FIFTH INTERNATIONAL CONFERENCE ON
SELF-HEALING MATERIALS

JUNE 22-24, 2015
Durham Convention Center
Durham, North Carolina
U.S.A.

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U.S.A.

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1. INTRODUCTION

1.1 Tokyo Metro System

The Tokyo Metro system constitutes a part of important transportation infrastructure in the capital area of Japan. The subway is used by more than 6,000,000 people per day and operates at intervals of less than two minutes minimum, meeting strong demand for reliable on-time operation from users. About 85% of its total length is reinforced concrete tunnels (Figure 2), with some of them being in service for more than 20 years.

2. TEST CONSTRUCTION METHOD

2.1 Materials Used

The self-healing materials used in this study contained CSA expansive agent, geo-material and carbonate group-based chemical additive. The CSA agent which gives expansion by forming ettringite (3CaO·Al₂O₃·3CaSO₄·2H₂O) through hydration is commonly used for shrinkage compensation or chemical prestressing. Geo-materials generally include sand, clay, rock and other natural sediments. In this study clay-based material was used.

2.2 Test Construction Method

Table 2: Repair techniques

<table>
<thead>
<tr>
<th>Technique</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drill holes of about 15 mm in diameter to a depth of about 30 mm at intervals of about 50 mm, fill the holes with the self-healing materials, and finish the surface with self-healing materials.</td>
</tr>
<tr>
<td>2</td>
<td>A combination of Technique 1 and injection of inorganic waterstop agents.</td>
</tr>
</tbody>
</table>

2.3 Test Construction Results

The previously repaired area suffered leakage of water again, most likely due to deterioration of the repair materials with age and concrete shrinkage by temperature change. Figure 9 shows the results of one-year monitoring from immediately after the test construction. Although seepage of water was observed at the upper part immediately after the test construction, the surface was found gradually drying at one week and three weeks. The surface was dry and sound at one year, with no recurrence of leakage. These suggest the effectiveness of the proposed water leak repair method using self-healing repair materials under the subway tunnel conditions.

3. CONCLUSIONS

