

# Quality of Bitumen Rubber Asphalt

Report Back on USA Study Tour  
(17 to 23 October 2011)

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8 November 2011 – Pretoria

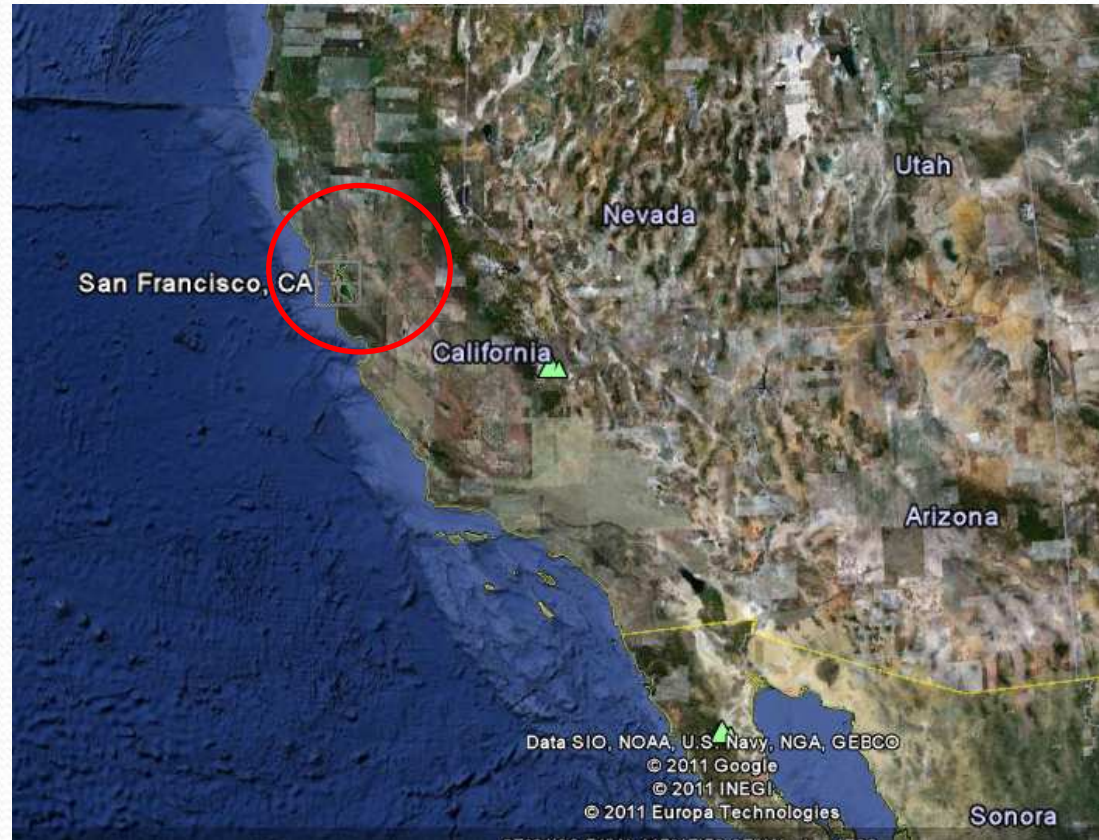
# Purpose

- Update of SABITA Manual 19
- Driven by recent performance of BRA
- Investigate recent technologies in rubber asphalt
- Investigate latest production plant technologies
- Investigate new bitumen rubber technologies, such as:
  - Hybrids,
  - Terminal blend.

# Visited

## San Francisco

- University of California – Davis
- CALTRANS
- Contractor
  - Teichert Rocks
  - Paramount Asphalt
- Blender manufacturer
  - CEI
  - Granite construction



# Visited

## Arizona

- Bearcat pumps & manufacturing
- Seal project – ISS construction
- Blender manufacturer
- D&H – Vulcan materials co
- BRA paving project
- Crafcoc industries
- AMEC laboratories





# Findings - California

- Mandate –
  - Maximise use of bitumen rubber
  - 30% of all bitumen used to be rubber (current)
  - Increase with 5% per year
- CALTRANS strategy – build strong pavements to only contend with top-down cracking
- Since 1995 ± 12 million tonne BRA
- Stringent environmental legislation
- Rubber use on wide range of traffic:
  - 20 000 to 500 000 ADT



