A Trial of Thicker Layer Semi-Rigid Pavement With Modified Polymer Mortar

Zhang Y.L., DAUD and Dr Wu, D.Q.

Chemilink Technologies Group, Singapore
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1. Introduction

- **Road pavement:**
  - Flexible pavement (asphalt concrete pavement)
    Easy to install, but no resistance to oil, chemicals, etc.
  - Rigid pavement (cement concrete pavement)
    High durability, but long time to install, difficult to maintain and repair.
  - Semi-rigid pavement (asphalt concrete filled with cement mortar)
    - Easy to install,
    - High skid resistance,
    - Easy to maintain and repair,
    - Resistance to oil, chemical,
    - High durability.

So, semi rigid pavement has been widely used in Europe since 1990s.
1. Introduction

- **Composition of semi rigid pavement:**
  - Open graded asphalt concrete (void content: 25-30% by volume) + 
  **high strength high fluidity polymer modified mortar** to resist rut and permanent deformation.

- **Thickness of semi rigid pavement:**
  - As for road, bus bay, etc., thickness of **50mm** is enough, but for **airport runway entry taxiway/taxiway junction**, because of heavy loading and high frequency of traffic, 50mm may not be enough. So a **thicker layer** of semi rigid pavement needs to be tried.
2. Polymer Modified Mortar

2.1 The Requirements For Polymer Modified Mortar:

- Good fluidity (Workability)
- High strength (Compressive and Flexural strength)
- Combination of the above two
2. Polymer Modified Mortar

2.2 Chemilink Polymer Modified Mortar SS-141

- Chemilink high performance polymer modified mortar
  - High fluidity ➞ Easy application
  - High early strength ➞ Early opening to traffic
  - High long-term strength ➞ Low maintenance

Testing data is shown as table below:
# 2. Polymer Modified Mortar

## 2.2 Chemilink Polymer Modified Mortar SS-141

<table>
<thead>
<tr>
<th>Properties</th>
<th>Test Method</th>
<th>Chemilink SS-141</th>
<th>Spec (1) (from website)</th>
<th>Spec (2) (in tender document)</th>
<th>Spec (3) (in tender document)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fluidity (Workability)</strong></td>
<td>ASTM C939</td>
<td>13~27 Seconds</td>
<td>-</td>
<td>10-14 Seconds</td>
<td>10-14 Seconds</td>
</tr>
<tr>
<td></td>
<td>JASS15-M103</td>
<td>27~31 cm</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Compressive Strength</strong></td>
<td>12 hrs</td>
<td>20~30 MPa</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1 day</td>
<td>55~85 MPa</td>
<td>55 MPa</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>7 days</td>
<td>100~120 MPa</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>28 days</td>
<td>120~140 MPa</td>
<td>110 MPa</td>
<td>40~50 MPa</td>
<td>-</td>
</tr>
<tr>
<td><strong>Flexural Strength at 28 days curing</strong></td>
<td>BS EN 12190</td>
<td>7 ~ 15 MPa</td>
<td>15 MPa</td>
<td>6~8 MPa</td>
<td>6 MPa</td>
</tr>
<tr>
<td><strong>Setting Time</strong></td>
<td>EN 196 - 3</td>
<td>2<del>3h, 3</del>6h, 6~8h</td>
<td>8~12 hours</td>
<td>2~3 hours</td>
<td>2~3 hours</td>
</tr>
</tbody>
</table>
3. Thicker Layer Semi-Rigid Pavement

3.1 W/P Ratio Selection of Chemilink Polymer Modified Mortar SS-141 For This Trial

Compressive Strength - W/P Ratio

- Curing Age
  - 28 days
- 1 day

Compressive Strength (MPa)

W/P Ratio:
- 0.20
- 0.21
- 0.22
- 0.23
- 0.24
- 0.25
- 0.26
- 0.27
- 0.28
- 0.29
- 0.30
- 0.31
3. Thicker Layer Semi-Rigid Pavement

