FEEDBACK:
MAXIMISE SEALWORK THROUGHOUT THE YEAR

24th Road Pavements Forum

7 November 2012

THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD

Reg. No.1998/009584/06

CSIR

our future through science

Outline

- Background
- Study outline and methodology
- Progress to date (phases completed)
- Feedback on winter seal trials
- Observations & Lessons learnt
- Australia winter seal trials
- Current and future phases

CSIR our future through science
THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg. No.1998/009584/06

Background

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

- Winter embargo & Christmas break reduce effective seal period to 7 months
- Resulting in high demand for bitumen and aggregate = project delays
- Worsened by bitumen shortage, unforeseen climatic conditions etc.
- **SANRAL** identified the need to investigate potential solutions to the problem and to implement a strategy to maximise sealwork throughout the year
- A task team has been appointed by SANRAL

CSIR our future through science
THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg. No.1998/009584/06

Project Team

- Kobus van der Walt (SANRAL)
- Danie Erasmus (SANRAL)
- Steph Bredenhan (SANRAL)
- Dennis Rossmann (SANRAL)
- Gerhard Fourie (SANRAL)
- Brian Mdziniso (SANRAL)
- Piet Myburgh (SABITA)
- Kim Jenkins (Stellenbosch University)
- Gerrie van Zyl (MyCube)
- Johan O'Connel (CSIR)
- Phil Paige Green (CSIR)

CSIR
our future through science
THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg. No.1998/009584/06

Study outline and methodology

- Phase 1 – Obtain and document current state of the art and best practice from available literature and local experience.
- Phase 2 – Develop and document a short to medium term strategy to maximise sealwork throughout the year and construct trial sections for performance evaluation
- Phase 3 – Investigate appropriateness of existing binder and aggregate specifications
- Phase 4 – Obtain and collate feedback from industry and finalise strategy

CSIR our future through science
THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg. No.1998/009584/06

Progress: Phase 1 completed

- Feedback from >20 local experienced practitioners regarding seal practices applied during winter
- Inspected 18 road sections where winter grade binders have been successfully used during the past decade

Progress: Phase 1 completed (cont)

- Industry opinions regarding:
  - Bitumen shortage and possible solutions
  - Aggregate demand and availability
  - Alternative seal types and specifications
- Summary of international practices highlighting:
  - Winter embargo on seal work applied by most countries
  - General movement away from cutback bitumen towards emulsion
  - Limited studies and winter seal trials elsewhere

