Update SABITA Manual 40 (TRH3)

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

Progress
RPF Nov 2019

Gerrie van Zyl

SCOPE

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- Summary
- Manual layout
- Some highlights per chapter (PART)
- Actions towards completion

Summary

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **TRH3 (2007) – 12 years old**
- **Need to incorporate:**
  - Research and studies – Art to science
  - Other relevant SABITA manuals, SAPEM, and others
  - Lessons learnt
  - In line with latest test methods & specifications
  - Minimise risk of failure
- **SABITA funded – as Manual 40**
- **Progress: Draft 1 - 80%**
- **Targets:**
  - Draft 1 for comments (30 Nov 2019) – (31 January 2021)
  - SAT Seminars (February 2021)
  - Finalisation (31 March 2021)

SABITA Manual 40

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **Document**
  - Part A: General
  - Part B: Materials
  - Part C: Performance
  - Part D: Seal type and binder selection
  - Part E: Design
  - Part F: Construction
  - Part G: Quality Assurance
  - Part H: Repair of premature failures

PART A: General

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- Definitions, functions and basic requirements
- Evolution of seal design in South Africa
- The South African environment
- Seal types used in southern Africa

PART B: Materials

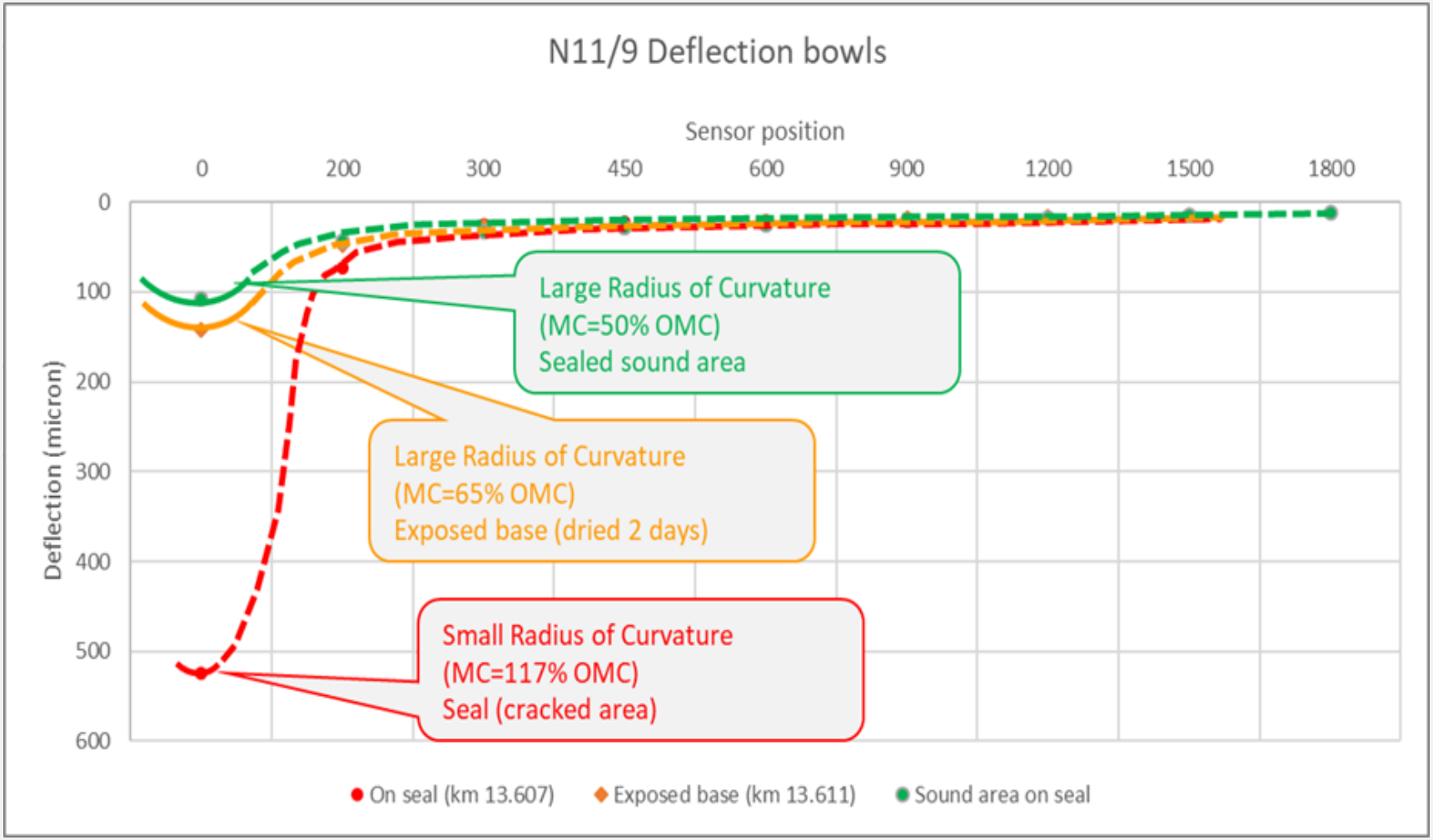
MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **Binders**
  - Bitumen
  - Grade classification
  - Modification
  - Binders commonly used in South Africa
- **Aggregates**
  - Aggregate types and properties
  - Single sized stone
  - Graded aggregate
  - Sand
  - Slurry aggregate
  - Microsurfacing aggregate
- **Additives for slurry mixes**

PART C: Seal Performance

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **Discussion on all factors influencing**



PART D: Seal and Binder selection

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- Traffic volume
- Gradient (Constructability, Urban/rural drainage – erosion)
- Turning actions/ Heavy vehicle movements
- Maintenance capability
- Road noise & tyre wear
- Vehicle damage
- Low temperature risks
- Maximising labour
- Contractor experience and equipment
- Initial seals versus reseals (Risks of granular base)
- Binder type availability
- Costs

PART D: Seal and Binder selection

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **Initial seals**
  - For each influencing factor per seal type

TRAFFIC VOLUME	SUITABILITY OF SURFACING TYPES FOR INITIAL SURFACING																							
(elv/lane/day)	S3(S<10)	S3(S10+)	S3(D<10)	S3(D10+)	S7(<10)	S7(>10)	S1(7)	S1(10)	S1(14)	S1(20)	S2(10)	S2(14)	S2(14/5)	S2(14/7)	S4(10)	S4(14)	S4(20)	S2(20/7)	S2(20/7/7)	S2(20/10)	S8(14)	S8(20)	AC
< 750	x	Y	Y	Y	x	Y	x	x	x	x	Y	Y	Y	Y	Y	Y	Y	Y	b	Y	Y	Y	Y
750 - 2000	x	a	x	a	x	Y	x	x	x	x	Y	Y	Y	Y	Y	Y	Y	Y	b	Y	Y	Y	Y
2000 - 5000	x	x	x	x	x	x	x	x	x	x	a	a	Y	Y	a	Y	Y	Y	b	Y	Y	Y	Y
5000 - 10000	x	x	x	x	x	x	x	x	x	x	x	a	a	Y	x	Y	Y	Y	b	Y	Y	Y	Y
10000 - 20000	x	x	x	x	x	x	x	x	x	x	x	x	a	Y	x	a	Y	Y	b	Y	Y	Y	Y
20000 - 40000	x	x	x	x	x	x	x	x	x	x	x	x	x	a	x	x	a	Y	b	Y	Y	Y	Y
> 40000	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	a	√a	a	a	Y	Y	Y

  - Additional guidance notes

Notes:	
a	Good performance has been noted in several cases. The use of modified binders and trials on site can reduce risks in these situations. Typical problems expected are bleeding and loss of skid resistance
b	Sensitive to permeability on coarse base textures due to first 7 applied without a binder
x	Not recommended.

