Special Materials for Concrete Pavement Surface Repair and Maintenance

Zhang Yanli, Dr Xu Wenyu, Dr Wu Dong Qing
Chemilink Technologies Group, Singapore
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1. Introduction

- Concrete pavements deteriorate over time, due to
  - exposure to severe weather conditions,
  - excessive traffic loading
  - thermal cracking of the concrete, etc.

- Conventional concrete pavement repair practice - reconstruction
  - needs long time and costly
  - generates air pollution and noise
  - causes traffic congestion
  - generates more wastes.

- Resurfacing is a practical way for most of the concrete pavement repair and maintenance, because
  - concrete pavement is still structurally sound
  - repair and maintenance are normally done when the defects are only at the surface.
2. Common Causes of Concrete Pavement Surface Defects

2.1 Common causes of concrete surface defects

- **Mechanical**
  - Impact
  - Overload
  - Movement (e.g. settlement)
  - Vibration

- **Chemical**
  - Alkali-aggregate reaction
  - Aggressive agents (e.g. sulphates, soft water, salt)
  - Biological activities
  - Erosion

- **Physical**
  - Freeze/thaw
  - Thermal
  - Salt crystallization
  - Shrinkage
  - Wear and Tear
2. Common Causes of Concrete Pavement Surface Defects

2.2 Main Causes of seaport concrete pavement defects

- Mechanical Cause:
  - Wear and Tear
  - Impact
  - Overload
  - Vibration

- Physical and Chemical Cause:
  - Thermal
  - Shrinkage
  - Erosion
3. Causes of Concrete Pavement Surface Repair Failure

3.1 Mechanical Cause

- Wear and Tear
- Impact
- Overload
- Vibration
3. Causes of Concrete Pavement Surface Repair Failure

3.2 Repair Material Cause

- High early strength
  - High modulus of elasticity
  - Low flexibility and toughness
  - Low cracking resistance
  - Susceptible to fracturing from impact loads

- Low adhesion to substrates – debond

- Incompatibility with substrates
3. Causes of Concrete Pavement Surface Repair Failure

3.3 Application Cause

- Substrate surface preparation
- Repairing method
- Curing
- Workmanship
4. Concrete Pavement Surface Repair Failure Process

4.1 Local Debond

Caused By:

- Poor adhesion
- Incompatibility
- Wear and tear
- Impact and vibration
4. Concrete Pavement Surface Repair Failure Process

4.2 Crack

Caused By:

- Local Debond
- Overload
- Wear and tear
- Impact and vibration
- Differential shrinkage
- Thermal shock
4. Concrete Pavement Surface Repair Failure Process

4.3 Pop Out

Caused By:

- **Cracks**
- **Overload**
- **Wear and tear**
- **Impact and vibration**
- **Differential shrinkage**
- **Thermal shock**
4. Concrete Pavement Surface Repair Failure Process

4.4 Debond and Crack in Surrounding Areas

Caused By:

- Wear and tear
- Impact and vibration
4. Concrete Pavement Surface Repair Failure Process

4.5 Examples of Concrete Pavement Surface Repair Failure

3 months after application in heavy traffic areas
5. Special Concrete Pavement Surface Repair Mortar

5.1 Requirements for Concrete Pavement Surface Repair Mortar

- Good adhesion to substrate
- Good compressive strength
- Good flexural strength
- Good skid resistance

As site closing time is limited, short setting time (High early strength) is also an important requirement.
5. Special Concrete Pavement Surface Repair Mortar

5.2 Chemilink SS-132 – for concrete pavement surface rejuvenation

Features:
- Two part product → powder + liquid polymer
- Specially designed for concrete pavement thin surface repair → 3-10mm
- Fast Setting → open to traffic early
- High final strength (35-50MPa/28days) → suitable for high loading situations
- High bond strength → not easy to de-bond
- High impact and crack resistance
- High abrasion and chemical resistance
- Good workability and easy to apply
5. Special Concrete Pavement Surface Repair Mortar

