TNRP
Use of innovative technology

Bitumen Treated Base
Fundamentals of BTB

Rob Vos
Bitumen Treated Base Pavement

- Economical type of bituminous pavement manufactured using available quarry run fractions with a relatively low binder content.
- Produced in a hot-mix asphalt plant and placed and compacted with conventional paving equipment.
- May include RAP and natural sand to provide a smooth grading and to ensure mechanical interlock.
Previous BTB in Qld

- **Boral 1999**
  - Enhanced Road Condition Project at Nanango Area

- **PPS/Fulton Hogan 2000 - 2009**
  - Mackay Regional Council BTB projects 2005-2009
  - Theiss Logan Motorway rehabilitation 2000+
    - (TMR BTB A00/1837 4.1% bit, 4.3% voids 21/11/00)

- **TMR**
  - Review of BTB based on BCC materials
  - Part of masters studies
Mackay is located approximately 1000 kms north of Brisbane.
Heavy Vehicle Loads

Oversize / Overweight permitted vehicles
Bitumen Treated Base (General Principles)

Materials
- In accordance with MRS11.05, material to be supplied as a type 2 material.
- A maximum PI of 6 and minimum CBR of 60
- Grading of material to be 37.5mm down to accord with MRS11.05.

Mix Proposal
- C320 Bitumen at 3.5% - 4% content in mix
- Standard test method in accordance with Table 3 of MRS11.30
- Table 8 of MRS11.30 to be used as a guide of the stability, flow, stiffness and voids of the design mix of the product.

Laying of Mix
- To be paver laid
- To accord with the Table 11 of MRS11.30 the thickness of paving would generally be 80mm ± 10mm. (subject to testing to see whether 100mm layers can be laid)
- Temperatures for laying to comply with MRS11.30
- Compaction of product to have a Characteristic Value of 90% ± 2%.
Alfred St
Macalister St – Gregory St

**AC – 50mm**
DG14, (C320 binder)

**BTB– 200mm**
Type 2.3 BTB, 4% binder, (C320 binder) (two layers)

**Insitu**
Insitu (CBR 4.5)

**Traffic Statistics**

- AADT = 5700
- % H.G.V = 3.9%
- Date Recorded: November 2006

**Date of Construction**
February 2007
Bridge Rd
Brooks St – Nebo Rd

AC – 50mm
DG14, (C320 binder)

BTB– 250mm
BTB Type 2.3, 4% binder
(C320 binder) (two layers)

Subgrade
(CBR 4.5)

Traffic Statistics

AADT = 8709
% H.G.V = 4%
Date recorded: March 2009

Date of Construction
September 2009
Archibald St
Nebo Rd – Railway Overpass
East Bound Carriageway

Traffic Statistics

AADT = 5590
% H.G.V = 11%
Date Recorded: October 2008

Date of Construction
May 2007

AC – 50mm
DG14, (C320 binder)

BTB – 350mm
BTB 4% binder, (C320 binder)
(three layers)

Base Gravel – 200mm
Type 2.3 gravel
## Comparisons of Cost

<table>
<thead>
<tr>
<th>Construction Types</th>
<th>$/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel (200mm)</td>
<td>13 - 15</td>
</tr>
<tr>
<td>Cement Stabilised (Existing) (200mm)</td>
<td>18 - 20</td>
</tr>
<tr>
<td>Cement Stabilised (New) (200mm)</td>
<td>32 - 35</td>
</tr>
<tr>
<td>Foamed Bitumen (200mm)</td>
<td>42 - 45</td>
</tr>
<tr>
<td>B.T.B. (150mm)</td>
<td>49 - 52</td>
</tr>
<tr>
<td>Concrete (200mm)</td>
<td>80 - 85</td>
</tr>
</tbody>
</table>
Performance of Bitumen Treated Bases
What is BTB?

- BTB is made from granular road base.
- Sourced from the quarry or pavement.
- Bitumen is then added.
- RAP can be added.
- Is mixed in the plant.
- Can be paver laid or graded.
- Compacted with rollers.
Why use BTB?