  - Spreadsheet provided to combine selected influencing factors

Selected situation		SUITABILITY OF SURFACING TYPES FOR INITIAL SURFACING																						
		S3(S<10)	S3(S10+)	S3(D<10)	S3(D10+)	S7(<10)	S7(>10)	S1(7)	S1(10)	S1(14)	S1(20)	S2(10)	S2(14)	S2(14/5)	S2(14/7)	S4(10)	S4(14)	S4(20)	S2(20/7)	S2(20/7/7)	S2(20/10)	S8(14)	S8(20)	AC
Traffic Volume (elv)	5000 - 10000	x	x	x	x	x	x	x	x	x	x	x	a	a	Y	x	Y	Y	Y	b	Y	Y	Y	Y
Gradient	6 - 8 %	x	c,d,f,h	c,d,f,h	c,d,f,h	c,f	c,f	d,e,f	d,e,f	d,e,f	d,e,f	e,f	c,e,f	e,f	e,f	f	f	f	e,f	e,f	e,f	Y	Y	Y
Turning actions	Rural with occasional heavy vehicle	x	Y	Y	Y	x	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Maintenance capability	Medium	x	i	Y	Y	x	Y	x	k	k	j,k	j	j	Y	Y	Y	Y	Y	Y	j	j	Y	Y	Y
Experience & work method	Small or emerging contractor	x	o	Y	Y	x	x	x	x	x	x	Y	Y	Y	o	Y	Y	Y	Y	x	x	q	q	p
Macro texture required	1,0 - 1,5	x	x	x	x	s	Y	Y	Y	Y	Y	Y	Y	Y	Y	t	t	t	Y	Y	Y	t	t	u

PART D: Seal and Binder selection

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **Initial seals (Additional guidelines on..)**
  - Temporary winter seals (From SANRAL Study)
  - Temporary deviations (SABITA Manual 10)
  - Low volume roads
  - Small airports (CAPSA Workshop – to be included)
- **Reseals**
  - 1st Level - Decision trees TMH9 (TRH3-2007) updated
  - 2nd Level – Additional contributing factors
- **Seal costs**
  - Relative costs (To be updated)
- **Binder selection (Focus on)**
  - Performance
  - Risks
  - Position within seal structure

PART E: Design

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- Prime coats (Summary and ref to Manual 26)
- Single and double seals
- Cape Seals
- Slurry and microsurfacing (Manual 28)
- Inverted double seals
- Choked seals (Racked-in)
- Graded aggregate seals (Otta seals)
- Sand seals
- Sealing through winter

PART E: Design

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **Single and double seals**
  - ❑ Design process

Basic application rate	• Traffic (ELVs/lane/day) • Embedment (Corrected ball penetration) • Average Least Dimension (ALD)
Adjustments	• Existing macro texture • Heavy vehicle speed • Macro climate • Cold microclimates • Aggregate micro texture
Binder distribution	• Cover spray • Tack coat • Penetration coat
Conversions	• Conventional to modified • Cold to hot

PART E: Design

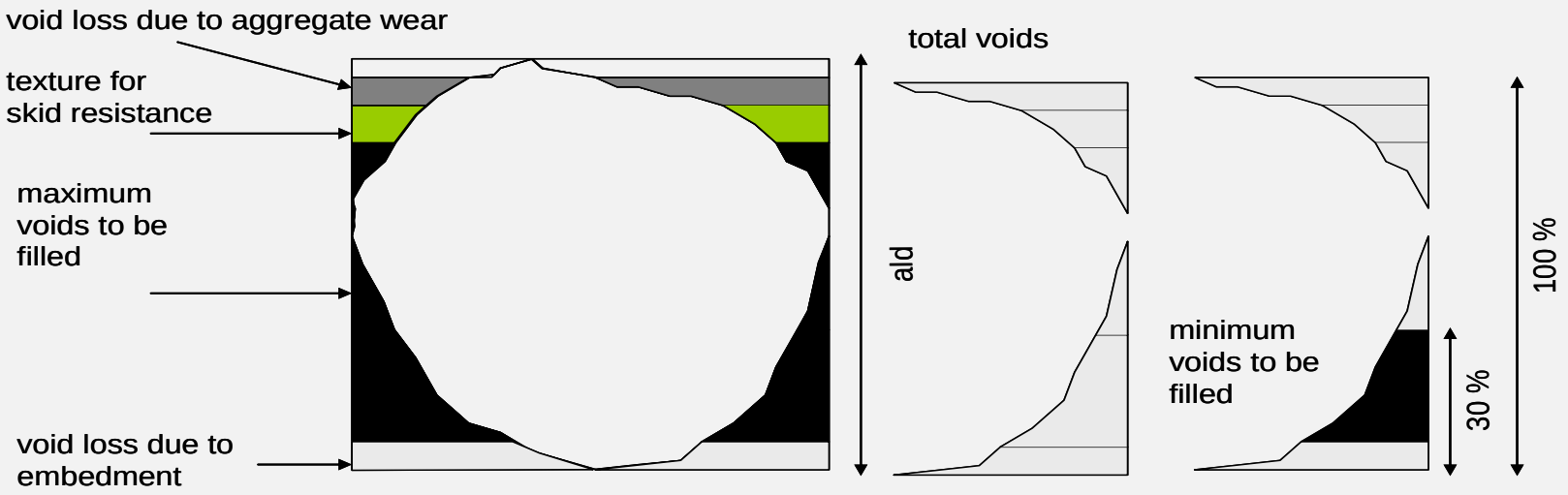
MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **Single and double seals**
  - ❑ Principles
  - ❑ Pre-design investigations
  - ❑ Interpretation of test results e.g.
    - Ball penetration (SANS 3001-BT10)