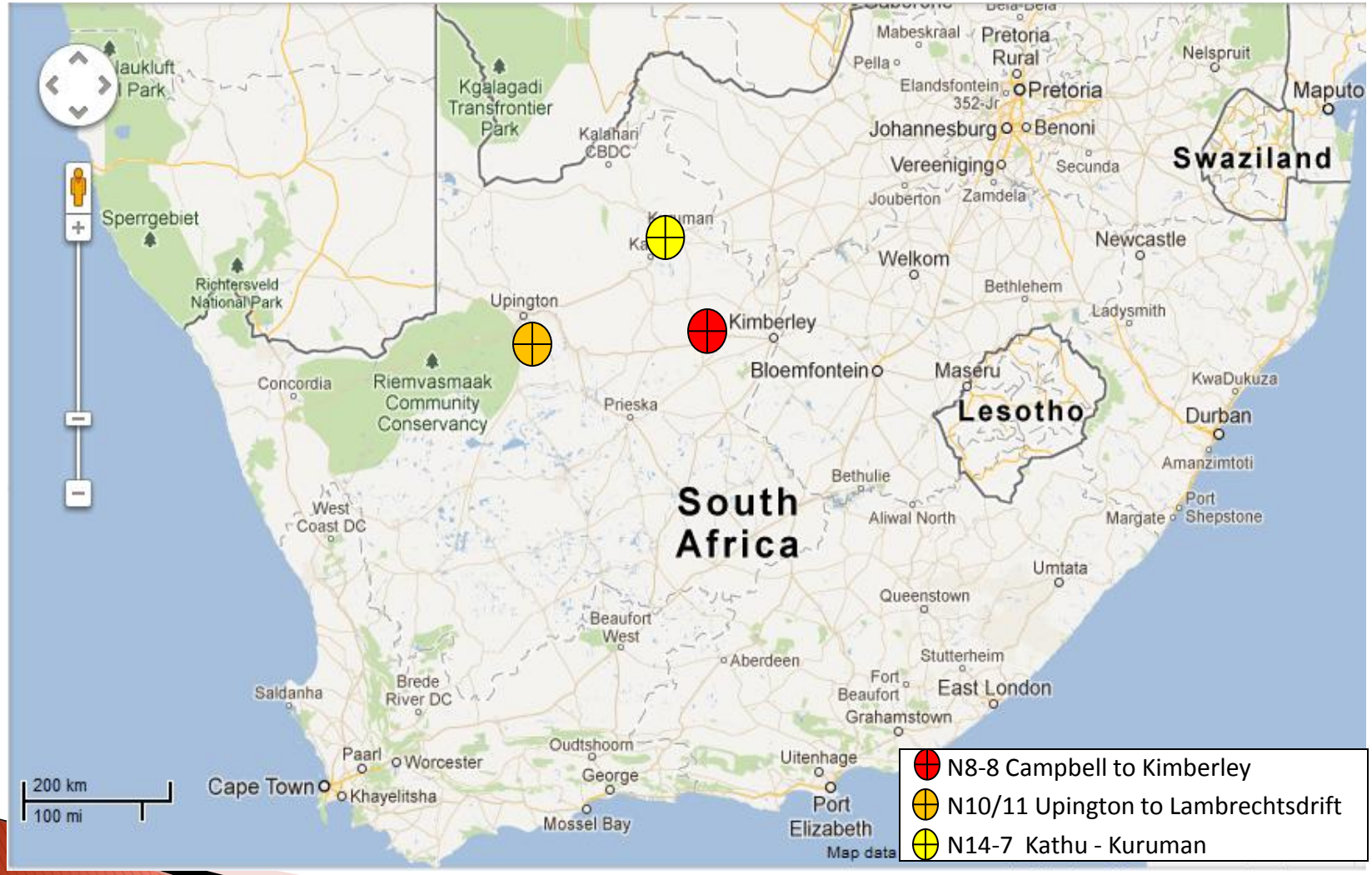
CSIR our future through science
THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg. No.1998/009584/06

Phase 2 – Design and construction of winter seals using cutback/emulsion binders (2012)

- 3 sites were identified to test the effectiveness of different combinations of seal types and binders.

CSIR our future through science
THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg. No.1998/009584/06

Location of Sites



Phase 2 – Design and construction of winter seals using cutback/emulsion binders (2012)

- The experimental matrix for these experiments provided for:
  - 13,2 mm Single ; 19,0 + 9,5mm Double ; 19,0 + 6,7 + 6,7 mm Split application double
  - Low and High total binder content using S-R1, S-E1 (SBS and SBR polymers) and SC-E1 (SBR polymer)
  - 0 – 4% cutters in the binder
  - Diluted and undiluted emulsion cover (fog) sprays, with and without cutter, and at different application rates

CSIR our future through science
THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg. No.1998/009584/06

Phase 2 – Design and construction of winter seals using cutback/emulsion binders (2012)

- The challenge with the design of these trials
  - No early stripping
  - Prevent or minimise tackiness during the first summer period.
- 26 trials have been successfully constructed
- In only two cases it was considered necessary to add additional binder in the form of an extra fog spray.
- All three sites experienced sub-zero temperatures within a short period after construction.