5.2 Chemilink SS-132 – for concrete pavement surface rejuvenation

**Typical Technical Data**

<table>
<thead>
<tr>
<th>Properties</th>
<th>Chemilink™ SS-132</th>
</tr>
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<tbody>
<tr>
<td>Compressive Strength at 2 hours</td>
<td>8~15MPa</td>
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<tr>
<td>Compressive Strength at 4 hours</td>
<td>15~25MPa</td>
</tr>
<tr>
<td>Compressive Strength at 1 day</td>
<td>20~30MPa</td>
</tr>
<tr>
<td>Compressive Strength at 3 days</td>
<td>25~35MPa</td>
</tr>
<tr>
<td>Compressive Strength at 28 days</td>
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<td>&lt; 40 minutes</td>
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</table>
5. Special Concrete Pavement Surface Repair Mortar

5.2 Chemilink SS-132 – for concrete pavement surface rejuvenation

Application

- Substrate preparation
- Pouring
- Spreading
- Brooming the surface
- Finished wet surface
- Finished dry surface
5. Special Concrete Pavement Surface Repair Mortar

5.3 Chemilink SS-133

– for concrete pavement surface and patch repair/restoration

**Features:**

- Two part product → powder + liquid polymer
- Designed for 10mm<thickness<30mm concrete pavement surface repair
- High early strength (10-15MPa/2h) → open to traffic early
- High final strength (35-50MPa/28days) → suitable for high loading situations
- High bond strength → not easy to de-bond
- High impact and crack resistance
- High abrasion and chemical resistance
5. Special Concrete Pavement Surface Repair Mortar

5.3 Chemilink SS-133
– for concrete pavement surface and patch repair/restoration

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5. Special Concrete Pavement Surface Repair Mortar

5.3 Chemilink SS-133

– for concrete pavement surface and patch repair/restoration

Application

Substrate Preparation

Mixing

Spreading

Finished Surface
5. Special Concrete Pavement Surface Repair Mortar

5.4 Chemilink SS-123 — for deep hole or thicker layer

Features:
- Designed for deep hole or thicker layer (>30mm) of concrete pavement repair
- High early strength (30~40MPa/1hour) → open to traffic early
- High final strength (45-65MPa/28days) → suitable for high loading situations
- High impact and crack resistance
- High abrasion and chemical resistance
- Good workability and easy to apply
5. Special Concrete Pavement Surface Repair Mortar

5.4 Chemilink SS-123 – for deep hole or thicker layer

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<td>35~45MPa</td>
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<td>Compressive Strength at 4 hours</td>
<td>35~50MPa</td>
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<tr>
<td>Compressive Strength at 1 day</td>
<td>40~55MPa</td>
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<tr>
<td>Compressive Strength at 7 days</td>
<td>40~60MPa</td>
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<tr>
<td>Compressive Strength at 28 days</td>
<td>45~65MPa</td>
</tr>
<tr>
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Powder mixed with water only
5. Special Concrete Pavement Surface Repair Mortar

5.4 Chemilink SS-123 – for deep hole or thicker layer

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<td>45~55MPa</td>
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<tr>
<td>Compressive Strength at 4 hours</td>
<td>45~60MPa</td>
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<tr>
<td>Compressive Strength at 1 day</td>
<td>60~75MPa</td>
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<tr>
<td>Compressive Strength at 7 days</td>
<td>60~80MPa</td>
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<tr>
<td>Compressive Strength at 28 days</td>
<td>65~85MPa</td>
</tr>
<tr>
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</table>

Powder mixed with water and aggregate (5-20mm), powder/aggregate = 1:1
5. Special Concrete Pavement Surface Repair Mortar

5.4 Chemilink SS-123 – for deep hole or thicker layer

Application

- Deep hole
- Mixing powder with water
- Add aggregate, mixing
- Pour into deep hole
- Finished surface (wet)
- Finished surface (dry)
6. Conclusions

1. Concrete surface repair is a system, and the success of the repair is affected by many factors, like loading condition, environment, substrate preparation, performance of repair materials and workmanship.

2. Chemilink has abilities to design and manufacture different repair materials based on their performance required.

3. Based on different damage scenarios, Chemilink has developed a series of products for repair of concrete pavement surface.
Thank You for Your Attention!