PART E: Seal design

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

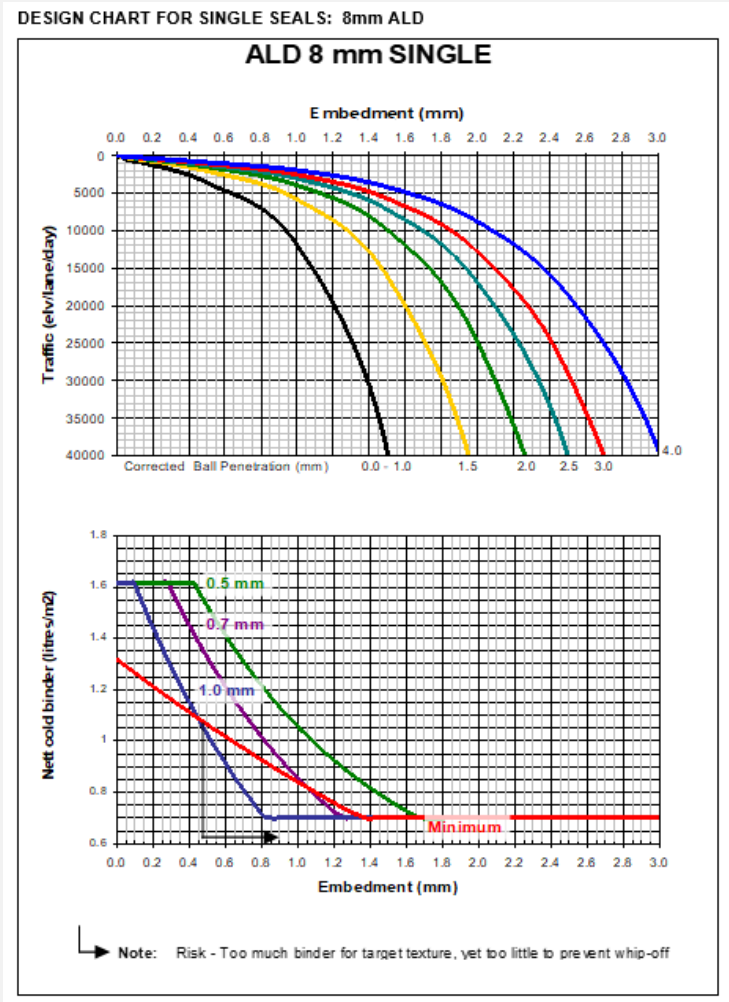
- **Basic application rate**
  - Average Least Dimension (ALD)
  - Traffic
  - Corrected Ball Penetration
  - Aggregate wear (insignificant for specified hardness)



PART E: Seal design

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **Basic application rate**
  - ❑ Formulae now available
    - Minimum application rate
    - Max for target texture
  - ❑ Spreadsheet incorporated



PART E: Seal design

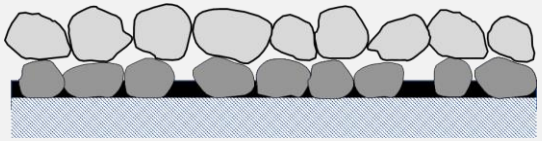
MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

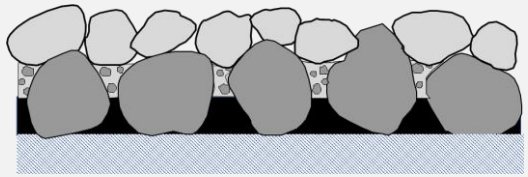
- **Adjustments (Or how to handle)**
  - Existing texture
  - Macro Climate adjustment
  - Cold microclimates
  - Aggregate micro texture
  - Slow-moving traffic
  - Aggregate spread rate
  - Sealing during very cold periods
  - Porous surfaces
  - Fatty surfaces
  - Road not trafficked for a while
  - Porous seal aggregates
  - Construction traffic
  - Stone and sand seal combinations

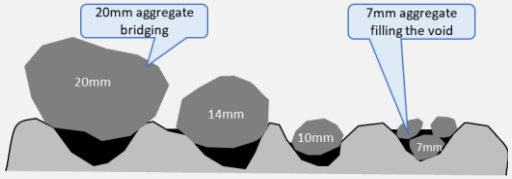
PART E: Seal design

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

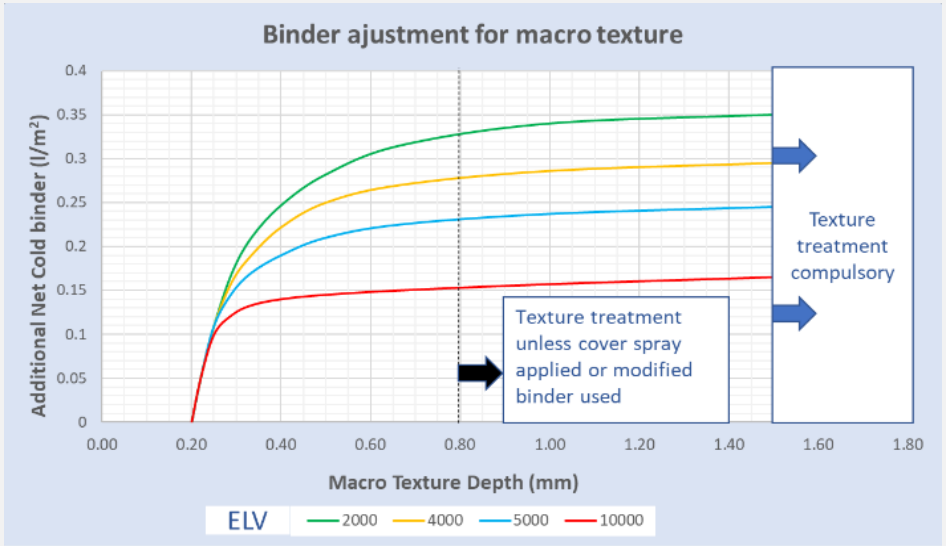
- **Adjustments**
  - ❑ Guidance on existing texture adjustment
  - ❑ When to ignore







