**Introduction and Objective**

- **Introduction**
  - Main problem of porous asphalt (PA) pavement
  - Open-graded structure
  - Faster binder aging
  - Preventive maintenance method

- **Objective**
  - To investigate the key factors affecting the raveling recovery efficiency of damaged PA under the effects of different ST emulsions

**Materials and Methods**

- **Raw materials**
  - Mixture: PA 13 (VV 22%)
  - Asphalt emulsion (CSS-1, 60% asphalt content)
  - Rejuvenators: 2 petrol-based, 3 bio-based

- **Sample preconditioning**
  - Preventive maintenance method
  - To investigate the effects of different ST emulsions

- **Experimental methods**
  - Cantabro abrasion test
  - Functional performance test
  - Noise absorption test
  - Skid resistance test
  - Permeability test

**Factors Condition**

- Application rate (kg/m2)
  - 0.4, 0.6, 0.8, 1.0
- Solid content (%)
  - 40, 50, 60
- Curing duration (day)
  - 3, 7, 14
- Rejuvenator
  - five types

**Recovery Efficiency of the Damaged PA**

- **Effect of the solid content of ST emulsion**
  - The cohesion and adhesion inside mixtures get worse
  - More brittle and vulnerable to cracking

- **Effect of the application rate of ST emulsion**
  - Application rate decreased first and then the downturn flattened out when the application rate increased from 0.4 kg/m² to 1.0 kg/m².
  - The recommendation value of application rate is 0.6 kg/m².

- **Effect of curing duration**
  - Curing duration decreased first sharply and then slowly as the curing duration increased.

- **Effect of rejuvenator**
  - Except for one kind of bio-based rejuvenator, most rejuvenators weakened the recovery efficiency of the ST emulsion on the damaged mixtures due to the non-uniform penetration or the slow diffusion of rejuvenator.

**Functional Performance Verification**

- **Storage modulus**
  - The storage modulus of the treated PA mixture after ST emulsion filling up micro-cracks increased.

**Significance analysis**

<table>
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<th>Factors</th>
<th>Source of difference</th>
<th>SS</th>
<th>DF</th>
<th>MS</th>
<th>F</th>
<th>Sig.</th>
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<td>218,649</td>
<td>3</td>
<td>72,883</td>
<td>16.818</td>
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<td>Within groups</td>
<td>46,320</td>
<td>8</td>
<td>5,790</td>
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<td>188,754</td>
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<tr>
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**Findings and Conclusions**

- Both the application rate and solid content of the ST emulsion have significant effects on the raveling resistance recovery of the damaged PA mixtures. In practice, it is critical to control them to ensure the quality of this method.
- The recovery efficiency of the rejuvenator on the damaged PA mixtures was not obvious within 14 days of curing. But in the long term, it is expected that the rejuvenator may soften the aged binder by diffusion, which needs further study.
- The vertical permeability coefficient $K_v$ of treated specimen obviously decreased due to clogged pores, but it still meet the specification minimum requirement.