CSIR our future through science
THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg. No.1998/009584/06

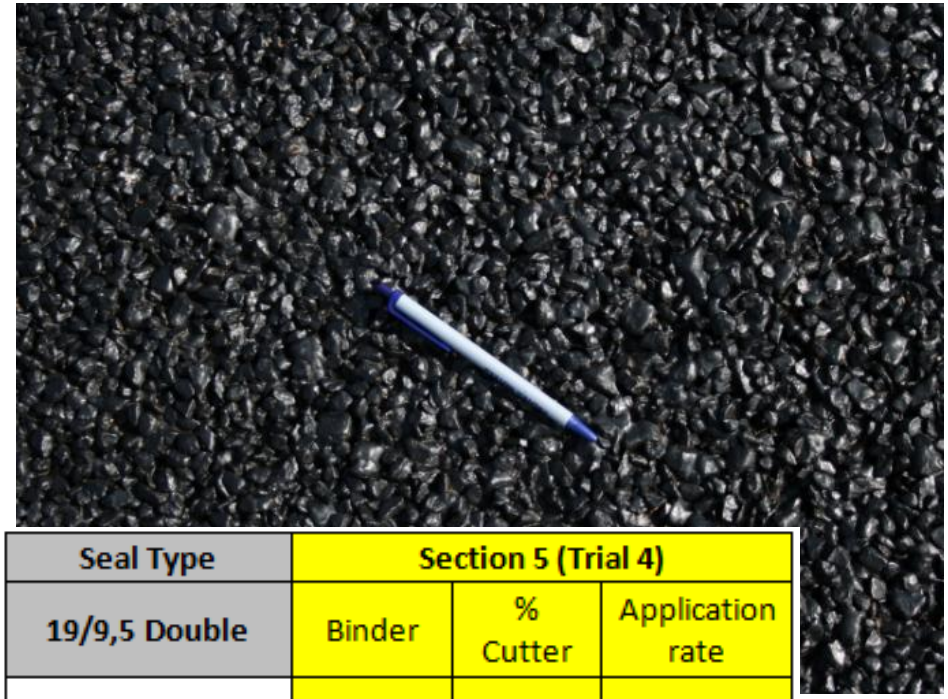
Winter Seal Trials : N8-8 (19/6/6 Split double seal) - 2012

Seal Type	Section 4		
19/6,7/6,7 Split application	Binder	% Cutter	Application rate
Tack coat	S-E1	1.5%	1.45
Penetrations Coat	S-E1	4.0%	1.55
Fog Spray	Cat 65 Emulsion	0.0%	1.00

Winter Seal Trials : N10-11 (13mm Bitumen Rubber) – 2012

Seal Type	Section 22 & 23 (18)		
13,2 mm Single Seal	Binder	% Cutter	Application rate
Tack coat	S-R1 (WG)	4.0%	2.50
Penetrations Coat			
Fog Spray	70/30 Cat 65 Emulsion	3.0%	0.90

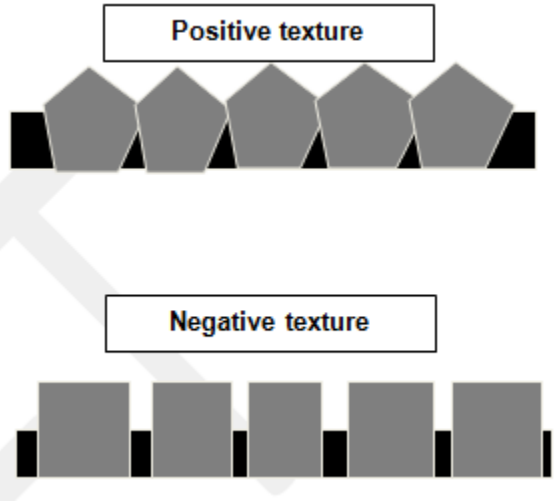
Winter Seal Trials : N14-7 (19/9 double seal) – 2012



Seal Type	Section 5 (Trial 4)		
19/9,5 Double	Binder	% Cutter	Application rate
Tack coat	SC-E1	3.0%	1.50
Penetrations Coat	S-E1	4.0%	1.35
Fog Spray	Cat 65 Emulsion	3.0%	1.20

