Britpave Seminar 2012
Roads Task Group

The Return of Concrete as the Pavement Material of Choice

John Donegan
The return of concrete

Why now?

- “More for less”
- The “Austerity” pavement!
- Price certainty in volatile market for oil
- Environmental considerations
Bitumen v Cement

Paving Material PPI Price Comparisons
1996 = 100

Old Reality: 1982-2004
- Average Annual Concrete PPI Increase: +2.1%
- Average Annual Asphalt PPI Increase: 1.1%

- Average Annual Concrete PPI Increase: +4.0%
- Average Annual Asphalt PPI Increase: 12.0%

Source: Bureau of Labor Statistics, Producer Price Indices
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- Haven’t we been here before?
  - Is it worth the effort?
  - Can past prejudices be overcome?
  - How can we really have more for less?
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- Lower first build cost
- More cumulative traffic per £ spend
- More bang for your buck!
- “More for less”!
- And………
- Environmental benefits through significant fuel savings on rigid pavements
Cost Comparison

- Analysis based on following assumptions
- Major greenfield site or substantial reconstruction
- Heavily trafficked pavement - > 80msa
- Existing options from DMRB, HD26/06
- On Class 3 Foundation
- Benchmark pavement = DBM/HDM50 Fully Flexible
- Flexible composite with HBM Category D base
- CRCP with 30mm Thin Surface Course
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Cost Comparison

Further potential options

- 200mm CRCP with Exposed Aggregate Concrete Surface (EACS)
- 200mm CRCP with Grooved & Ground (G&G) surface
- 250mm Roller Compacted Concrete (RCC) with 70mm surfacing (*ECOPAVE trial on A30, 1992*)
The return of concrete

**Pavement cost/m² comparison**

- 100 - 400msa EACS $f_c = 4.5 - 6.0 \text{MPa}$: $92\%$
- $>80\text{msa RCC + Surfacing C40/50 RCC}$: $88\%$
- 100 - 400msa CRCP + G & G $f_c = 4.5 - 6.0 \text{MPa}$: $106\%$

- EACS
- CRCP
- 200mm
- Grooved & ground CRCP
- 200mm
- Surface course 30mm
- Binder course 40mm
- 250mm RCC base induced cracking at 2m centres
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Obstacles to progress

- **Noise!!!**
- Perceived problems with concrete surfaces are no longer valid with modern low-noise surface options
Noise

- New Highways Agency noise classification system will be performance based
- Noise parameters and texture depth will be specified
- EACS is at least as quiet as hot rolled asphalt (HRA) and many other thin surface course systems – TRL report 576
- G&G noise level is significantly quieter than HRA and “in some locations performed as well as a very quiet surfacing material” - TRL PPR607
Obstacles to progress

- Durability of new surfaces
- EACS already proven in Britain – 15 years plus
- Grooved & Ground surface in USA – at least 10 years life with limestone aggregates
- TRL report PPR607 – Long term friction performance of longitudinally diamond ground concrete
Grooving & Grinding

- SCRIM testing confirms durability of low speed skid resistance
- Texture depth is good
- High speed friction has returned to previous levels
- 10 year life for treatment?
Obstacles to progress

- Design & Specification
- Existing design standard covers CRCP
- EACS is in SHW 1000 Series
- Grooving & Grinding will be in updated HD32 – Maintenance of Concrete Roads
- Design method for RCC rigid composite to be part of planned trial on A11, Suffolk
- Evidence from ECOPAVE trial on A30
Obstacles to progress

Buildability
M23 Construction Details
Inlay of CRCP Road Slab
With EACS
1320 m Long
4 m Wide
200 mm Thick
BRITPAVE Seminar 2000

North Bound Carriageway, Lane 1 had 25 mm Ruts
Traffic 70,000 Vehicles Per Day
4 Traffic Lanes at All Times
5 Lanes at Peak Periods
BRITPAVE Seminar 2000

M23 Construction Details
BRITPAVE Seminar 2000

M23 Construction Details
BRITPAVE Seminar 2000

M23 Construction Details
Buildability

A47 - Placer/Spreader
Buildability

A47 - Slipform Paver
Buildability

M25 Widening - 2012
Buildability

Total Station Level Control on HBM Paver
Environmental Issues

- Fuel Usage

- Up to 6% saving

- on concrete

- pavements!
### Worldwide Research

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<thead>
<tr>
<th>Country</th>
<th>Average fuel saving reported</th>
<th>Source</th>
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<tbody>
<tr>
<td>Canada</td>
<td>2.35%</td>
<td>National Research Council</td>
</tr>
<tr>
<td>UK</td>
<td>1.14%</td>
<td>Transport Research Laboratory</td>
</tr>
<tr>
<td>Sweden</td>
<td>6.7%</td>
<td>National Road &amp; Transport Institute</td>
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<tr>
<td>Japan</td>
<td>3.1%</td>
<td>Nippon Expressway Research Institute</td>
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<tr>
<td>USA (Texas)</td>
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# Case Study

## RING ROAD OF ANTWERP

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<th>number of heavy vehicles per day</th>
<th>directions</th>
<th>fuel saving</th>
<th>price diesel</th>
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## SAVINGS PER DAY

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<tr>
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<th>NOx (kg)</th>
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## SAVINGS PER YEAR

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## SAVINGS OVER THE 30 YEAR LIFETIME OF THE ROAD

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Summarise Findings

- Cost saving cementitious options already exist in DMRB, HD26.

- Further cementitious cost saving options are available without compromising on noise.

- The “tipping point” whereby rigid and rigid composite options are competitive on first cost has been passed.

- The cost differential will increase as the bitumen and cement price trend continues.
Summarise Findings

- Clear case for rigid concrete pavements on heavily trafficked pavements
- Lane 1 replacement/inlay and widening to create a new Lane 1 for HGV traffic
- Significant cost saving possible through the development of a rigid composite option using roller compacted concrete (RCC)
- Challenges – disposal of arisings from EACS and G&G
Conclusion

- Is it now time?
- Lower first build cost – significant savings over the benchmark fully flexible options
- Fuel savings – both £s and lower life cycle carbon
- Cementitious pavement options will generate “MORE for LESS”!
- It IS now time for the return of concrete as the pavement material of choice