Key factors in selection

ASPHALT
- Use of specification material
  - Current practices only allow 10-20% RAP
  - Higher BC for an equivalent layer

BTB
- Use of marginal material
  - Higher use of RAP up to 50%
  - Relatively low BC
Compaction

Laboratory Compaction (50 Blow Marshall)
Binder content vs Air Voids

Laboratory Compaction (Gyropac) Gyratory cycles vs Air Voids
Creep and Resilient Modulus

• 2% strain is achieved around 3000 pulses
• BTB (2.1c) has similar resilient modulus to DG 20 - likely to have high strength value and good load spreading ability.

<table>
<thead>
<tr>
<th>Specimen number</th>
<th>Air voids</th>
<th>Resilient Modulus</th>
<th>Inflection slope</th>
<th>No. of pulses to achieve 2% strain</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 200-1</td>
<td>6.6</td>
<td>7569</td>
<td>3.82</td>
<td>2448</td>
</tr>
<tr>
<td>B 200-3</td>
<td>6.2</td>
<td>7840</td>
<td>4.17</td>
<td>2856</td>
</tr>
<tr>
<td>B 200-4</td>
<td>6.5</td>
<td>8246</td>
<td>2.7</td>
<td>3888</td>
</tr>
</tbody>
</table>
Wheel tracking

- Limited tests indicate BTB (2.1c) ave rut rate 0.15mm/1000 cycles
- Final rut depth ave 2.73 mm @5000 cycles or 10000 passes.
- Material rut resistance < 0.2mm/1000 cycles
- Compared to DG 20 range 0.15mm to 0.25mm/1000 cycles
Permeability

• BTB mix was permeable within air voids range of 5.6% to 7.7%
• Testing range 15 µm/s to 43 µm/s
• Cat C classification (10 to 100µm/s) - (Q304)
• BTB is usually sealed
• Toowoomba some BTB performing well unsealed - low traffic and rainfall
Advantages

• Lower cost aggregate, up to 1% less binder
• Priced between Foam & DGA
• High volume production > 1500 tonnes/day
• Faster construction
• Easier construction process
• Rapid opening to traffic, less delays
• Improved engineering properties
  o Equivalent to UK DBM
  o Flexibility to select in project design
Process

- National Specification BTB in development
- Request to AAPA for earlier project documents – Roma area
- Queensland AAPA Working Group
  
  Peter Pezet, Jonathan Hoffman, Richard Murray, Chris Lange, Jamie McLeod, Steve Mole & Rob Vos

- Based on existing TMR specifications, technical standards, annexure and systems
- Delivered as draft project specification after interaction with the TMR BTB steering committee
Bitumen Treated Base Pavements (BTB)

Guide Notes

DRAFT v12.1
Changes marked in Blue

Project Specification

MRSXXXX
Bitumen Treated Base Pavements (BTB)

DRAFT v12.1
Changes marked in Blue

April 2011
Project BTB

• Use available MRTS05 type 2.1 with C grading (28mm) with 5-12% at 0.075mm and lower PI ≤ 4, LS ≤ 2

• Designed to Marshall Properties and reporting on performance including:
  o wheel tracking, modulus, fatigue, permability
  o Class 320 bitumen 3.5 to 4.5%, ✗ PMB, ✗ lime
  o Voids 4-6, stab≥6, flow≥2, stiff≥1.5, VMA≥11
  o Armour-coat 7mm & class 320

• Job mix design approved by Administrator
  o design(s) base layers, overlay possible
  o design based on available materials / traffic
And . . . .

- Early feedback on design parameters
- Keep future requirements achievable ≠ DG
- Feedback into national BTB guide
- Possible wider application in Qld where quarry aggregates for dense graded asphalt not available
- Has a role in the TNRP for rapid strengthen and providing network resilience
- Capacity available in asphalt sector
Thank You

Questions?