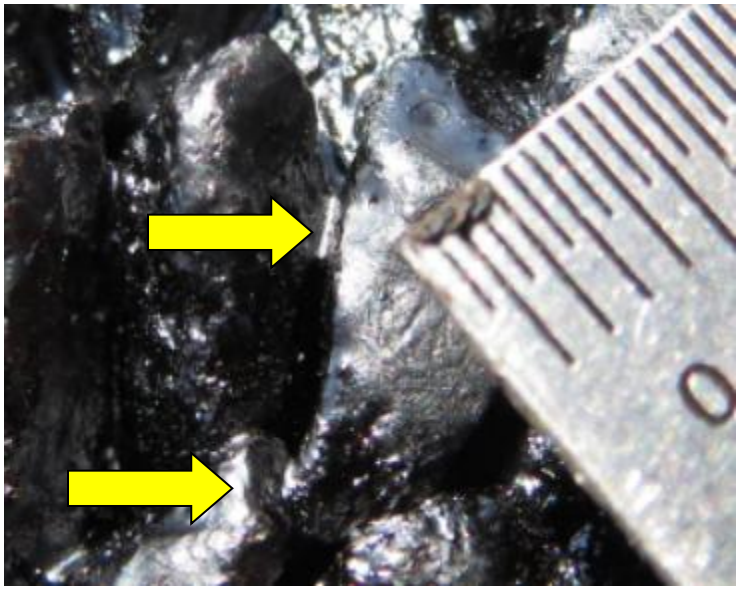
Interesting observations and lessons learnt (1)

- The seal matrix, to a large extent, determines the strength of the seal and sensitivity to stripping.
  - NB: Creating an even surface with preferably a negative texture , reduces the horizontal forces induced by tyres on individual aggregate particles.
  - NB: Orientation of the stone by appropriate rolling, type of rollers and sequence



Interesting observations and lessons learnt (2)

- Creating bonds between the aggregate particle shoulders increases the strength of the seal.
  - No sensitivity to aggregate loss has been observed on all the trial sections where an undiluted 65% Cationic spray grade emulsion (at 1 litre/ m^2) was applied as a cover spray.



CSIR our future through science
THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg. No.1998/009584/06

Interesting observations and lessons learnt (3)

- S-E1 with cutters (lower viscosity), flows quicker into the dry 6,7mm layer or 19 mm layer, leaving less binder for the final aggregate layer of the double seals to adhere to.
  - Increase penetration spray (2nd application),
  - Emulsion in the penetration layer (second application) of double seals is considered an even higher risk

CSIR our future through science
THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg. No.1998/009584/06

