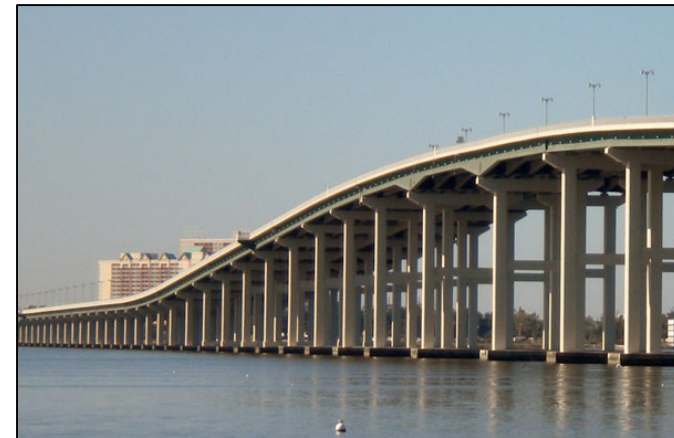


BARE IS BEAUTIFUL

How to waterproof and protect
concrete structures when you cannot
change their appearance



Presenters: Mario Baggio & Peter Kesser - *Alchemco*



BARE IS BEAUTIFUL: *HOW TO WATERPROOF CONCRETE STRUCTURES, WHEN YOU CANNOT CHANGE THEIR APPEARANCE*

PRESENTATION OVERVIEW

Concrete is one of the most utilized construction materials in the world. However, in order to realize it's maximum potential lifespan, steps must be taken to prevent premature deterioration. Options to effectively waterproof concrete structures include a variety of integral & surface applied products and systems. As with many things, the wide range of products available in the marketplace can sometimes be more confusing than helpful.

This presentation will help you understand what causes concrete to deteriorate ... common methods available to increase it's sustainability & durability ... and how to *effectively* and *permanently* waterproof concrete structures without changing their appearance

BARE IS BEAUTIFUL: *HOW TO WATERPROOF CONCRETE STRUCTURES, WHEN YOU CANNOT CHANGE THEIR APPEARANCE*

TOPICS COVERED

- Why it's Important to Waterproof Concrete Structures
- Causes of Concrete Deterioration
- Commonly used types of Waterproofing Applications
- Modified Silicate Gel Technology: Integral & Invisible
- Case Studies
- Summary



WHY IT'S IMPORTANT TO WATERPROOF CONCRETE STRUCTURES



WHY IT'S IMPORTANT TO WATERPROOF CONCRETE STRUCTURES

The use of concrete in construction projects has many **advantages**, including:

- Low Cost
- Non-Flammable
- Eco-Friendly
- High Stiffness Rating
- High Compressive Strength
- Ease of Fabrication
- Formability



WHY IT'S IMPORTANT TO WATERPROOF CONCRETE STRUCTURES

However, there are **disadvantages** to using the material as well, including:

- Low Tensile Strength
- Brittleness
- Lack of Long-Term Durability (*in its most basic form*)



WHY IT'S IMPORTANT TO WATERPROOF CONCRETE STRUCTURES

Premature Deterioration

- Spalling
- Cracking
- Corrosion



CAUSES OF CONCRETE DETERIORATION



CAUSES OF CONCRETE DETERIORATION

A number of factors can contribute to the premature deterioration of concrete. These contributing factors include:

- Weather (*Temperature & Moisture*)
- Improper Concrete Mix
- Chemical Interactions (*Corrosion, Carbonation, Chlorides, etc.*)
- Design Flaws
- Poor Construction / Installation Practices

CAUSES OF CONCRETE DETERIORATION

- While concrete can be very durable, **it will deteriorate over time** as a result of weathering. The amount of deterioration depends greatly on exposure to the following factors:

- *Temperature*
- *Moisture*
- *Chemicals*



Chemical Deterioration



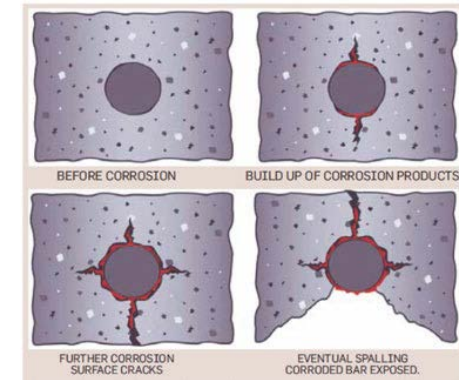
Temperature & Moisture Deterioration

CAUSES OF CONCRETE DETERIORATION

- In addition to being exposed to temperature ... moisture ... and chemicals; the 'mix' that's used when the concrete is being made is critical to its durability and sustainability. Here are some of the problems that can occur if the mix is incorrect:
 - Too much water (*can cause weakened surface & pitting*)
 - Wrong type of aggregates (*can cause popping*)
 - ASR (*Alkali Silica Reactivity*)
 - ACR (*Alkali Carbonate Reactivity*)
 - Sulfate Attack (*Expansive Reaction*)

CAUSES OF CONCRETE DETERIORATION

- **'CORROSION'** of the steel reinforcing rods is another potential factor in the deterioration of concrete. This is caused when the 'passive layer' of concrete surrounding the steel reinforcement breaks down ... exposing the steel. When the steel reinforcement corrodes, it expands in size ... exerting a force on the surrounding concrete, which ultimately leads to cracking, spalling, etc. The process accelerates in the presence of chlorides that are dissolved in water from sea water or salts used for de-icing.



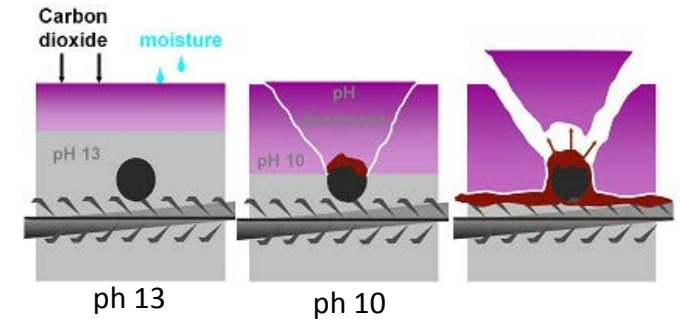
Here is an example of corrosion of the steel reinforcement causing the concrete to 'spall'.



Spalling caused by Corrosion of the Steel Reinforcement

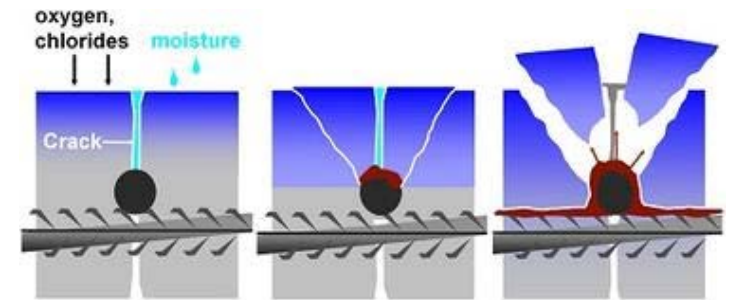
CAUSES OF CONCRETE DETERIORATION

- **'CARBONATION'** is another form of deterioration that occurs when calcium carbonate forms in the cement paste. If water is also present, carbonic acid will be formed **which lowers the pH** of the surrounding concrete. The result will be a weakening & break down the passive layer of concrete surrounding the steel reinforcement. In the presence of oxygen & water, this will then lead to corrosion of the steel.



CAUSES OF CONCRETE DETERIORATION

- The presence of '**CHLORIDES**' migrating through the concrete can also cause deterioration of the passive layer surrounding the steel reinforcement. In the presence of water this **will form iron chloride**, which will ultimately cause the corrosion of the steel reinforcement as well.



