Asphalt Performance – Durability - Recycling

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## Contents

1. Performance of thin surfacings across the UK
2. What are the main issues affecting performance?
3. Options to make improvements
4. Recycling - Cold
5. Recycling – Hot mix surface course
Aggregate loss – open joint ($j_o$)
Joints - fretting

M5, S/P – j_{fsc}, 7.1 yrs
Joints - repairs

N1, M –, 8.3 yrs
Emerging Experience

- What does the tyre see?

Increasing aggregate size → Increasing contact area → Increasing skid resistance?
Recommendations

Improving durability:

- To extend the current service-life there is a need to reduce the open appearance of TSCSs and improve joint construction.
- New national surfacing course specification should be considered.
- Optimising texture should be discussed with the asphalt industry, including introduction of a maximum texture. (Currently IAN 157 with Europe to do this)
- Improve quality of joint construction through method statements and new construction techniques.
- Better supervision
- Reduce nominal aggregate size on laterally loaded sites.
TAIT procedure for new surfacing in Scotland

Background

Following in-service performance issues of surface course layers identified in 2006, Transport Scotland has been working with TRL and the road industry to develop and now implement a new surface course specification. The new performance-based specification is expected to deliver significant improvements in material durability, reduce disruption to road users caused by road construction and maintenance, and provide better value for money.

Controlled introduction

The need to control the quality of materials and workmanship was recognised as a key factor in delivering the benefits of the new specification. A Type Approval Installation Trial (TAIT) process was developed to ensure that all new materials are consistently produced in accordance with the requirements of the specification.

TAIT process

The TAIT comprises a four-stage process: Laboratory testing and design, Product mix trial, Trunk Road Network Trial (Interim Approval), and Final Approval. Client approval is required at the end of each stage before the Supplier can proceed to the next stage of the process. A ‘Feedback’ report at the completion of each stage is issued prior to approval to proceed to the next stage.

Key benefits

- Dialogue between the Client and asphalt suppliers has led to improvements in material consistency and quality, new joint construction techniques, including echelon laying and the application of grit to enhance early-life skid resistance;

- The move to a performance based specification, with collection of skidding data at 4 weeks and 6 months will allow an increase in the use of locally won materials to be considered, leading to more sustainable options.
Specifications and Design Guides (Cold mix)

- 1999 TRL 386 In situ recycling
- 2004 TRL 611 Design guide and specification for cold recycled materials
  - This last development gives a framework for use of recycled materials. It allows for the use of alternative materials and binders as it is Performance based
Trafficking trial
Case Study – A46 Stratford by-pass

- Maintenance of a flexible composite pavement requiring structural maintenance. (On going annual routine and emergency maintenance to maintain in serviceable condition)

- Approximately 2km long, 12m wide 2 lane single carriageway on the A46 Stratford–upon-Avon northern bypass.

- Scheme works undertaken by Cemex in Jan – Feb 2006

- First UK use of crack and seat of CBM combined with new cold recycled base course

- PPR 228
Surface course recycling

Feasibility study 2002-2005
- Thin surfacings
- Increasing quantity of high PSV stone
- Valuable resource
- Desk and Laboratory study
- Field trials

Development of best practice guide 2006-2009
- More laboratory work
- Monitoring of site trials for medium term performance
- Monitoring of major resurfacing schemes

Monitoring of site trials and schemes for longer term performance
Industry practice

- Recycled back into asphalt
- Generally into base and binder course layers
- Use in capping and Type 1 sub-base
- Insignificant quantities going to landfill
- Increasing quantities and value of application
## A405 Bricket Wood

Results after 6 years service (September 2010)

<table>
<thead>
<tr>
<th>Recovered Pen and Softening Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ TAC sections.</td>
</tr>
<tr>
<td>▪ Penetration 67, 64, 43 (93, 89, 66)</td>
</tr>
<tr>
<td>▪ S.P. 67.2, 60.6, 58 (66, 68.6, 60.6)</td>
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</tbody>
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<table>
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<tr>
<th>Viscosity (after 49 months)</th>
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<tbody>
<tr>
<td>▪ TAC sections comparable</td>
</tr>
<tr>
<td>▪ TSMA sections comparable</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Deformation Resistance</th>
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<tbody>
<tr>
<td>▪ TAC sections 0.7, 0.7, 0.6 mm/h</td>
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<table>
<thead>
<tr>
<th>Visual Assessment</th>
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</thead>
<tbody>
<tr>
<td>▪ TAC sections all ‘Moderate’ some cracing and aggregate loss.</td>
</tr>
<tr>
<td>▪ TSMA sections affected by ‘unbound’ binder course. 30% better than 10% Assessed as A-S-A</td>
</tr>
</tbody>
</table>
Schemes – M25 Reigate 1

M25 Reigate 1

- PA laid in 1996 (11 years old)
- Client (Mouchel) demanded re-use of PA RA into new surface course layer
- Tarmac, August 2008
- Energy audit undertaken to evaluated any potential additional benefits of using RA for this scheme (PPR 304)
- Visual assessment in May 2012, ‘Good’
Case Study – M25 Reigate

- Resurfacing contract to replace worn out porous asphalt surfacing
- Scheme works undertaken by Tarmac in August 2007
- Client demanded use of high RA content from existing surfacing into new surface course layer
- Grading compatibility and asphalt plant capability restricted RA content to 23%
- Requirement to superheat virgin aggregate to compensate for addition of cold RA into the mix
- Energy audit of sourcing, processing, mixing and laying of materials undertaken to compare with conventional approach
Case Study - M25

General sequence

First nights work plane out and lay 100% virgin aggregate materials. Future nights 23% RA

PA (RA), screen out oversize and undersize fractions. QA checks for compatibility with TSC mixture.

Transport and lay material in conventional manor (potential to use delivery wagons to return to plant with planings for following nights work)

Add RA to mixture.
Best Practice Guide

ROAD NOTE 43

Best practice guide for recycling into surface course

PUBLISHED
TRL / IHS

Design and planning advice
Materials production advice
Mixture design advice
Development of flow charts

- Identify aggregate properties
- Are they suitable?
- Determine grading, binder content and recovered binder properites

- Select target RA proportion
  - Calculate maximum practical
  - Check plant capability

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**Step 1**

- Assume initial active binder
  - 0-25 % if < 15 pen
  - 25-50 % if 15-30 pen
  - 75 % if > 30 pen

**Step 2**

- Design initial trial mixture
- Determine binder drainage
- If target RA \( \leq 10 \% \), use trial mixture
- If target RA > 10 %, determine volumetric properties
Development of flow charts

- Determine recovered binder properties
- Check volumetrics acceptable?

- Does trial mixture comply?
  - Yes, continue
  - No, re-design

Step 5

- Is RA content > 20 %?
  - Yes, determine wheel-tracking and other specified performance requirements
  - No, do not

Step 6

Step 7

Step 8

- Check performance as part of normal QA
**Latest research**

### Adding RA from mixed stockpiles

- Most of UK work is replacement of surface course layers
- Check consistency of treatment of planings and stockpiles across asphalt plants
- How much can be added without affecting performance?

### Stage 1

- Review of data from asphalt plants
- Petrographic analysis
- Preparation of laboratory samples
Thank you for listening
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