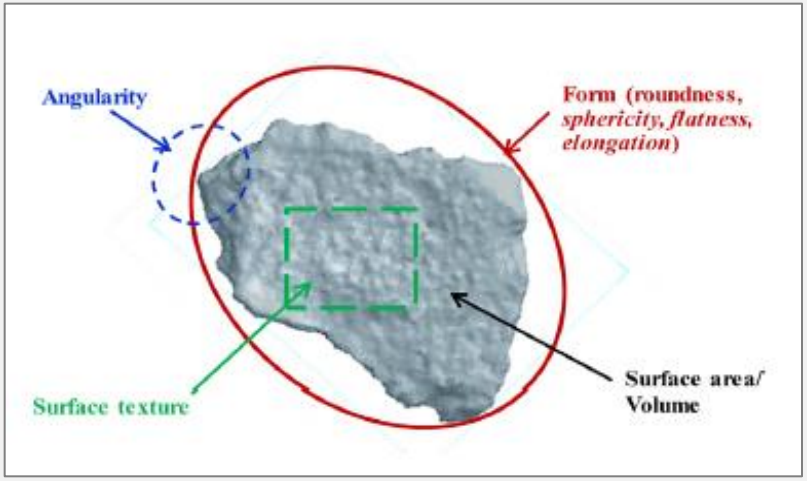
  - ❑ Changes
  - ❑ Coarse bases



PART E: Seal design

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

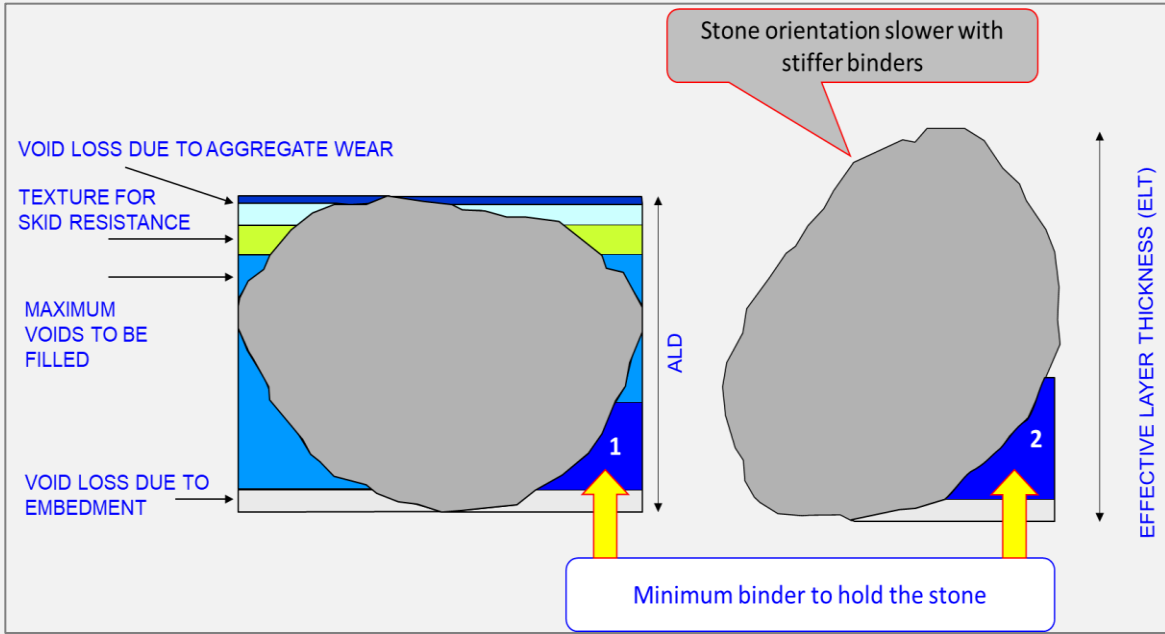
- **Adjustments**
  - Aggregate micro texture (surface area)



PART E: Seal design

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

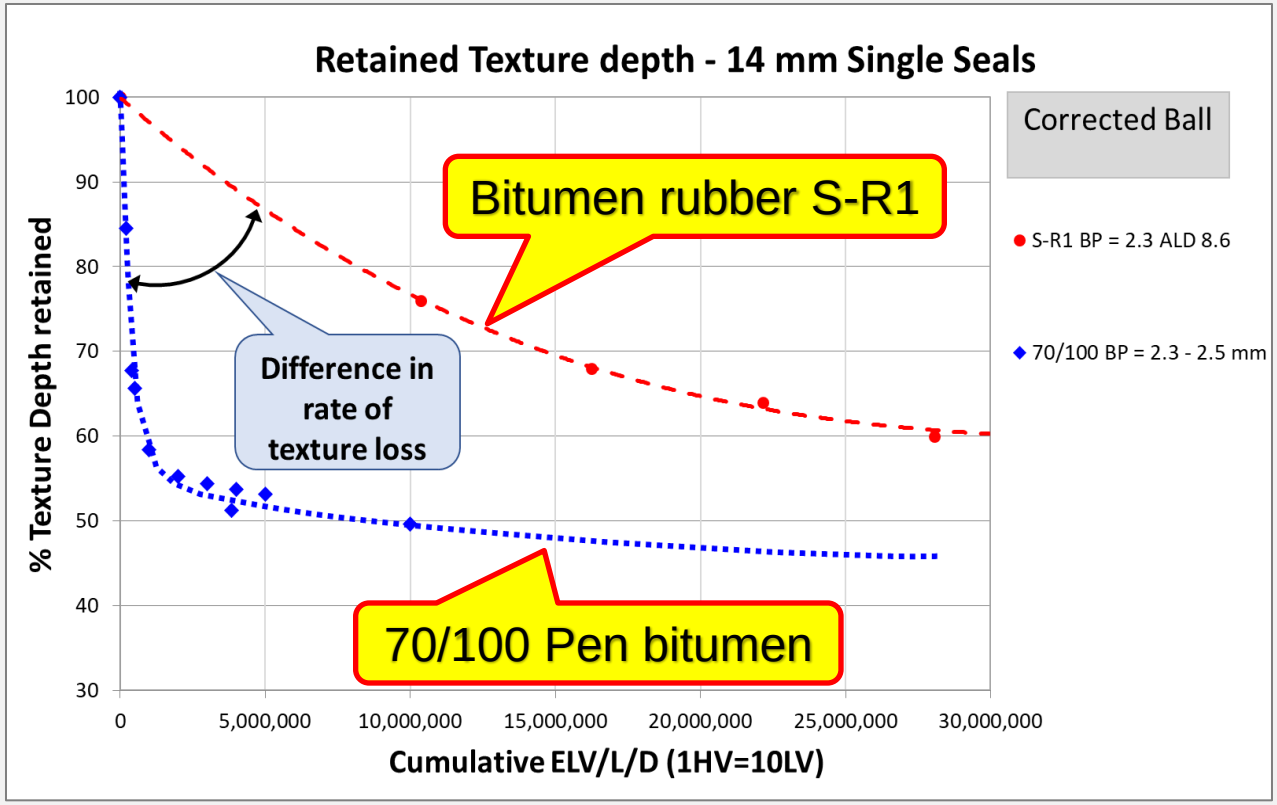
- **Binder distribution (Tack, penetration, cover)**
  - Guidance (Seal types, climate, aggregate shape)
- **Conversions**
  - Modified binders
  - Cold-to-hot



PART E: Seal design

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

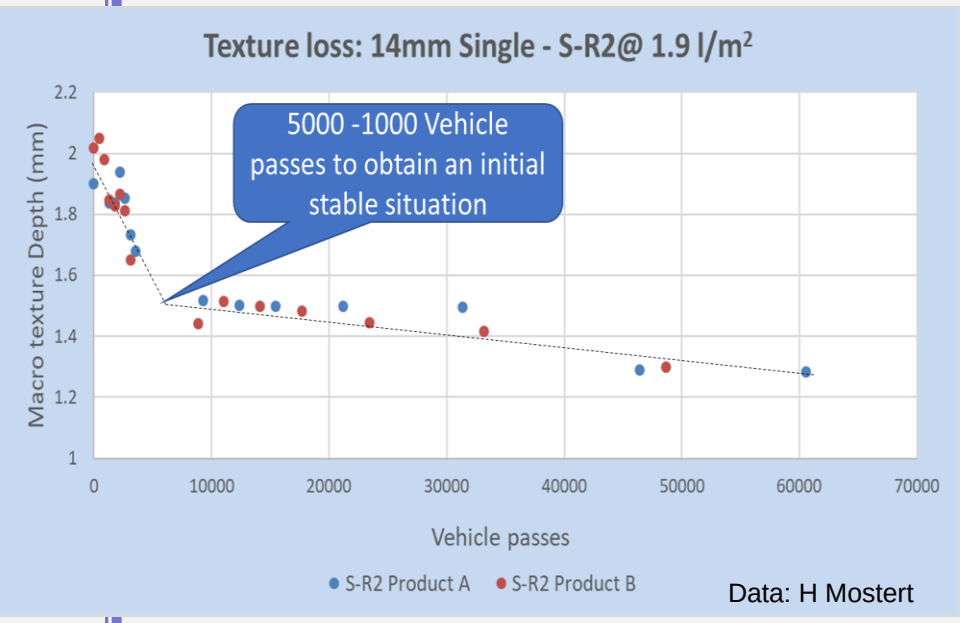
- **Conversions for Modified binders**
  - Changes to S-R1
  - S-R2 recommendations based on rate of orientation