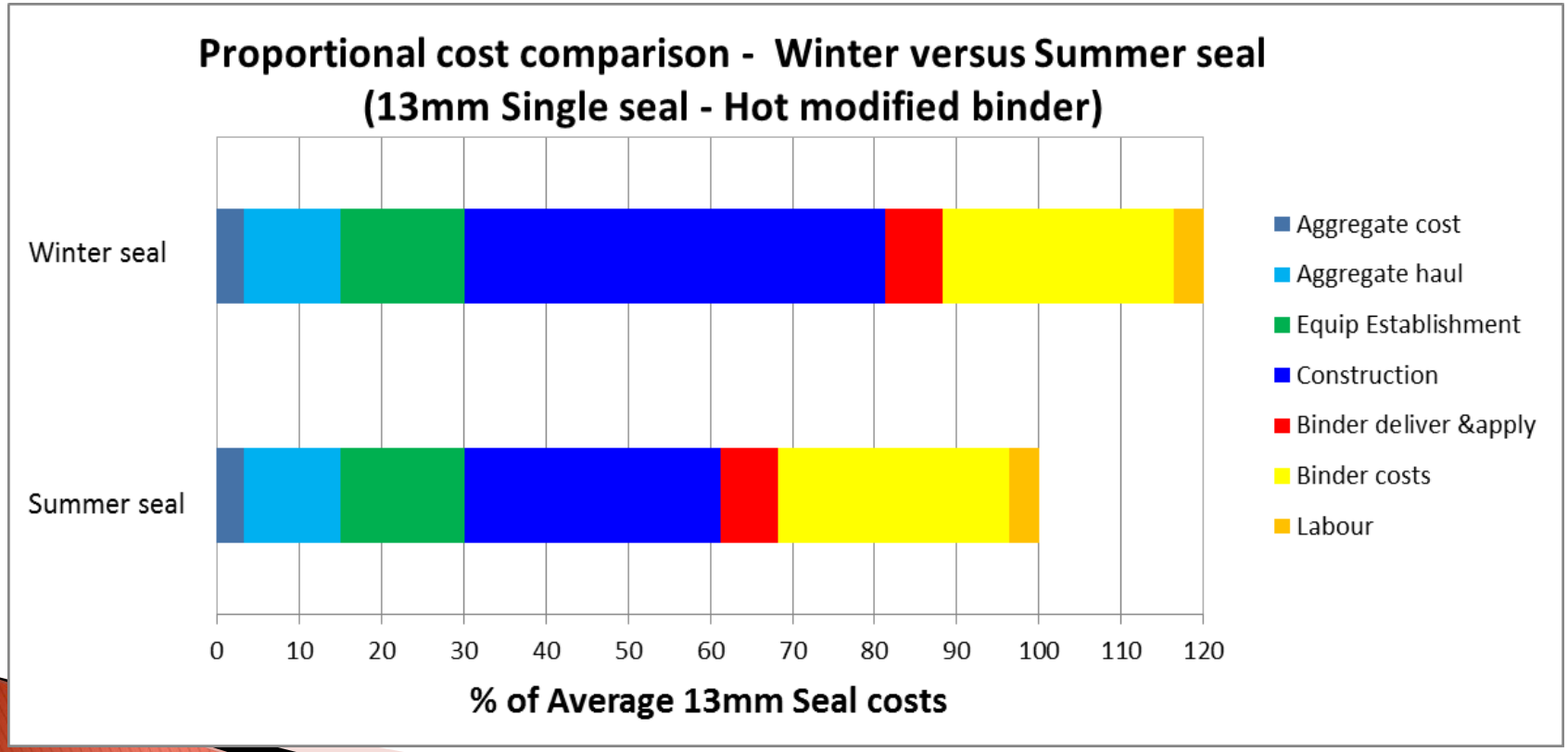
Interesting observations and lessons learnt (4)

- To prevent aggregate loss allow sufficient time for the binder and aggregate to develop a proper bond, before opening to traffic.
  - Specifically precoated aggregate and when temperatures are low.
  - Initial adhesion develops quickly – could take up to four days before a proper bond has developed underneath the aggregate

our future through science
THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg. No.1998/009584/06

