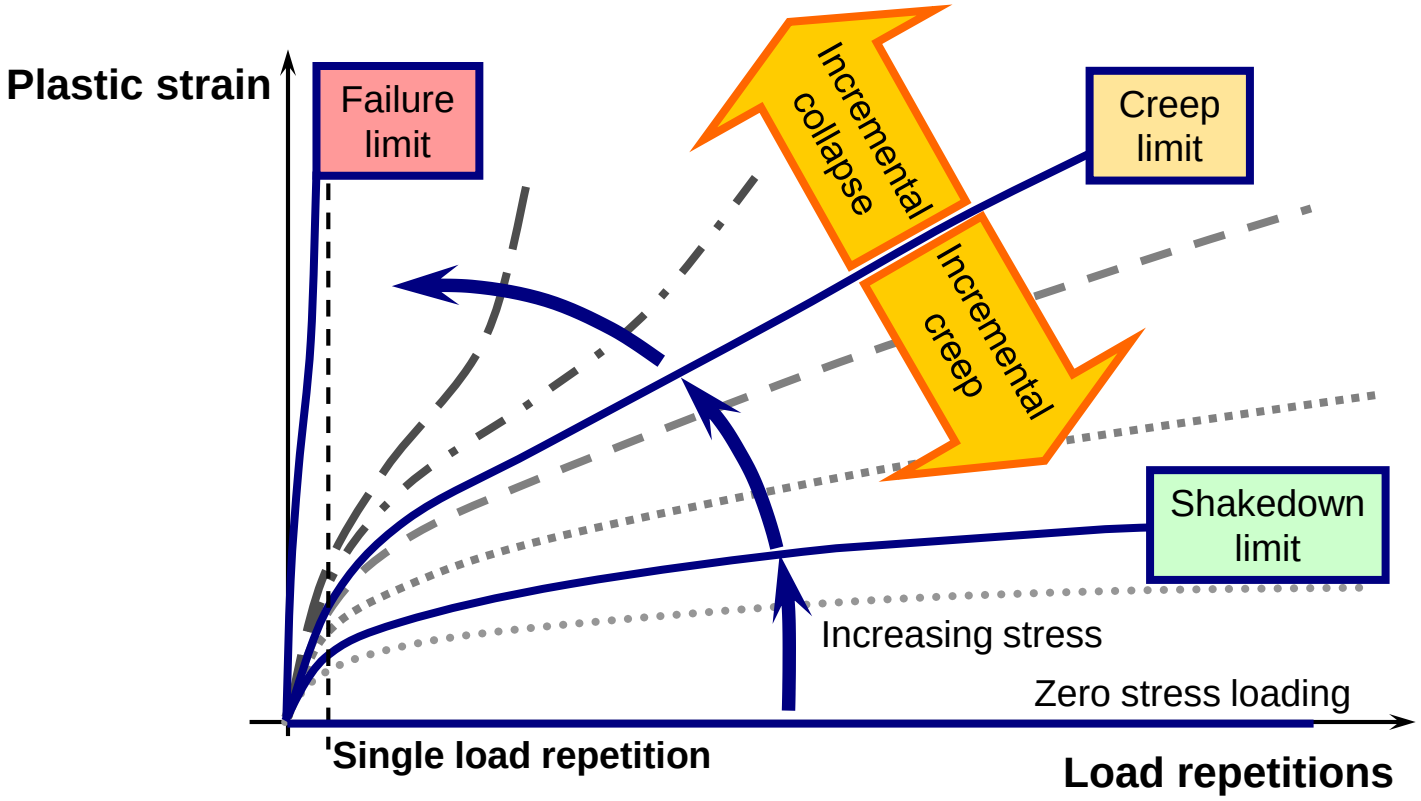
General plastic strain behaviour

- Spectrum of plastic strain response
  - Shakedown
  - Incremental creep
  - Incremental collapse
  - Instant failure in theory at Stress Ratio = 1



3. EME with LTPP

- South Coast Road in eThekwini constructed in 2011
- CSIR / SABITA /eThekwini / VNA LTTP

- 32.5 million E80s (7 year period)
- < 10mm rut depth (laser measured)
- No rut visually discernable
- 8 Durban summer seasons

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CSIR
our future through science

vna
Transformation through Consultation

2019
condition

How about that SMA in 2019

EME Guideline Update Status

Stalled for a short while….