PART E: Seal design

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **Conversion factors for S-R2**



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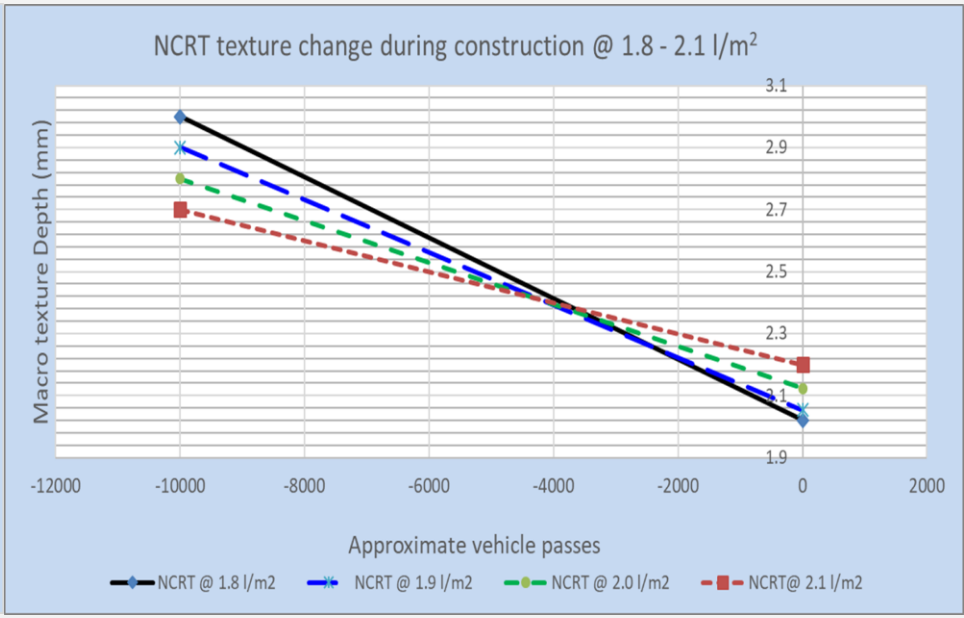

PART F: Construction

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- Equipment
- Preparation
- Pretreatment
- Binder application
- Aggregate application
- Brooming and cleaning
- Slurry mixing and application
- Rejuvenation sprays
- Specific recommendations related to seal types

New: Spray fan distribution test

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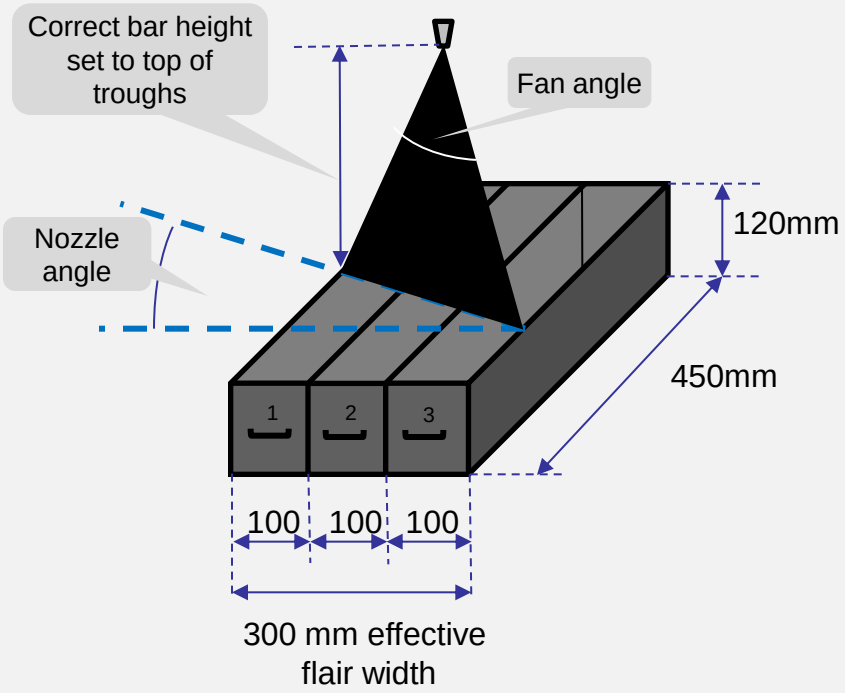
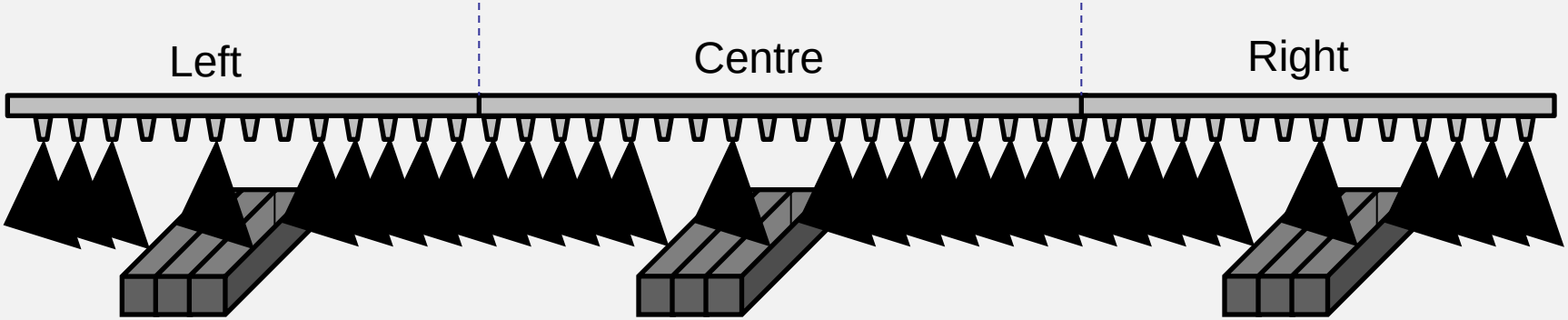
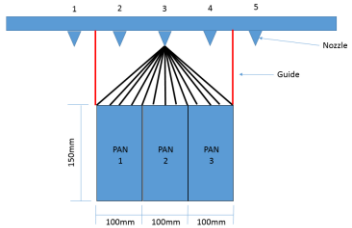
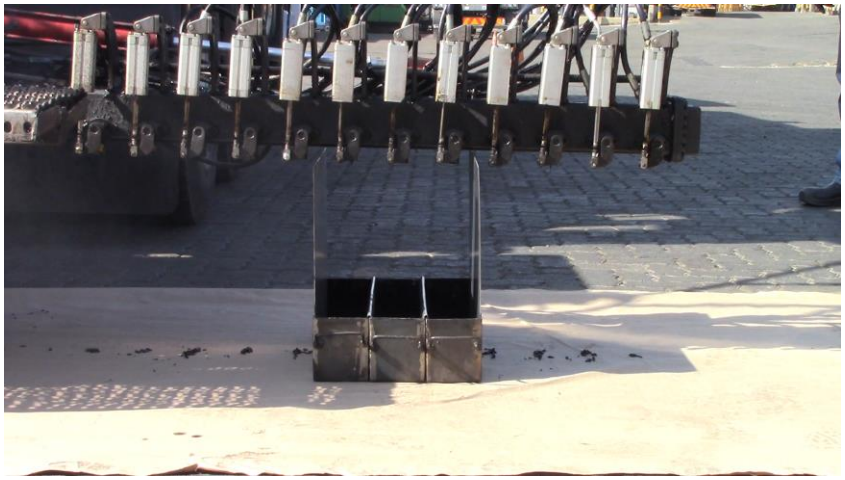




