Chemilink SS-141 Semi-Rigid Pavement
for Airport Aprons & Heavy Traffic Roads

Chemilink Technologies Group, Singapore
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1. Introduction

Road pavement:

- Flexible pavement (asphalt concrete pavement)
- Rigid pavement (cement concrete pavement)
- Semi-rigid pavement (asphalt concrete filled with cement mortar)

<table>
<thead>
<tr>
<th>Properties</th>
<th>Asphalt Concrete</th>
<th>Cement Concrete</th>
<th>Semi-Rigid Pavement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rutting Resistance</td>
<td></td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Quick installation and short curing time</td>
<td>√</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Easy to maintain and repair</td>
<td>√</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>High Skid Resistance</td>
<td>√</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>No joints required</td>
<td>√</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Resistance to oil, chemicals and petrol, etc.</td>
<td></td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Resistance to moisture damage</td>
<td></td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>
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, thickness of more than 50mm is needed.
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></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 hrs</td>
<td>BS EN 12390</td>
<td>20~30 MPa</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1 day</td>
<td></td>
<td>55~85 MPa</td>
<td>55 MPa</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7 days</td>
<td></td>
<td>100~120 MPa</td>
<td>-</td>
<td>-</td>
<td>40MPa</td>
</tr>
<tr>
<td>28 days</td>
<td></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>
2. Polymer Modified Mortar

2.3 W/P Ratio Selection of Chemilink Polymer Modified Mortar SS-141

Fluctuation – W/P Ratio

Fluidity (Second)

W/P Ratio

Chemilink SS-141
2. Polymer Modified Mortar

2.3 W/P Ratio Selection of Chemilink Polymer Modified mortar SS-141

Compressive Strength - W/P Ratio

- Curing Age
  - 28 days
- 1 day

Compressive Strength (MPa) vs. W/P Ratio

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

Compressive Strength (MPa):
- 150
- 130
- 110
- 90
- 70
- 50
3. Semi-Rigid Pavement

3.1 Construction Procedures of Semi-Rigid Pavement

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

3.1 Construction Procedures of Semi-Rigid Pavement

Loading Polymer Modified Mortar Into Mixer

Mixing Polymer Modified Mortar With Water
3. Semi-Rigid Pavement

3.1 Construction Procedures of Semi-Rigid Pavement

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

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

3.2 Sample Coring
3. Semi-Rigid Pavement

3.3 Sample Cored For Testing
3. Semi-Rigid Pavement

3.4 Skid Resistance Testing
### 3. Semi-Rigid Pavement

#### 3.5 Test Result of Semi-Rigid Pavement (Chemilink SS-141 as Grouting Material)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive strength at 12 hrs</td>
<td>EN 12190</td>
<td>• 3 ~ 5 MPa</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Compressive strength at 1 day</td>
<td></td>
<td>• 6 ~ 8 MPa</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Compressive strength at 8 days</td>
<td></td>
<td>• 9~12.5 MPa</td>
<td>-</td>
<td>-</td>
<td>≥7 MPa</td>
</tr>
<tr>
<td>Compressive strength at 28 days</td>
<td>EN 12190</td>
<td>• 10 ~ 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 12190</td>
<td>• 6~7 MPa</td>
<td>3.5 MPa</td>
<td>3.5 MPa</td>
<td>≥3 MPa</td>
</tr>
<tr>
<td>Modulus</td>
<td>ASTM D4123</td>
<td>• ≥6,500 MPa (25°C)</td>
<td>-</td>
<td>-</td>
<td>≥6500 MPa</td>
</tr>
<tr>
<td>Skid Resistance</td>
<td>ASTM E303</td>
<td>• 60 ~ 90 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 (after final setting)</td>
<td></td>
<td>• 4 ~ 8 hours</td>
<td>-</td>
<td>4~8 hours</td>
<td>4~8 hours</td>
</tr>
</tbody>
</table>
4. Completed Projects (Examples)

4.1 Heavy Loading Yard at Sungei Kadut Street 4 (2005)
4. Completed Projects (Examples)

4.2-a Singapore Changi International Airport Apron 1 (2007)
4. Completed Projects (Examples)

4.2-b Singapore Changi International Airport Apron 2 (2007)
4. Completed Projects (Examples)

4.3 Heavy Loading Yard at Sungei Kadut Street 1 (2010)
4. Completed Projects (Examples)

4.4 Heavy Loading Yard at Abingdon Road (2010)
4. Completed Projects (Examples)

4.5 Road Junction at Sungei Kadult Drive 1 (2010)
4. Completed Projects (Examples)

4.6 Road Junction at South Buona Vista Road (2011)
4. Completed Projects (Examples)

4.7 Junction of Taxiways (150mm thick of Semi Rigid Pavement in 2 layers as Base Course) in Singapore Changi International Airport (2011)

Laying Porous Asphalt Concrete, 75mm / layer  
Filling Chemilink SS-141
4. Completed Projects (Examples)

4.7 Junction of Taxiways (150mm thick of Semi Rigid Pavement in 2 layers as Base Course) in Singapore Changi International Airport (2011)
5. Conclusions

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

   Meets all Singapore specs

2) Semi Rigid Pavement (Chemilink SS-141 as grouting)
   - Compressive strength$(28\text{-d})$, $10\sim 14.5 \text{MPa}$,
   - Flexural strength$(28\text{-d})$, $6\sim 8 \text{MPa}$.

   Much higher than all Singapore specs

3) Chemilink Can Adjust the formula of Polymer Modified Mortar SS-141 To Meet Different Requirements, and Chemilink Is The Only Manufacturer Of This Product In South East Asia.
Thank You for Your Attention!