

THIRD TRIAL OBJECTIVES

- Reduce mixing and paving temperatures by a further 10°C
- Include:
 - polymer modified binders in the “warm” mixes
 - at least 10% RA in all the mixes, some up to 40%
 - base as well as surfacing mixes

Gather sufficient information to compile a South African WMA Guideline & Specification

WMA TECHNOLOGIES

REDISET WMX is a blend of surfactants and short chain polymers. The product facilitates a reduction in asphalt mixing and paving temperatures of at least 30°C whilst maintaining the bitumen properties. Rediset WMX contains a built in adhesion promoter to address any initial coating problems, due to residual moisture caused by reduced temperatures, and to also improve long term durability

SASOBIT® is an organic “bitumen flow modifier”, both during the asphalt mixing process and during paving operations, due to its ability to lower the viscosity of the binder. This decrease in viscosity allows mixing and working temperatures to be decreased by 20-30°C. Depending on the addition level, it can hence be used as either a WMA additive, HMA or HIMA modifier. At temperatures below its melting point, Sasobit® forms a crystalline network structure in the binder that leads to increased deformation resistance of the asphalt in the in-service temperature range.

Sasolwax Flex™ is a technology concept of co-modified SBS and Sasobit® bitumen, enhancing the elastic recovery and high temperature deformation resistance benefits imparted by the components. It utilises a proprietary cross-linking agent, Sasolwax Link TX™, to improve polymer-bitumen compatibility and enables the production of polymer modified bitumen with controlled consistency. The final product exhibits a continuous polymer phase with excellent storage stability. This technology enables the combined use of high RA mixes at reduced [WMA] temperatures.

NA Foamtec™ is a water-based technology whereby a relatively small percentage (1.5% to 3.0% by mass of the binder) of water is injected at high pressure into the hot bitumen in an expansion chamber. The binder expands many times its original volume, forming a foam with a greatly reduced viscosity. This significantly enhances the ability of the binder to coat the aggregate at lower mixing temperatures. The quality of the foam is related to binder temperature as well as quantity of water injected into the binder.

ASPHALT BASE	TYPE	
Mix B (40/50 pen bitumen)	Control	Conventional HMA temperatures
10% RA MIXES		
Mix B AE2 (Sasolwax Flex™) + 10% RA	WMA	Temperatures reduced by 30°C
Mix B AE2 + 10% RA	Control	Conventional HMA temperatures
Mix B AP1 + Rediset + 10% RA	WMA	Temperatures reduced by 30°C
Mix B AP1 + 10% RA	Control	Conventional HMA temperatures
Mix B AP1 Foamtec + 10% RA	WMA	Temperatures reduced by 30°C
40% RA MIXES		
Mix B AE2 (Sasolwax Flex™) + 40% RA	WMA	Temperatures reduced by 30°C
Mix B AE2 + 40% RA	Control	Conventional HMA temperatures
Mix B AP1 + Rediset + 40% RA	WMA	Temperatures reduced by 30°C
Mix B AP1 + 40% RA	Control	Conventional HMA temperatures

ASPHALT SURFACING	TYPE	
Mix D (60/70 pen bitumen)	Control	Conventional HMA temperatures
10% RA MIXES		
MIX D Sasobit® + 10% RA	WMA	Temperatures reduced by 30°C
MIX D Foamtec +10% RA	WMA	Temperatures reduced by 30°C
MIX D Rediset + 10% RA	WMA	Temperatures reduced by 30°C
20% RA MIXES		
Mix D AE2 (Sasolwax Flex™) + 20% RA	WMA	Temperatures reduced by 30°C
Mix D AE2 + 20% RA	Control	Conventional HMA temperatures
Mix D AP1 + Rediset + 20% RA	WMA	Temperatures reduced by 30°C
Mix D AP1+ 20% RA	Control	Conventional HMA temperatures



HIGGINSON HIGHWAY REHABILITATION INVESTIGATION JUNE 2010



Fast lane

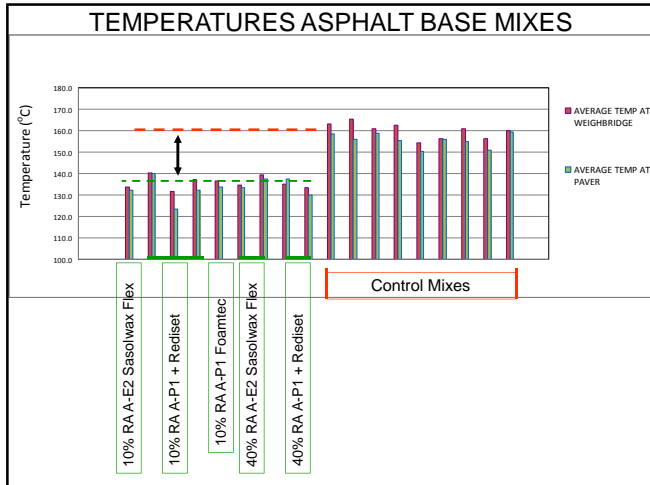
150 mm



Slow lane

150 mm





SUMMARY OF FINDINGS

Successful in:


- Reducing mixing and paving temperatures by 25°C to 30°C below those of conventional mixes
- Including polymer modified binders in the “warm” mixes
- Adding up to 40% RA
- Using base as well as surfacing mixes

The quality of the WMA is shown to be at least as good as that of the HMA control mixes

WMA BEST PRACTICE GUIDELINE & SPECIFICATION

UTILISE:

- Information and experience gained from the 3 trials
- Worldwide literature search of WMA
- Sabita, TRH manuals



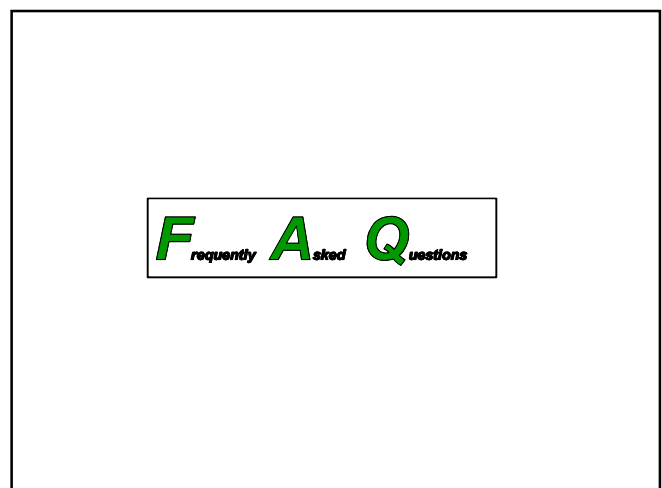
WMA BEST PRACTICE GUIDELINE & SPECIFICATION

Panel Members:

- A Lewis (TLC) (scribe)
- K Naidoo (WAM National Co-ordinator)
- E Lathieff (eThekweni Municipality)
- I McDonald (City of Cape Town)
- W Nortjè (National Asphalt)
- H Marais (Much Asphalt)
- R Archibald (Vela VKE)
- D Needham (Akzo Nobel)
- S Strydom (Sasol Wax South Africa)

We've used the opportunity to:

- Revisit general “best practice” in asphalt design, manufacture, and paving



ANNEXURE A

INTERIM SPECIFICATION FOR WARM MIX ASPHALT
BASE & SURFACING

Styled as a "stand-alone" specification based on COLTO 4200

CHAPTER 3

What are the benefits of WMA in terms of the environment, working conditions and costs?

Environment benefits

Engineering & economic benefits

CHAPTER 4

What technologies are used to reduce the asphalt temperature while still enabling a high level of compaction to be achieved?

Overview of WMA Technologies (WMA-T):

Water Technologies

Chemical additives

Rheological modifiers

CHAPTER 5

How are WMA Technologies classified?

More detailed descriptions of:

Water Technologies

Chemical additives

Rheological modifiers

Rheological polymer modified hybrids

CHAPTER 6

Are any additional or less stringent measures required regarding HSE when manufacturing and paving WMA?

Apply same best practice as for HMA

UTILISE Sabita Manuals and safety related Sabita videos

Safety



First

CHAPTER 7

How should the various components that are used to make up WMA be handled?

- New aggregates
- Fillers
- Reclaimed asphalt (RA)
- Binders
- WMA Technologies

CHAPTER 7

How should the various components that are used to make up WMA be handled?

- New aggregates

Recommend keeping fine aggregate stockpiles under shelter to reduce their moisture content



CHAPTER 7

How should the various components that are used to make up WMA be handled?

- Reclaimed asphalt (RA)

Recommend keeping fine aggregate stockpiles under shelter to reduce their moisture content

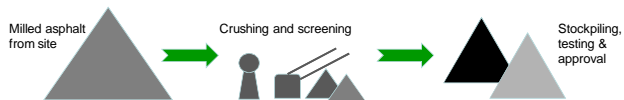


CHAPTER 7

How should the various components that are used to make up WMA be handled?

- Reclaimed asphalt (RA)

Stockpiling & processing RA prior to recycling – crushing, screening into fractions



CHAPTER 7

How should the various components that are used to make up WMA be handled?

- Binders

Binder grade depends upon:

- properties of RA
- RA content in mix
- Use of polymer modified binders

NOTE: Where mixes with high RA contents are considered, a specialized rejuvenating agent may be required to achieve satisfactory recovered binder properties in the recycled mix.

CHAPTER 7

How should the various components that are used to make up WMA be handled?

- WMA Technologies

Mechanical binder foam systems

Water carrying chemical additives

Moist fine aggregate addition systems

Blending of powdered, pelletized, or liquid WMA additives

CHAPTER 8

What quality assurance methods should be applied to the mix components?