CAUSES OF CONCRETE DETERIORATION

- **DESIGN FLAWS** can also cause the deterioration of concrete. Some of the common factors attributed to this are:
 - Not properly designing for structural capacity
 - Not adequately accommodating for movement caused by thermal shifts
 - Not planning properly for shrinkage and/or settling



CAUSES OF CONCRETE DETERIORATION



Pitting/Honeycombing



Stress Cracking



Shrinkage Cracking

Even if the project is designed properly, problems can be caused by **POOR CONSTRUCTION and INSTALLATION PRACTICES:**

- Pitting or Honeycombing
- Stress Cracks
- Shrinkage Cracks

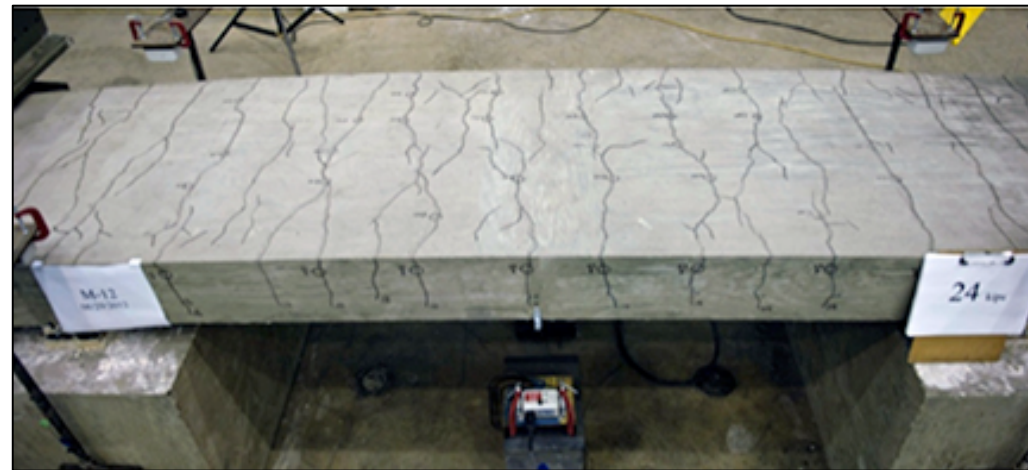
CAUSES OF CONCRETE DETERIORATION



Thermal Stress Cracking

Even if the project is designed properly, problems can be caused by **POOR CONSTRUCTION and INSTALLATION PRACTICES** (*continued*):

- Thermal Stress Cracks
- Tension Cracks



Tension Cracking

CAUSES OF CONCRETE DETERIORATION

- Any of the issues we've just covered will allow chemicals, water & oxygen to migrate into the concrete ... which then contributes to the concrete deterioration process.
- As you can see, while concrete is a reliable & commonly used construction material ... there are many forces acting on it from the day it's first poured - trying to tear it apart.
- In order to realize the full, long-term functionality of this material, it's critical that the design & installation are handled properly ... including the use of the right waterproofing systems for any particular project.

WE'LL NOW REVIEW THE MOST COMMONLY USED METHODS OF WATERPROOFING CONCRETE ...



COMMONLY USED TYPES OF WATERPROOFING APPLICATIONS

(Integral and Non-Integral Systems)



COMMONLY USED TYPES OF WATERPROOFING APPLICATIONS

- In order to help prevent the premature deterioration of concrete structures, a variety of waterproofing systems have been developed & tried over the years. These systems can either be 'integral' (*inside the concrete*) ... or 'non-integral' (*applied to surface of the concrete*)
- While the intent of these various waterproofing systems are the same: to prevent water, chemicals, etc. from penetrating into the concrete (*stopping premature deterioration before it starts*) ... the materials & methods that are used vary widely.
- This section will provide a high level summary of the most common concrete waterproofing systems used in North America today ... **MOST OF THESE PRODUCT OPTIONS CHANGE THE APPEARANCE OF THE CONCRETE STRUCTURE**

COMMONLY USED TYPES OF WATERPROOFING APPLICATIONS

- **SHEET Waterproofing Membranes**

- Self-Adhesive (*Peel & Stick*) Membranes
- Thermo-fusible (*Torch-on*) Membranes



- **FLUID APPLIED Waterproofing Membranes**

- Hot Rubberized Asphalt
- Cold Applied Membranes



- **INTEGRAL Waterproofing Systems**

- Crystalline Technology
- Modified Silicate Gel Technology



COMMONLY USED TYPES OF WATERPROOFING APPLICATIONS

'SHEET' Waterproofing Membranes:

Self-Adhesive (*peel & stick*)



- Modified Bitumen waterproofing sheets are asphalt-based products that have adhesive 'factory applied' to the backside of the sheet ... with a release sheet covering it. The waterproofing sheet is rolled out onto the structure, as the release sheet is removed (*see photo*) ... and adhered to the concrete surface.
- Proper surface preparation and conditions are necessary to insure the system is installed properly.