Up and running again under Chairmanship: M Manicum

WG met on 13 June 2019

2. Database of Projects

- R104
- N1 Huguenot Tunnel
- N2 EB Cloete
- N3 Candella Road to Paradise Valley
- South Coast Road in eThekwini
- eThekwini BRT
- N3 Corridor Upgrade - APT

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Increase EME Binder Understanding

PG Characterization

Two different local refinery sources – Engen & Shell

Reactor binder – Spray-pave Cape Town

Imported binder – Shell Black Rhino Storage facility offers possible options

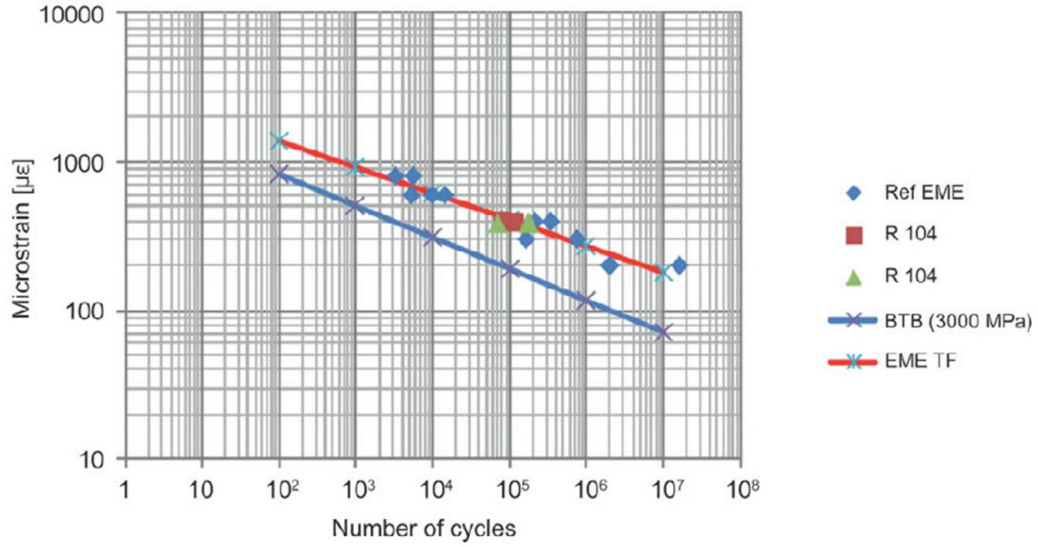
90% RA binder – how can we given reality of present plants in SA?

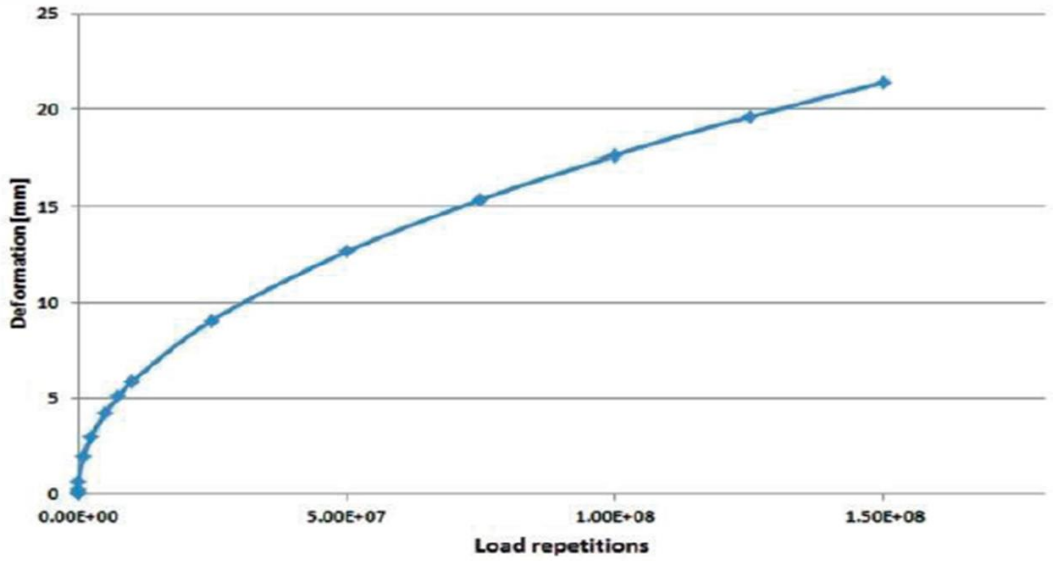
Further Mix Design Optimisation

- Current % RA in EME up to 20% (Aggregate and Binder)
- Higher RA EME mixes
- Have we optimized the aggregate packing optimally ?
  - GB5 is leading the way with aggregate packing optimization?
- Warm mix EME?
- GB5…..