# Findings - California

- Binder
  - 18% to 22% rubber crumbs
  - CRM to be 75% tyre + 25% high natural CRM
  - Asphalt rubber binder reaction design profile
  - Use binder within 24hrs, allow 2 x reheat
  - Use of extender oil mandatory
- Tests
  - Cone penetration: 25°C
  - Resilience: 25°C
  - Softening point
  - Viscosity



# Findings - Califo

- BRA
  - Mix types
    - Gap graded
    - Open graded
    - No continuous grade
  - Gap graded
    - Predominantly used
    - Compact 92% of RICE
    - Typically densifies to 7% un
    - Typical thickness = 60mm
    - Hveem compaction for vol





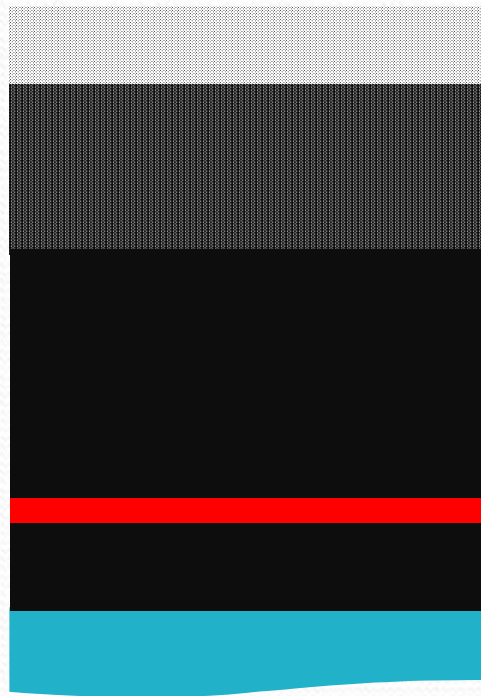
# Findings - California

- Open graded
  - Typically  $\pm 25\text{mm}$  thick
  - Lasts for  $\pm 10$  years, with fog spray at 8 to 9 years
  - Field air voids of 12% - 18%
  - Design with conventional binder content x 1,4
  - Construction - Method specification



# Findings - California

- Typical PCC rehabilitation design
  - Repair (Grinding) / replace damaged slabs
  - Crack and seat



± 25mm Open BR

± 50mm Gap BR

± 75 - 125mm Dense Conventional

Fabric layer

± 30mm Dense Conventional

PCC

# Finding

- Seals
  - Ratio H
  - Genera roads (
  - Many p
    - Dirty
    - Poor c
    - High p
  - SAMI g



w volume  
erience)

rid

# Findings - California

- Terminal blend
  - Blended at refinery:
    - 16hrs @ 218°C
    - Under pressure
    - Turn into PG58-22 concentrate
  - Finer crumb, completely dissolved
  - Modifiers may be added
  - Tend to be ½ stiffness of wet blend
  - Outperformed wet blend i.t.o. reflective cracking (UC research project)
  - Can be used in dense graded mixes
  - Typically lower viscosity
  - Optimum BC typically lower

Motivation could be CA environmental legislation

# Findings - Arizona

- Original BR technology adopted by RSA
- Binder
  - Use of extender oils not allowed
  - 18% to 22% rubber crumbs specified, BUT
  - 18% - 18,5% typically used
  - Crumb grading typically courser than RSA
  - Binder viscosity and Temp. lower than RSA
  - Typical base binder PG64-16
  - Asphalt rubber binder reaction design profile
  - Allow 2 x reheat, viscosity still to meet specification

# Findings - Arizona

- Hybrid
  - 16% rubber crumbs + 2% SBS
  - PG64-16 binder ( $\pm$  52 pen.)
  - Reduction of flushing (seals)
  - Better holding of aggregate (seals)
- Tests
  - Similar to CA



# Findings - Arizona

- BRA
  - Mix types
    - Open graded
      - used mostly by ADoT – concrete freeway overlays
    - Gap graded
      - used by cities and counties
      - Marshall mix design, 4% - 6% Va
    - No continuous grade









na

ze = 9,5mm

ce temps  $\pm 75^{\circ}\text{C}$



# Summary

- Bitumen Rubber used extensively and successfully in California & Arizona
- California driven by Legislation (air, water, noise)
- Arizona driven by success and climate
- Seals not done to same extent & design not intricate
- Hybrid binder shows promise
- Blender technology has advanced
- Binder spray rates appear to be higher than RSA
- Gap and Open graded BRA used in different applications

# Way Forward





Thank You