COMMONLY USED TYPES OF WATERPROOFING APPLICATIONS

'SHEET' Waterproofing Membranes:

Thermo-fusible *(torch on)*

- Asphalt adhesive on the backside of the modified bitumen waterproofing sheet is melted/liquified with a propane torch. As it cools, it fully adheres the waterproofing material to the concrete.
- The use of open flame can be a problem with this system ... with some insurance companies refusing to insure the contractors that use these systems.
- Proper surface preparation is necessary to insure the system is installed properly.



COMMONLY USED TYPES OF WATERPROOFING APPLICATIONS

'FLUID APPLIED' Waterproofing Membranes:

Hot Rubberized Asphalt

- The hot rubberized asphalt is heated to the proper temperature range in a kettle, and is generally spread around the structural deck by squeegee. A continuous liquid membrane is created, so there are no seams to be concerned about.
- Proper surface preparation is necessary to insure the system is installed properly.



COMMONLY USED TYPES OF WATERPROOFING APPLICATIONS



‘FLUID APPLIED’ Waterproofing Membranes:

Cold Applied

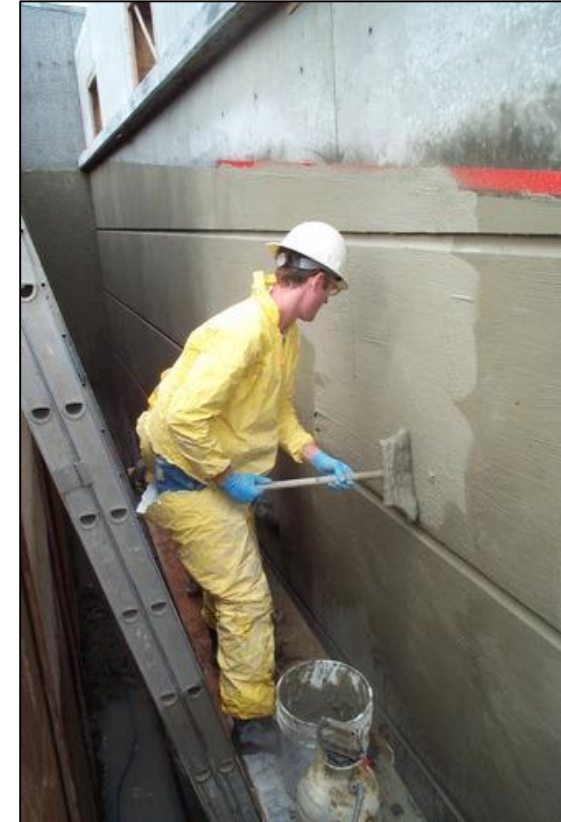
- Proper surface preparation is necessary to insure the system is installed properly.
- These waterproofing systems can be applied by spray rig or squeegee, using cold adhesives to form a continuous liquid membrane. As a result, there are no seams to be concerned with.
- It’s critical that the installation crew apply the appropriate thickness of material over the entire surface, in order for the system to meet it’s specified useful lifespan.

COMMONLY USED TYPES OF WATERPROOFING APPLICATIONS

'INTEGRAL' Waterproofing Systems:

Crystalline Technology 'Slurry'

- Used exclusively on existing concrete structures
- Heavy liquid slurry, that is applied to the surface of the concrete structure by brush, broom or sprayed with the proper spray rig. Proper surface preparation is necessary to insure the system is installed properly
- Active ingredients in these products use the process of diffusion to absorb into the concrete, reacting with the calcium hydroxide and other by-products that were formed during the concrete hydration process that occurred when the concrete was first formed.