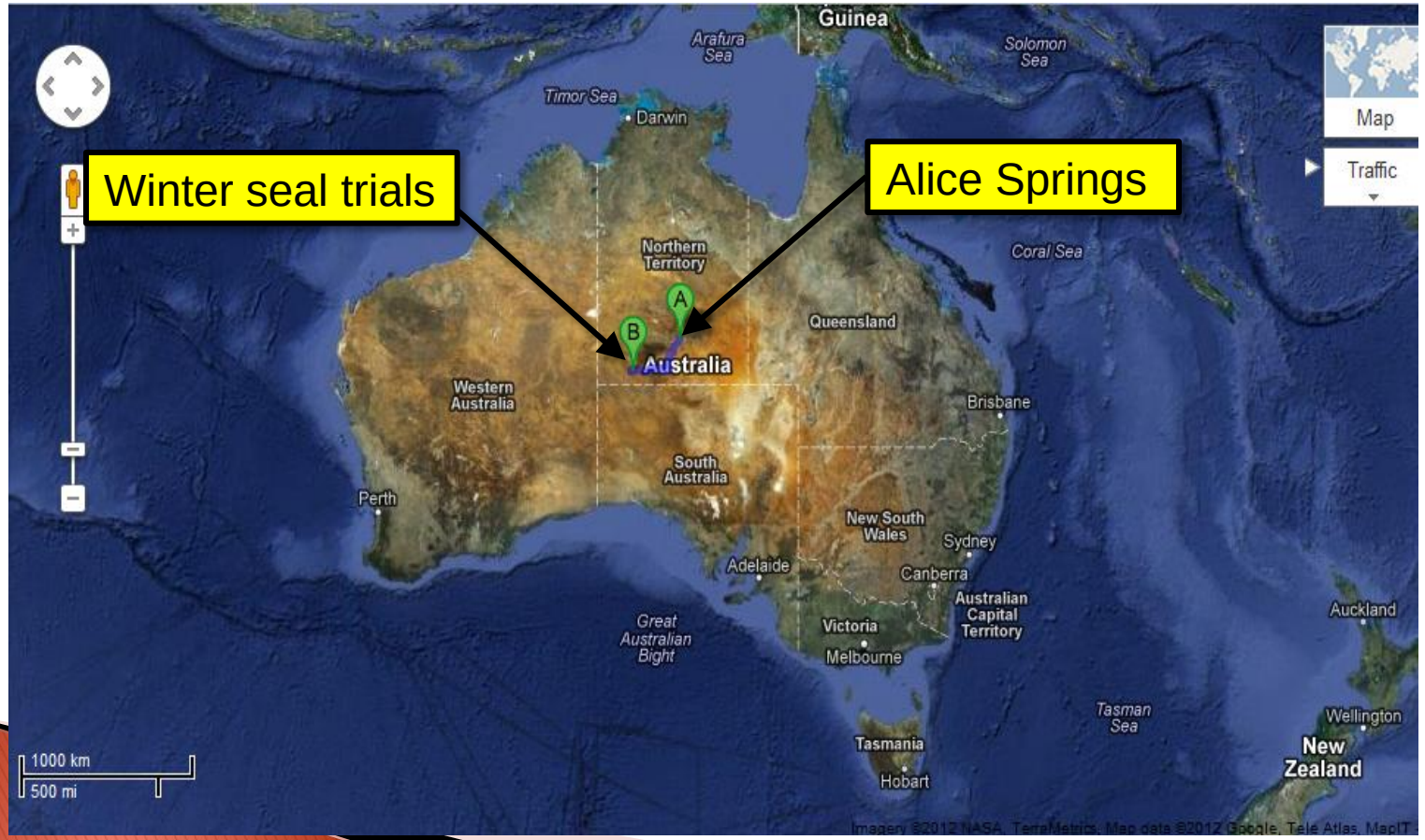
Cost Implications

- Approx 20 % more when compared to summer sealing



Australia Winter Seal Trials

- Alice Springs, Northern Territory (Central Australia)



PBD binder + 2% jet A1 + 2% adhesion agent

60 to 100 vehicles per day

Seal life more than 20 years

1 year after construction – Cutters still not fully evaporated

Bonds well developed on outside – still tacky on inside (1 year after construction)

Current & Future Stages

- Workshop based on findings of phases 1 & 2
  - Draft strategy document (in progress)
- Phase 3 – Investigate appropriateness of existing specifications and procurement strategies (in progress)
  - Binders
  - Aggregates
  - Construction techniques
- Phase 4
  - Disseminate information – documentation and SAT
  - Obtain and collate feedback from industry and finalise strategy (completion – March 2013)
  - Monitor winter seal trails for next 2 -3 years

CSIR our future through science
THE SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
Reg. No.1998/009584/06

Acknowledgements

- Project team
- Local practitioners and suppliers
- International practitioners

THANK YOU