Tonkin & Taylor
Pavement Mechanistic Design Workshop
01 May 2008

HIWAY STABILIZERS
Foamed Bitumen Design Considerations
Mix Design Process

WLB10 foaming lab – series of briquettes:
Indirect Tensile Strength – Dry & Wet
Tensile Strength Retained
Unconfined Compressive Strength

Assess site drainage factor

Then use empirical relationship to derive resilient modulus.
Phase 1 (primary) & Phase 2 (steady state)

Validated by MATTA direct resilient modulus testing (and also by performance under several seasons of traffic loading)
TNZ Supplement to Austroads 2007

- Outlines FBR requirements
- Identifies more robust pavement systems for higher traffic numbers / loadings
- Foam Bitumen a good intermediate treatment for modified/lightly bound pavements falling between conventional / modified and fully bound
Mechanistic Design Framework

Achieve a Phase 1 & Phase 2 Modulus

Resilient Modulus = 800 MPa

Anisotropic (conservative?)
No Sublayering (unconservative?)
Poissons Ratio = 0.35

Austroads sublayering not appropriate.

Is there a better means of modelling??
High Strength AND Ductility

- High compressive strength – up to 6 MPa
- BUT - Ductile – not Brittle
  - Maintains Load Capacity at Strains up to well past Twice Peak Load
Experience with Sealing on Foamed Bitumen

- Presents a Hard Surface
- Often low texture and matrix rather than stone mosaic
- Usual seal design for texture, temperature etc
Experience with Sealing on Foamed Bitumen

- THEN *reduce 1st Coat rate by 10 to 20%*
  - Why? - Much lower permeability so bitumen will not be absorbed
- Ensure well broomed and keep slightly moist to avoid dust
- Trafficate to allow chip to set-up
  - TNZ B/05 Draft Specification recognises sealing differences
  - Note – no formal seal design approach in Australia – also recognise that a reduction in 1st coat rate is required.

• Some early jobs experienced flushing of seals, or flooding of asphalt wearing course voids / instability
Experience with Sealing on Foamed Bitumen

Can treat stabilise all year round – the same cannot be said for surfacing.

FBR pavement will handle exposure to elements without failure for significantly longer period of time than granular basecourse.
Not Just for Recycled Pavements

- FBR also a treatment option for new pavements
- TNZ CAPTIF Test track
- Foamed Bitumen Trial
  - 6 x test sections
  - Unmodified, cement only, bitumen only & 3 iterations bit/cem
  - Good performance of bit/cem in all cases. In-service performs better than RLT testing would suggest.
Case Study – Alpurt Motorway Albany to Silverdale

- Northern Motorway Outer Lanes: Okura Bridge to Wilks Road Overpass
  - Area: 39,000 m²
  - Client: Transfield Services Ltd
  - Traffic: High
  - Design: 3.0% cement and 1.5% bitumen to 180mm
  - Construction time: 4 days for 39,000 m²
  - Date: April 2008
Case Study – Alpurt Motorway Albany to Silverdale

- **Evaluation:** Beca undertook comprehensive test pit investigation, materials testing & site walkover.
- **Pavement Layer Condition:**
  - Subgrade Improvement: Excellent
  - Subbase: Very Good
  - Basecourse: Poor in places

- **Basecourse Departure:** Grading fine, plastic fines, moisture problems in places.
- **OGPA surfacing** extensively cracked in outer/crawler lane
  - Do deflections good. High curvature though.
  - AC strains too high for surfacing. 1500 – 2000 MPa OGPA takes on excess strains.

**Constructed Life:** 10 - 11 years  
**Design Life:** 25 years
Case Study – Alpurt Motorway Albany to Silverdale
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Case Studies – Northern Motorway FBR