Evaluation of The Use of Lithium Compounds in Controlling ASR in Concrete Pavement

Tri-Service Infrastructure Conference

3 August 2005
Norfolk, Nebraska
ASR Distress
Site Layout

Phase II Concrete  Phase I Concrete

Control  Treated

Norfolk, Nebraska Test Panel Layout
Site Characterization

- Petrographic Examination
- Map Cracking
- “V” Meter
- Schmidt Hammer
- Impact Echo
- Expansion / Contraction Measurements
Core Samples
Core Samples
Crack Mapping
Crack Mapping
“V”-Meter
Schmidt Hammer
Impact Echo
Expansion / Contraction
Demac Points
Demac Points
Expansion / Contraction Measurements
Expansion / Contraction Measurements
Saw Cut Operation
Saw Cut
Treated / Control Panels

9’ x 9’ Panel
Lithium Application
Lithium Application

**Dates & Application Rates:**

- **Nov 2002:** 0.006 – 0.012 gal/s.f.
- **Dec 2002:** 0.012 gal/s.f.
- **May 2003:** 0.006 gal/s.f.
- **Oct 2003:** 0.006 gal/s.f.
- **May 2004:** 0.006 gal/s.f.
- **Oct 2004:** 0.012 gal/s.f.
Lithium Nitrate
Salt Residue
Powder Samples
Powder Samples
Pressure Injection
Pressure Cell
Pressure Cell
Pressure Cell
Pressure Injection
Pressure Cell
Vacuum Impregnation
Vacuum Impregnation
Powder Samples

Lithium Content ????

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Nebraska Department of Roads
Data Analysis
N-S Phase I Concrete

Panel Number

% Expansion/Contraction

0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40

Treated  Treated  Control  Control  Treated  Treated  Control  Control

Panel Numbers: 10, 11A, 12, 13, 14, 15, 16, 17, 18
E-W Phase I Concrete

% Expansion/Contraction

Panel Number

Control

Treated

Expansion

Contraction

Panel 10:

Panel 11A:

Panel 12:

Panel 13:

Panel 14:

Panel 15:

Panel 16:

Panel 17:

Panel 18:
E-W Phase II Concrete

Panel Number

<table>
<thead>
<tr>
<th>Panel</th>
<th>Expansion/Contraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Treated</td>
</tr>
<tr>
<td>2</td>
<td>Control</td>
</tr>
<tr>
<td>3</td>
<td>Treated</td>
</tr>
<tr>
<td>4</td>
<td>Treated</td>
</tr>
<tr>
<td>5</td>
<td>Control</td>
</tr>
<tr>
<td>6</td>
<td>Control</td>
</tr>
<tr>
<td>7</td>
<td>Treated</td>
</tr>
<tr>
<td>8</td>
<td>Treated</td>
</tr>
<tr>
<td>9</td>
<td>Treated</td>
</tr>
</tbody>
</table>
N-S Expansion / Contraction

Panel Number

Phase II Concrete
Control Panel
Treated Panel
Phase I Concrete
E-W Expansion / Contraction

Panel Number

% Expansion / Contraction

-0.05 0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4

1 2 3 4 5 6 7 8 9 10 11A 12 13 14 15 16 17 18

Phase I Concrete

Phase II Concrete

Control Panels

Treated Panels

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Department of Roads
Schmidt Hammer Evaluation

Panel No. 6
Control
Treated

Panel No. 7
Control
Treated

Panel No. 17
Control
Treated

Panel No. 18
Control
Treated

Rebound #
Impact Echo Evaluation

Panel No. 6
Control
Panel No. 7
Treated
Panel No. 17
Control
Panel No. 18
Treated

GPa

Panel No. 6  Panel No. 7  Panel No. 17  Panel No. 18

Control  Treated  Control  Treated

Oct-02  Oct-03  May-04
“V”- Meter Evaluation

- Control
- Treated

Panel No. 6, Panel No. 7, Panel No. 17, Panel No. 18

GPa

Oct-02, Oct-03, May-04, Jun-05

University of Nebraska
Department of Roads
Map Cracking
Map Cracking

SLAB 18 NO. 5

TREATED
- JUNE 05
- MAY 04
- OCTOBER 02
Questions ??