3.1 W/P Ratio Selection of Chemilink Polymer Modified Mortar SS-141 For This Trial

Fluidity – W/P Ratio

Fluidity (Second)

W/P Ratio

0.22 0.23 0.24 0.25 0.26 0.27 0.28 0.29 0.30 0.31

14.00S

12.60S
3. Thicker Layer Semi-Rigid Pavement

3.1 W/P Ratio Selection of Chemilink Polymer Modified Mortar SS-141 For This Trial

- The above 2 figures show that:
  
  As W/P = 0.30~0.31
  
  - Compressive strength of Chemilink SS-141:
    1-d ≥ 55MPa, 28-d ≥110MPa, and
  
  - Fluidity ≤ 14seconds,

  Meet all specs.

- So, we select W/P ratio of 0.30~0.31 to do this trial
3. Thicker Layer Semi-Rigid Pavement

3.2 Construction Procedures of Semi-Rigid Pavement

- Coring
- Spraying Primer
- Laying Porous Asphalt Concrete
- Compacting Porous Asphalt Concrete
- Finished Surface of Porous Asphalt Concrete
3. Thicker Layer Semi-Rigid Pavement

3.2 Construction Procedures of Semi-Rigid Pavement

Loading Polymer Modified Mortar into Mixer

Mixing cement mortar with water at W/P ratio of 0.30~0.31
3. Thicker Layer Semi-Rigid Pavement

3.2 Construction Procedures of Semi-Rigid Pavement

- Filling Cement Mortar into Porous Asphalt Concrete
- Spreading Cement Mortar
- Vibrating

- Surface Just After Filling
- Hardened Surface
3. Thicker Layer Semi-Rigid Pavement

3.3 Sample Coring
3. Thicker Layer Semi-Rigid Pavement

3.4 Sample Cored For Testing

80mm thick
3. Thicker Layer Semi-Rigid Pavement

3.5 Skid Resistance Testing For This Trial
## 3. Thicker Layer Semi-Rigid Pavement

### 3.6 Test Result of Semi-Rigid Pavement For This Trial

<table>
<thead>
<tr>
<th>Properties</th>
<th>Test Method</th>
<th>Result</th>
<th>Spec (1) (from Website)</th>
<th>Spec (2) (in tender document)</th>
<th>Spec (3) (in tender document)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive strength at 8 days</td>
<td>EN 12390</td>
<td>12.5 MPa</td>
<td>-</td>
<td>-</td>
<td>7 MPa</td>
</tr>
<tr>
<td>Compressive strength at 28 days</td>
<td></td>
<td>14.5 MPa</td>
<td>7~10 MPa</td>
<td>7~10 MPa</td>
<td>-</td>
</tr>
<tr>
<td>Flexural strength at 28 days</td>
<td>EN 12390</td>
<td>6.65 MPa</td>
<td>3.5 MPa</td>
<td>3.5 MPa</td>
<td>3 MPa</td>
</tr>
<tr>
<td>Wet Surface Skid Resistance</td>
<td>ASTM E303</td>
<td>78 BPN</td>
<td>-</td>
<td>-</td>
<td>60 BPN</td>
</tr>
<tr>
<td>Impermeability</td>
<td>DIN 18130</td>
<td>impermeable</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Curing time</td>
<td></td>
<td>4 hours</td>
<td>-</td>
<td>4~8 hours</td>
<td>4~8 hours</td>
</tr>
</tbody>
</table>
4. Conclusions

This Trial Presents That:

1) Chemilink Polymer Modified Mortar SS-141
   - Compressive Strength: $\geq 55\text{MPa (1-d), } \geq 110\text{MPa (28-d)}$
   - Flexural Strength: $7\text{~}15\text{MPa (28-d)}$
   Meets all specs

2) Semi Rigid Pavement (80mm thick) (Chemilink SS-141 as grouting)
   - Compressive strength (28-d), 14.5MPa
   - Flexural strength (28-d), 6.65MPa
   Meets all specs

3) Chemilink Polymer Modified Mortar SS-141 Can Be Adjusted to Meet Different Requirements.
Thank You for Your Attention!