Test 1 (continued)

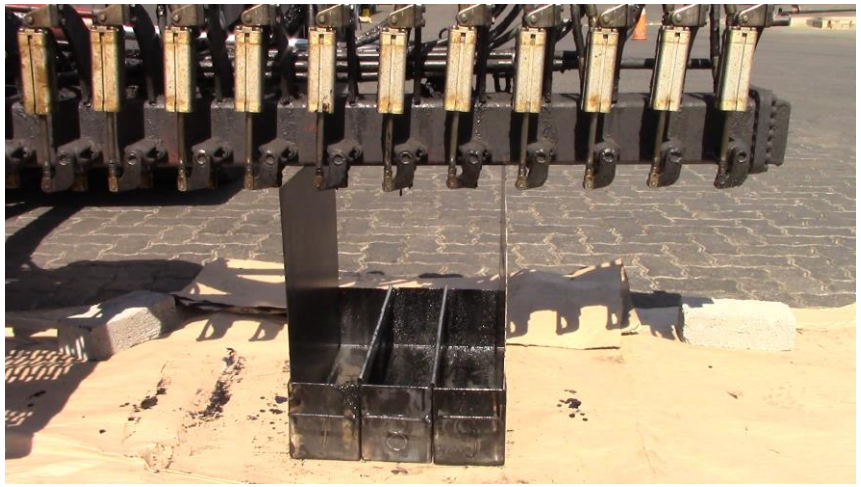


New Crumb Rubber Technology™ - NCRT



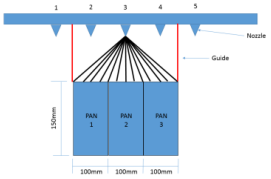
NCRT_Test1_0001

SS60 – Bitumen emulsion



SS60_Test1_0001

Test 1 (continued)



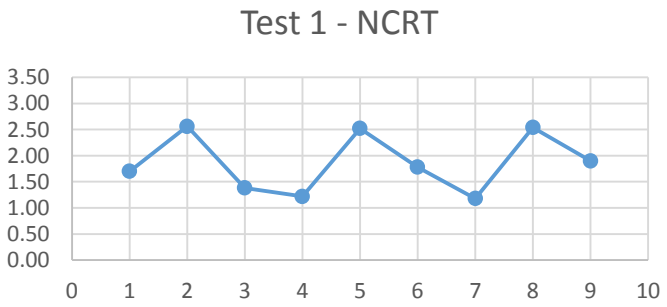
$$\% \, Deviation_{i=1\ldots9} = \left(\frac{M_{ave} - M_i}{M_{ave}}\right) * 100$$

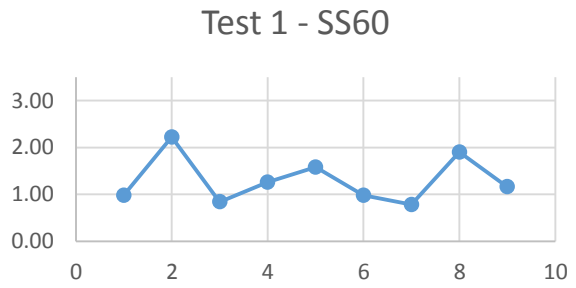
New Crumb Rubber Technology™ - NCRT

Pan #	Weight before [kg]	Position on bar	After [kg]	Discharge amount in pan [kg]	% deviation as per document
1	6.86	Right wing (nozzle 6)	8.56	1.70	8.82%
2	4.14		6.70	2.56	-37.31%
3	6.70		8.08	1.38	25.98%
4	6.84	Middle bar (nozzle 12)	8.06	1.22	34.56%
5	4.16		6.68	2.52	-35.16%
6	6.86		8.64	1.78	4.53%
7	6.88	Left wing (nozzle 5)	8.06	1.18	36.71%
8	4.14		6.68	2.54	-36.23%
9	6.86		8.76	1.90	-1.91%

SS60 – Bitumen emulsion

Pan #	Weight before [kg]	Position on bar	After [kg]	Discharge amount in pan [kg]	% deviation as per document
1	7.02	Right wing (nozzle 6)	8.00	0.98	24.62%
2	4.22		6.44	2.22	-70.77%
3	6.92		7.76	0.84	35.38%
4	6.82	Middle bar (nozzle 12)	8.08	1.26	3.08%
5	4.26		5.84	1.58	-21.54%
6	6.98		7.96	0.98	24.62%
7	6.92	Left wing (nozzle 5)	7.70	0.78	40.00%
8	4.22		6.12	1.90	-46.15%
9	6.94		8.10	1.16	10.77%





Binding roads, linking people – since 1972

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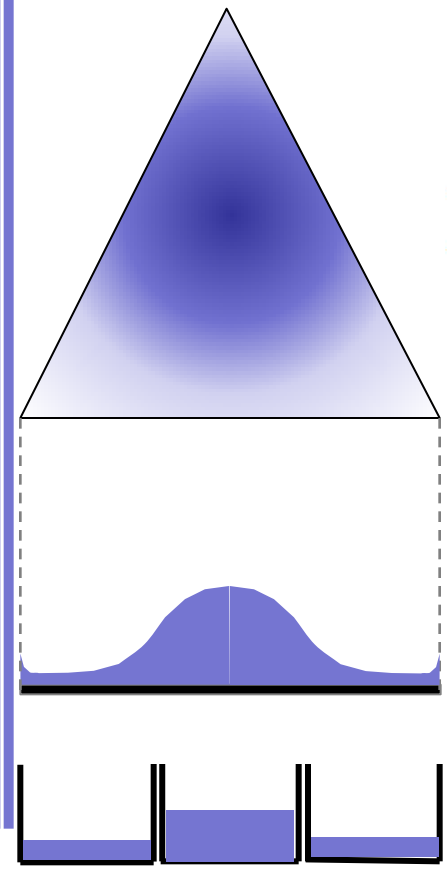
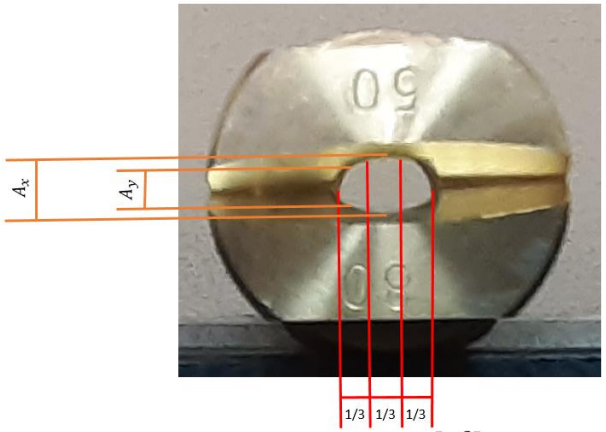
New: SANS 3001- BT25