Sampling & testing of Aggregates & Fillers

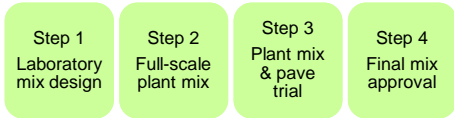
Sampling & testing of RA – testing includes recovered binder properties

Sampling & testing of binders – includes modified binder tests in TG1

Quality assurance of WMA Technologies

CHAPTER 9

What process is used to approve the mix? What changes are there to the mix design procedures used for WMA?



NOTE: This guideline only caters for continuously graded mix types

CHAPTER 9

What process is used to approve the mix? What changes are there to the mix design procedures used for WMA?

STEP 2 Plant mix and paving trial

A minimum quantity of 100 tons of mix for this trial is recommended

CHAPTER 9

What process is used to approve the mix? What changes are there to the mix design procedures used for WMA?

STEP 2 Plant mix and paving trial

Typical manufacturing and paving temperatures

BINDER TYPE	MANUFACTURING (°C)	UPON ARRIVAL AT PAVER (°C)
40/50 pen	130 - 140	120 - 130
60/70 pen	120 - 130	110 - 120
A-P1	140 - 150	130 - 140
A-E2	140 - 150	130 - 140

CHAPTER 10

How is WMA manufactured; can both batch and continuous type drum mixers be used, what modifications are required, how is the plant adjusted to produce mix at a lower temperature?

- Various options for batch plants
- Various options for drum mixers
- Recommended maximum RA contents
- Cold feed requirements
- Binder storage facilities

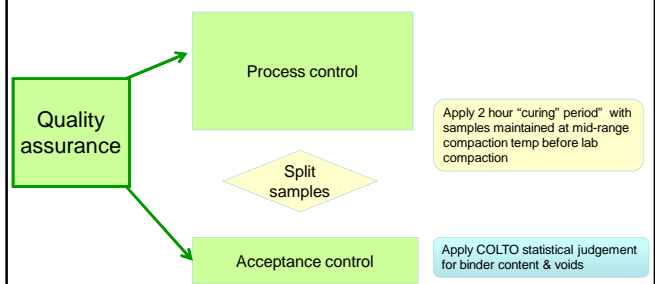
CHAPTER 10

How is WMA manufactured; can both batch and continuous type drum mixers be used, what modifications are required, how is the plant adjusted to produce mix at a lower temperature?

TYPE OF MIXING PLANT	MAXIMUM % RA
Batch mix	
- Pug mill only	10
- Pug mill & hot elevator	25
Drum mix	
- Parallel flow feed with aggregate	10
- Parallel flow with centre ring	30
- Counter flow with RA ring	40
- Counter flow with after-mixer	40
Twin dryer drum	50
Double barrel drum	70

CHAPTER 11

What quality control measures should be implemented during the manufacture of WMA? Are aspects such as moisture susceptibility and rutting potential addressed?



CHAPTER 12

Are any special measures required during the transportation and paving of WMA?

Preparation work

Paving & compaction

Opening to traffic

CHAPTER 12

Are any special measures required during the transportation and paving of WMA?

Weather conditions

Wind speed/ layer thickness

CHAPTER 12

Are any special measures required during the transportation and paving of WMA?

Layer thickness		25 mm	40 – 60 mm	> 60 mm
Base temperature		18°C	10°C	4°C
Binder type	Wind speed (km/h)	Minimum air temperatures		
60/70 pen	0 - 10	10°C	5°C	2°C
A-E2, A-P1		15°C	10°C	4°C
60/70 pen	> 10	15°C	10°C	5°C
A-E2, A-P1		18°C	13°C	10°C

CHAPTER 13

What quality assurance measures should be implemented at the paving site?

Mix temperature upon arrival at the paving site

Compaction

Samples for acceptance control testing of binder content and grading

CHAPTER 14

When new WMA Technologies are proposed, what procedure is used to introduce and approve them?

- Some WMA-T are already proven
 Sasobit®, Rediset WMX™, Sasolwax Flex™, NA Foamtec™, Rediset WMX™ in combination with standard EVA
- Phased approach for new technologies:
 - Phase 1 Provide information – usage, dosage, MSDS, etc
 - Phase 2 Mix design approval process as in Ch 9, including moisture susceptibility and rutting potential testing, plant mix and full-scale trials
 - Phase 3 Approval of the new WMA –T based upon the assessment of documentation, and results of lab, plant and full-scale paving trial

Interim Specification

- Stand-alone specification
- Based on COLTO Section 4200
- Allows use of A-E1, A-E2, AP1, A-H2
- Limited to continuously graded mixes
- Aggregate & RA moisture content limits

Interim Specification

- RA preparation
- WMA-T
- Plant modifications to enable lower temperatures
- Weather conditions
- Mix approval – lab, plant mix, and trial pave

Where to now?

WMA is already being used full-scale on some rehab projects

Achieve more widespread use of WMA