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## Perpetual pavements and Sustainability

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Introduction and state of the art/practice (1)

- Traditional understanding of flexible pavement deterioration
  - Fatigue cracking (from bottom up)
  - Deformation throughout pavement

Therefore:

- Higher traffic levels = Thicker designs

- In 1990’s studies suggested a different behaviour
  - For ‘thick’ well-constructed pavements
    - No fatigue cracking (only top down surface cracking)
    - Deformation only in surfacing

Therefore:

- No structural deterioration

- Higher traffic levels ≠ Thicker designs
Introduction and state of the art/practice (2)

- Pavements without structural deterioration are called:
  - Perpetual pavements – in USA
  - Long-life pavement – in Europe - LLP

- Initially only applied to fully flexible pavements – *(Phase 1 Report)*

- ELLPAG (European Long-Life Pavement Group)
  - A long-life pavement is a well designed and well constructed pavement where the structural elements last indefinitely provided that the designed maximum individual load and environmental conditions are not exceeded and that appropriate and timely surface maintenance is carried out.

- Now, in Europe, ELLPAG suggests also can apply to
  - Flexible composite/Semi-rigid pavements *(Phase 2 Report)*
  - Rigid pavements *(Phase 3 Report)*
Cost benefits of LLP’s over 50 years
- DLP NPV/LLP NPV = over 2 for Fully flexible or semi-rigid

Network management of LLP’s
- Design
- Maintenance

LLP’s are structurally long life but need timely surface maintenance
Therefore:
- Further savings if surfacings longer life economically

Current usage of long-life pavements
- Europe
- USA
Contribution to sustainable pavement solutions?

- How do we assess such a capability?
  - Whole life value?
  - Ecological economics?

- Full methodology does not yet exist?

- *asPECT* documents and software are freely available as downloads from the project website. Visit:
  - [www.sustainabilityofhighways.org.uk](http://www.sustainabilityofhighways.org.uk)

However:

- If long-life designs = determinate life designs
  - In terms of initial construction

- Since long-life pavements only need surface maintenance

- Long-life designs >>> determinate life designs
  - In terms of sustainability

- But what if future traffic levels don’t match expectations?
Knowledge gaps in perpetual pavements?

Lack of:

- Tools to assess sustainability impact of alternative pavement management methodologies
  - i.e. long-life vs determinate life design and maintenance
- Full understanding of pavement deterioration
  - All pavement types
  - Long-life vs determinate life
  - Threshold design concept
- Full understanding of effect of pavement quality on pavement performance
- Network and scheme level tools to evaluate long-life status with minimum traffic disruption
Priority research questions

For all main pavement types:

- Develop sustainability indicator
- Confirm threshold design concept and identify threshold levels
- Define importance of construction variables on pavement life
Long life = 2000 years?

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“Long Life Surfacings for busy roads”

published by OECD in November 2007

For further information, see:
http://www.cemt.org/JTRC/WorkingGroups/Pavements/index.htm
### Indicative Cost Estimates: Comparison of EA, HPCM & Reference mixes

Table: Comparison of costs between materials

<table>
<thead>
<tr>
<th>Description</th>
<th>Epoxy Asphalt 30mm wearing course</th>
<th>HPCM 10mm wearing course</th>
<th>Conventional 30mm asphalt solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected Lifespan</td>
<td>30 years?</td>
<td>30 years?</td>
<td>7-15 years</td>
</tr>
<tr>
<td>Milling 50-100mm</td>
<td>0.75-1.25</td>
<td>0.75-1.25</td>
<td>0.75-1.6</td>
</tr>
<tr>
<td>Binder course (50mm)</td>
<td>6-10</td>
<td>8-12</td>
<td>6-12</td>
</tr>
<tr>
<td>Tack/bond coat</td>
<td>0.25</td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>Wearing course</td>
<td>18-31</td>
<td>20</td>
<td>6-12</td>
</tr>
<tr>
<td>Total costs</td>
<td>25-42.5</td>
<td>29-33</td>
<td>13-25</td>
</tr>
</tbody>
</table>
Phase III Field Trials: Overall Aims

The overall aims of a coordinated programme of field trials of the Epoxy Asphalt and HPCM surfacings are:

- To demonstrate that the performance envisaged on the basis of the laboratory tests and the accelerated testing will hold within the period of the trial under real traffic and environmental conditions.

- Collateral aims include to: develop construction methods, improve cost estimates, optimise material mixes and increase contractor experience levels.