Waterproofing Protection for Highway Bridges
Are you familiar with these issues?
Deck Cracking
Efflorescence / Calcium Leaching
Longitudinal Cracking

Reinforcing Steel

Concrete Body

Longitudinal Cracking
Longitudinal Cracking

Spalling

Delamination
Corrosion
Freeze – Thaw Issues
CAUSES OF CONCRETE DETERIORATION
What are the main causes of the deterioration on concrete?

**MAIN FACTORS CAUSING CONCRETE DETERIORATION**

- Water/Moisture Penetration
- Calcium Hydroxide
- Chlorides
- Cracks

**THEY CAUSE**

- Alkali-Carbonate Reaction (ACR)
- Alkali-Silica Reaction (ASR)
- Carbonation
- Chloride Attack
- Corrosion
- Efflorescence
- Freeze/Thaw Issues
- Spalling
- Water Penetration

**SOLUTION**

- Deck Repair/Replacement
- OR
- Protect Concrete to increase the service life of the structure
So ... How will you choose to protect your concrete structure?
Innovative Technology: Integral Gel Waterproofing System

Alchemco BridgeDECK Waterproofing Agent produces a modified silicate gel material ‘below the concrete surface’ (inside the concrete matrix)

The gel is created by a chemical reaction between the calcium hydroxide that is present in the concrete (as a by-product of cement’s hydration) and the chemical components of BridgeDECK Waterproofing Agent

By filling concrete porosity and cracks, the gel works as an integral waterproofing barrier that protects concrete from infiltration of water and water-soluble contaminants ... especially de-icing salts.
Sub-Surface
Gel Forming Technology

Demonstration of the gel formation that occurs inside the concrete
Close up view of concrete sections: untreated and treated
10 – Day Water Permeability Test Results

Testing Method: TSA 112 – 1995 (done for Miami/Dade Roofing Approval)

3rd Party Testing done by Intertek Laboratories

- Poured two – 2” thick concrete slabs (12” x 12”) and let them cure for at least 14 days
- Encased the sides of the concrete slab with plexiglass, and sealed the edges
- Applied TC2500 Waterproofing System to the concrete slabs per Application Manual instructions
- Covered the concrete slab with a minimum 2” of water
Silanes

Writing Specifications –

12” x 12” Concrete Slab 2” thick

Plexiglass Walls with Water 2” Deep
# 10 – Day Water Permeability Test Results

**Testing Method: TSA 112 - 1995**

### Water Permeability Test after 10 days

![Water Permeability Test after 10 days](image)

### Water Permeability Test Results

<table>
<thead>
<tr>
<th>SPECIMEN ID</th>
<th>EXPOSURE TIME</th>
<th>OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 - 1</td>
<td>24 hours</td>
<td>No Leakage</td>
</tr>
<tr>
<td>24 - 2</td>
<td>24 hours</td>
<td>No Leakage</td>
</tr>
<tr>
<td>72 - 1</td>
<td>72 hours</td>
<td>No Leakage</td>
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<tr>
<td>72 - 2</td>
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<tr>
<td>7 - 1</td>
<td>7 days</td>
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<tr>
<td>10 - 1</td>
<td>10 days</td>
<td>No Leakage</td>
</tr>
<tr>
<td>10 - 2</td>
<td>10 days</td>
<td>No Leakage</td>
</tr>
</tbody>
</table>
The chemical reaction (gel formation) is an ongoing process

1st Day – Original water leak thru the concrete slab

3rd Day - Gel formation inside the concrete slab has permanently sealed the crack and stopped the leak
Crack Width Example

0.4 mm wide

2.0 mm wide

Pencil Lead

Car Key
Spray Applied
Gel Forming Waterproofing ...

... approximate application rate is 20,000 square feet per hour when pumped directly from the drum
SILANES

Writing Specifications

Be Consistent – Application rates per % of Silane
MODIFIED SILICATE GELS (Integral)
ARE INHERENTLY ‘LONG-TERM’ WATERPROOFING SOLUTIONS

• By creating a sub-surface gel that fills all the cracks, voids, micro-fractures, etc. in the concrete matrix ... these systems protect both the concrete, and the steel reinforcement rods from damage caused by water & chemical intrusion. Since the waterproofing is inside the concrete, it cannot be physically damaged, delaminate or degrade due to UV exposure, etc.

• By increasing the density & compressive strength of the concrete surface (approx. 30%) ... they make the drivable & walkable surfaces more durable.