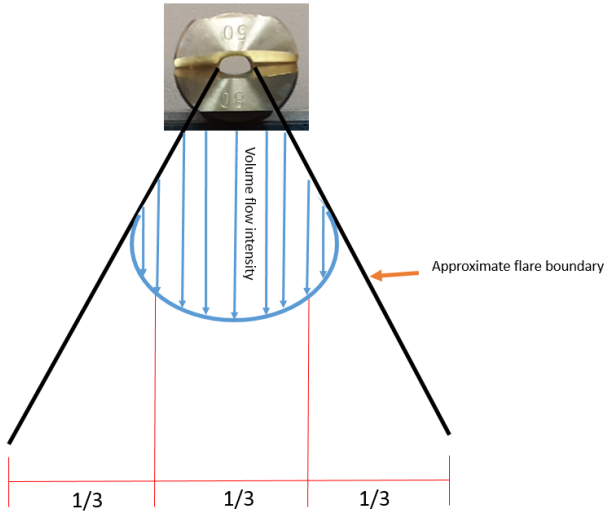
MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **Conclusions (Tosas, Colas, Spraypave)**
  - Nozzle design and hydraulics





$$Nozzle\ flow\ rate_{i=x\ldots y} = Q\left[\frac{m^3}{s}\right] = V\left[\frac{m}{s}\right]A_i[m^2],$$
$$where\ A_x \gg A_y$$



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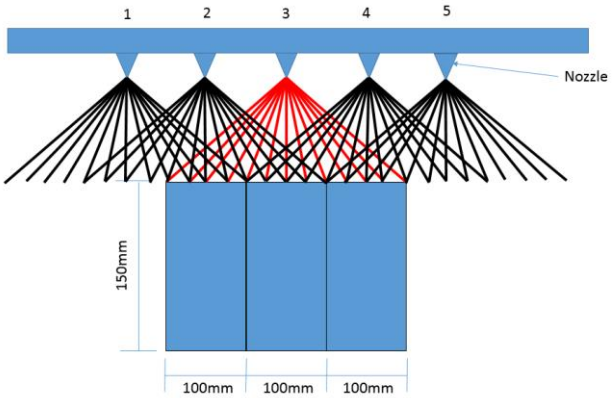
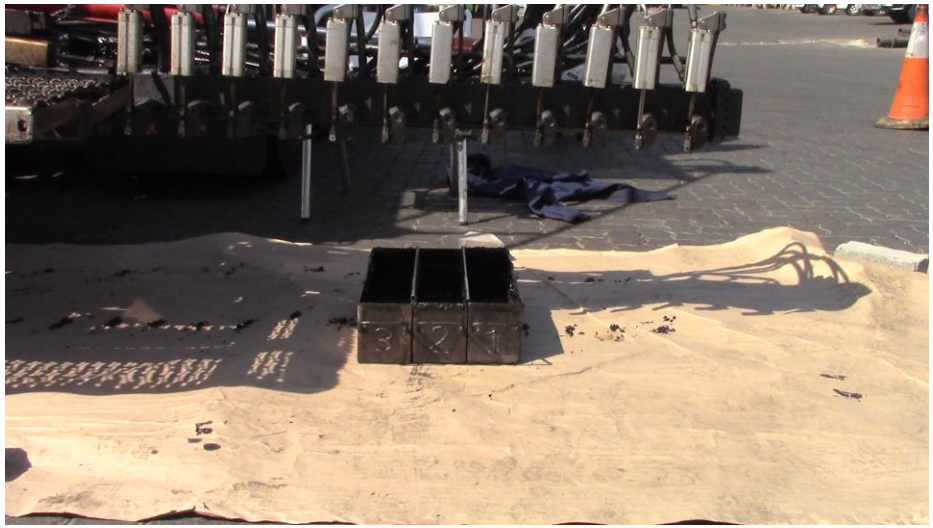
Test 2 (continued)

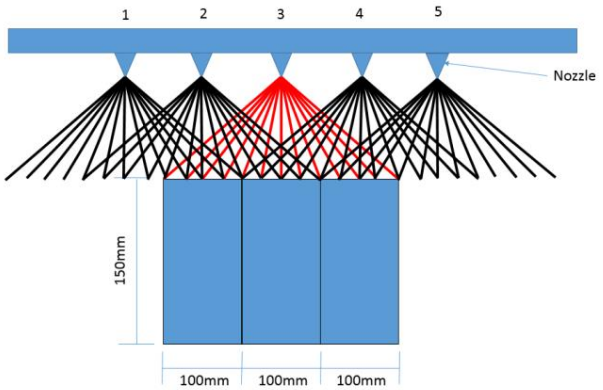


New Crumb Rubber Technology™ - NCRT



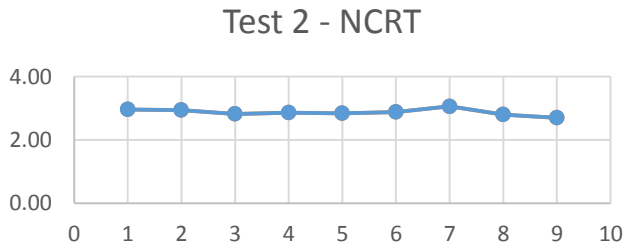
NCRT_Test2_0001

Test 2 (continued)



New Crumb Rubber Technology™ - NCRT

Pan #	Weight before [kg]	Position on bar	After [kg]	Discharge amount in pan [kg]	% deviation as per document
1	4.34	Right wing (nozzle 6)	7.30	2.96	-3.02%
2	4.40		7.34	2.94	-2.32%
3	4.32		7.14	2.82	1.86%
4	4.24	Middle bar (nozzle 12)	7.10	2.86	0.46%
5	4.34		7.18	2.84	1.16%
6	4.22		7.10	2.88	-0.23%
7	4.24	Left wing (nozzle 5)	7.30	3.06	-6.50%
8	4.26		7.06	2.80	2.55%
9	4.30		7.00	2.70	6.03%



$$\% \, Deviation_{i=1\ldots9} = \left(\frac{M_{ave} - M_i}{M_{ave}}\right) * 100$$