5. Structural Pavement Design

- Damage modelling in Sabita Manual 33





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5. Structural Pavement Design

- EME Catalogue Method being considered
- Simpler and more robust method?
- Does the lift and layer thickness guidelines make this approach logical?

50mm SMA

160mm EME

450mm C3

150mm G7

150mm G7

280mm G10

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Surfacing layers with EME

- Do we need a binder course with EME?
- How do we match loading conditions that EME is good for with a surfacing layer - economically, structurally and functionally?
- Are we adequately designing surfacing layers to respond to present needs – noise, friction, surface runoff management, water spray together with other “traditional” properties.

Interlayer bond

Sub-base layers

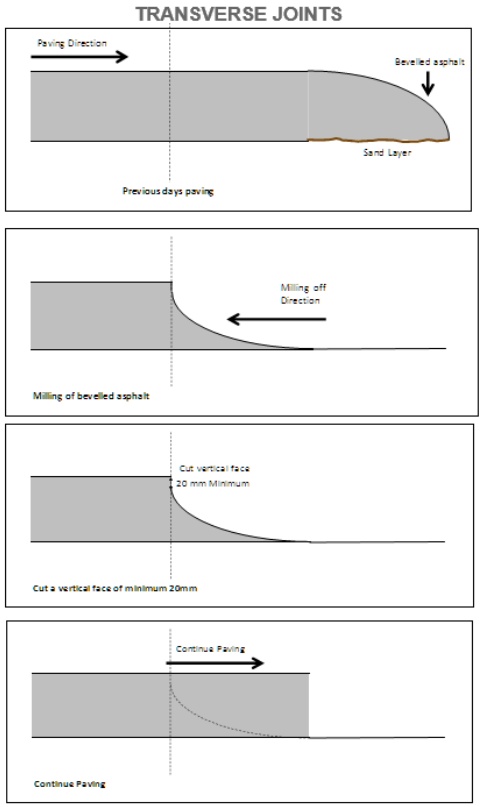
Between lifts

Binder course

Friction courses

6. Construction

- Storage
- Manufacturing
- Transportation
- Preparation
- Joints
- Paving
- Compaction
- Sampling
- Quality



Position	Target temperature
Mixing	170ºC to 190ºC
In front of the paver	≥ 170ºC
Uncompacted mat behind the paver	≥ 165ºC
Before the PTR begins rolling	≤ 145ºC
Completion of all rolling	≥ 120ºC
Placing a second layer on completed layer	≤ 60ºC
Opening to traffic	≤ 50ºC

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Paving Trials

Why do a paving trial?

When should we do a paving trial?

Should it be done just once on a job?

Who is involved in a paving trial? And how is each person involved?

How do we record the paving trial and its outcomes?

What, who and how do we implement outcomes of a paving trial?

Will routine operations have less “effort” once a paving trial has been successfully undertaken?

6. Construction Tolerances

Vs

“Slanted Sigmoid Function”

her-verwerking

LEVEL (COTO)

ALLOWABLE TOLERANCES	TOLERANCES
H90	± 15 mm
H MAXIMUM	± 20 mm

LAYER THICKNESS (COTO)

LAYER	D90	D MAXIMUM	D AVERAGE
Asphalt Base	15 mm	20 mm	5 mm
Asphalt surfacing	5 mm	8 mm	2 mm

LEVEL (COLTO)

LAYER	H90	H MAXIMUM
Selected layer	25 mm	33 mm
Subbase	20 mm	25 mm
Base	15 mm	20 mm
Shoulder and wearing course		25 mm

LAYER THICKNESS (COLTO)

LAYER	D90	D MAXIMUM	D AVERAGE
Selected layer	30 mm	40 mm	10 mm
Subbase	21 mm	27 mm	5 mm
Base	21 mm	27 mm	5 mm
Shoulder and wearing course		30 mm	-0 mm

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8. Moving forward

- Development of EME Catalogue Method
- Revisit of HWTT testing procedure
- Use of reclaimed asphalt in EME
- Minimum paving practices for EME

RPF Port Elizabeth (July 2nd and 3rd): Revision of Sabita Manual 33 (EME)

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“Panta Rhei”