• By leaving latent waterproofing chemicals in the concrete matrix ... it is able to seal future cracks that form, since any new water intrusion will generate new gel formation (to seal the new crack)

• Because the sub-surface gel is vapor permeable, so it allows outgassing (does not trap moisture)
No other product offering combines the:

- Ability to seal future cracks (sustainability)
- Proven performance in the field
- Quick traffic reopen
- Long re-application periods (up to 25 years)
- Cost effective ... ‘money saving’ solution to water intrusion problems

**IMPRESSIVE PHYSICAL CHARACTERISTICS**

- Can’t be damaged or deteriorate (long-term solution)
- Densifies concrete (increases hardness/durability)
- Resistant to chloride ions, chemicals & hydrostatic pressure
- Allows outgassing = no trapped moisture (vapor permeable)
- VOC free ... environmentally friendly (green)
- Potable water safe – UL Certified: NSF/ANSI 61
- Doesn’t change the appearance of the structure
- Colorless & odorless ... safe & easy to work with

Provides great ‘value’ to Transportation Departments
BRIDGE APPLICATION RATES

Faster Application = ‘Shorter Lane Closure Times’
WATERPROOFING SYSTEM COMPARISON
(after cleaning & prep work is done)

**BridgeDECK PROtectant**
15-year ‘material only’ warranty

**STEP ONE**
- Spray Waterproofing
- Let dry & then Water

**STEP TWO**
- Spray C&V Treatment
- Spray Accelerator
- Let dry & then Water

Very Short Downtime
15-year performance

**BridgeDECK PROtectant Plus**
20-year ‘material only’ warranty

**STEP ONE**
- Spray Waterproofing
- Let dry & then Water

**STEP TWO**
- Spray C&V Treatment
- Spray Accelerator
- Let dry & then Water

Short Downtime
20-year performance

**BridgeDECK Waterproofing**
25-year ‘material only’ warranty

**STEP ONE**
- Spray Waterproofing
- Let dry & then Water

**STEP TWO**
- Spray C&V Treatment
- Spray Accelerator
- Let dry & then Water

Short Downtime
25-year performance
Louisiana D.O.T.
Bridge Test Site
Old Highway 61
St. Francisville, LA
LOUISIANA D.O.T. – Bridge Site
TechCrete 2500 Waterproofing Agent
February 2020

STEP ONE
Applying Waterproofing

Backpack Sprayer
applying 3,000 square feet per hour
OKLAHOMA D.O.T. – Bridge Site
BridgeDECK PROtectant Plus

STEP ONE
Applying Waterproofing

Direct Spray
applying 20,000 square feet per hour

OKLAHOMA D.O.T. Bridge Application
STEP ONE
Applying Waterproofing

Spray Bar – Small Tractor
applying 30,000+ square feet per hour

IOWA D.O.T. – Test Bridge Site
BridgeDECK Protectant Plus
FASTER APPLICATION translates into LESS DOWN TIME

APPLYING WATERPROOFING

Truck Mounted Spray Rig
applying 40,000+ square feet per hour

South Dakota D.O.T. Application: Hwy 12 - Millbank, SD
FASTER APPLICATION translates into LESS DOWN TIME

STEP ONE

Truck Mounted Spray Rig
Watering

South Dakota D.O.T. Application: Hwy 12 - Millbank, SD
Jersey Barrier
Waterproofing Protection

Delaware D.O.T.
Jersey Barrier
Waterproofing Protection

Delaware D.O.T.
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Jersey Barrier Waterproofing Protection

Delaware D.O.T.
BridgeDECK Waterproofing Products can seal cracks from 1.0 mm to 2.0 mm wide at the time of application.
U.S. DEPARTMENT OF TRANSPORTATION
CONCERNS WHEN ANALYSING NEW TECHNOLOGIES

- Lane Closure – Time to Traffic?  Very short
- Life Expectancy – How often do we have to reapply?  Up to 25 years
- Modulus - Is it rigid or flexible?  Flexible Gel
- Will it penetrate microcracks? (viscosity)  Yes
- What are the preparation requirements?  Pressure Wash & Dry Surface
- What is the temperature range for application?  40 degrees and rising
- Cost  Low
- Lifecycle Cost  Very low
Alchemco Waterproofing Systems

Selected U.S. Bridge Projects
WASHINGTON - D.O.T. Highway Bridge Application
Drying after Application

Drying after Watering

MINNESOTA - D.O.T. Highway Bridge Application
MINNESOTA - D.O.T. Application: Part of the TSP2 ... ITD Task Force Project to Evaluate New Technologies
ILLINOIS - D.O.T. Application: Hwy 171 & I-55 – Summit, IL (Chicago Metro)
Cleaning & Prep

Spray Application out of 55-gallon drum

OHIO - Highway Bridge Applications
IOWA - Highway Bridge Application
IOWA - Highway Bridge Application
SOUTH DAKOTA - D.O.T. Application: Hwy 12 - Millbank, SD
Spray Applied Waterproofing

Water Truck

OKLAHOMA - D.O.T. Highway Bridge Application
DELAWARE - D.O.T. Application: Jersey Barrier Protection
DELAWARE - D.O.T. Application: Jersey Barrier Protection
PENNSYLVANIA - Fort Pitt Bridge
NEW JERSEY - D.O.T. Highway Bridge Applications
VIRGINIA - D.O.T. Highway Bridge Application
ARKANSAS - D.O.T. Highway Bridge Application
LOUISIANA - D.O.T. Highway Bridge Application
UPCOMING APPLICATIONS

• Oregon
• Texas
• Florida
• North Carolina
• Mississippi
QUESTIONS?