PART G: Quality Assurance

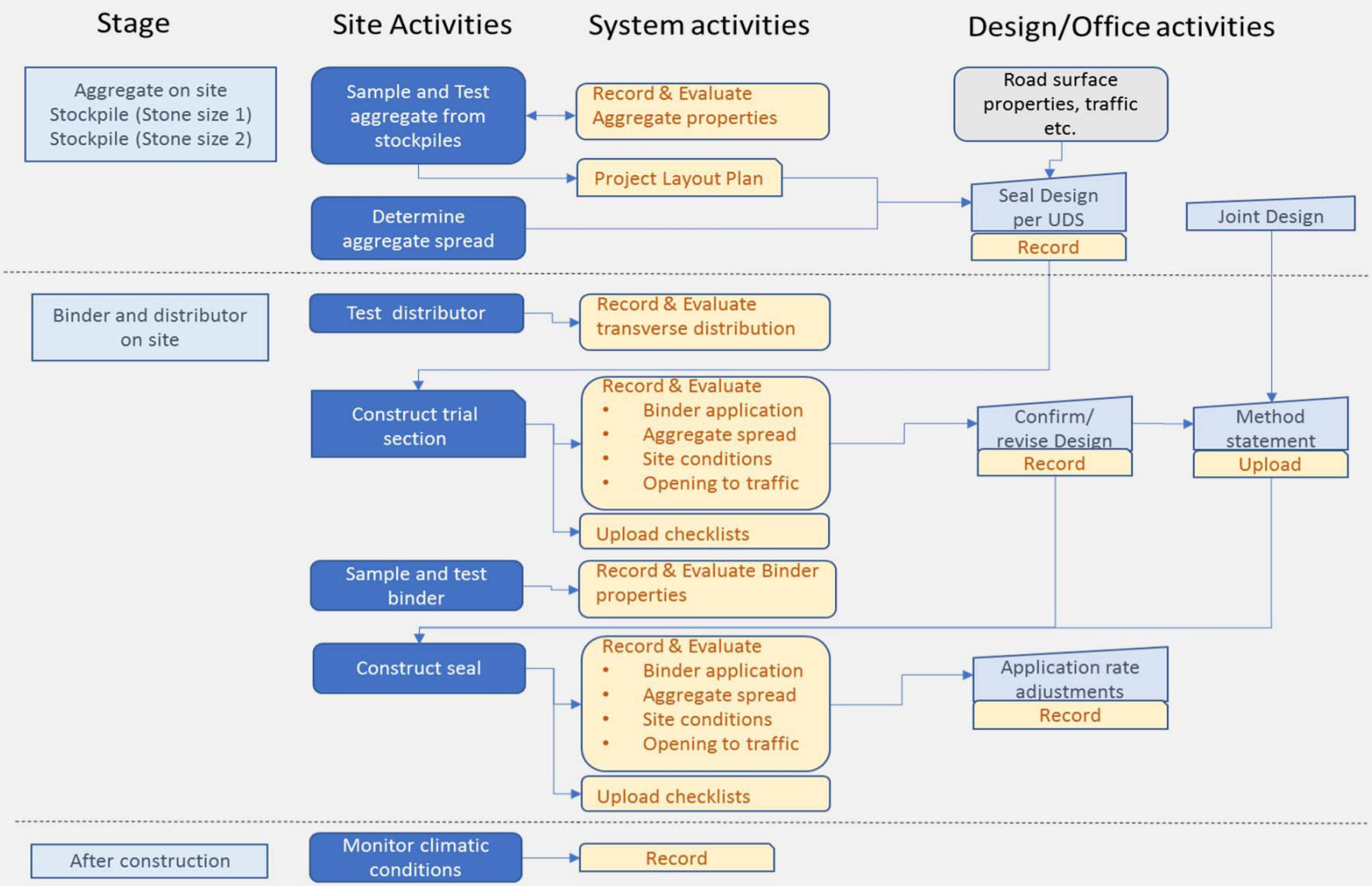
MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- Quality plan
- Processes
- Sampling and testing
- Evaluation and adjustments

PART G: Quality Assurance

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

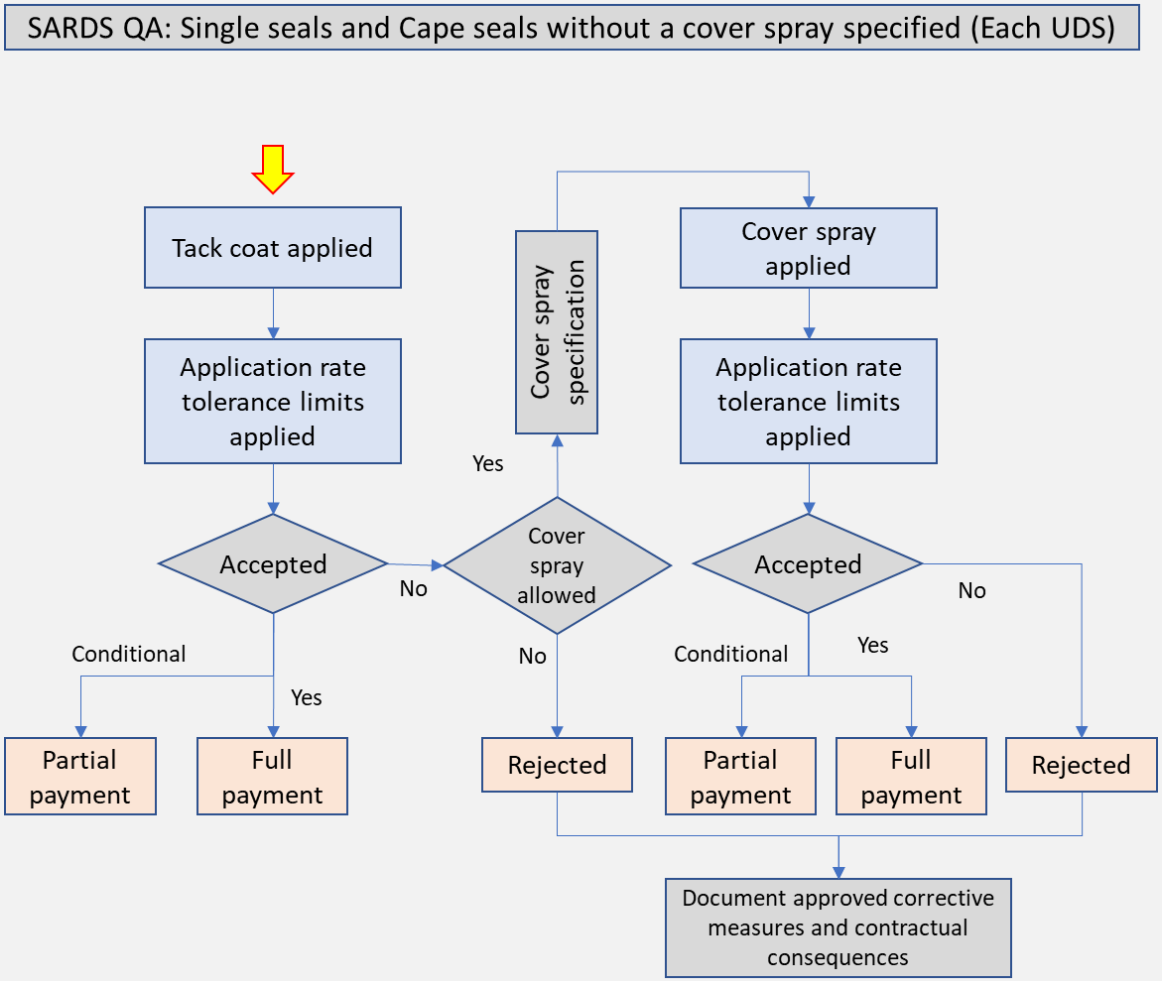
- **Several diagrams**



PART G: Quality Assurance

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **Several diagrams**



PART H: Repair of premature failures

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- **Focus on:**
  - Aggregate loss
  - Bleeding

Towards completion

MYCUBE ASSET MANAGEMENT SYSTEMS (PTY) LTD

- Dropbox folder – End November 2019
- Shared – e-mail to gerriev@mycube.co.za
- Comments – End of January 2020
- SAT Seminars – February 2020
- Completion – March 2020