COMMONLY USED TYPES OF WATERPROOFING APPLICATIONS

'INTEGRAL' Waterproofing Systems:

Modified Silicate Gel (*flexible*)

- These products are clear, colorless sprayable liquids that penetrate into concrete using water as a transport mechanism. The products are sprayed on the surface of the structure, and travel deep into the concrete by process of diffusion. Proper surface preparation (*cleaning, patching & repair*) is necessary to insure the waterproofing system performs properly.
- When applied, these products form an impermeable & flexible waterproof structure inside the concrete. This gel interacts with calcium hydroxide and other by-products leftover from the hydration process that occurred when the concrete was initially poured to block capillaries, cracks, micro-fractures, etc.



MODIFIED SILICATE GEL TECHNOLOGY

Integral & Invisible



Modified Silica Gel – Spray Applications



MODIFIED SILICATE GEL – Integral & Invisible Waterproofing



- Clear & colorless sprayable liquid that **does NOT change the appearance of the concrete surface**
- In addition to filling & blocking the microcracks and voids inherent in the existing concrete, it also has the ability to ‘self-heal’, as future micro-cracks occur in the concrete structure.
- Highly resistant to chemicals, chloride ions (*salt water, ice melt, etc.*), and hydrostatic pressure. Important for marinas & ports, and bridges & parking ramps up north
- The result is a ‘permanent’ integral waterproofing system, that cannot be damaged ... and that effectively blocks water penetration for the life of the structure.

MODIFIED SILICATE GEL – Integral & Invisible Waterproofing

ADVANTAGES

- FAST Installation ... in fairly open applications, contractors can cover 8,000+ square feet per hour (*or 60,000+ square feet per day*). This is several times as much area as a similar crew can apply using Crystalline based products.
- The gel products are applied using a simple spray system, and completely absorb into the concrete ... leaving the surface of the concrete unchanged. This can be a critical factor in projects where maintaining 'the look' of a structure is important (*historical structures ... restorations ... highly visible structures ... etc.*)
- The surface of the concrete can still be painted or coated if desired. These gel products also do not affect the 'slip resistance' of the concrete surface



Modified Silica Gel – Spray Application

MODIFIED SILICATE GEL – Integral & Invisible Waterproofing

ADVANTAGES *(continued)*

- In addition to fast application rates, these products are easy to apply ... as most of the products do not require on-site mixing (*ready-to-use*) ... and only require basic spray equipment or foam rollers to apply
- Can bridge cracks that are 5 times wider than those that Crystalline technology products can (*2.0 mm vs. 0.4 mm*)
- Increases the hardness of the concrete from 6 to 8 on the Mohs scale
- Modified Silicate Gel based products perform very effectively in high thermal stress conditions, due to their inherent flexible characteristics
- Allows outgassing (*concrete can breathe*) ... does not trap vapor inside the concrete, as most waterproofing coatings & membranes do



Modified Silica Gel – Spray Applications



MODIFIED SILICATE GEL – Integral & Invisible Waterproofing

PROS

- Improves **DURABILITY & SUSTAINABILITY** of concrete structures.
- Resistant to aggressive chemicals & chloride ions
- Allows concrete to breathe (*outgassing*) ... *does not trap moisture within the concrete*
- Acts as a ‘densifier’ ... increasing the hardness of concrete from 6 to 8 on the Mohs scale (*same as Granite*)
- Resists extreme hydrostatic pressure (*1,300 feet*)
- Seals ‘stable’ cracks up to 2.0 mm wide at the time of application ... and *continues to seal* future cracks up to 0.4 mm wide
- Not subject to typical types of damage or deterioration ... **a permanent solution**
- **FAST** to install ... requires simple spray equipment. The result is far less ‘down time’ for the structure
- **LESS COSTLY** to apply than most other methods
- Becomes an integral part of the substrate ... not a surface coating that can be damaged or wear off.
- Gel formulation handles ‘thermal stress’ very well
- Non-toxic and VOC free ... completely recyclable after demolition of a structure
- No costly surface priming or leveling prior to application.
- Does not require sealing, lapping & finishing of seams at corners, edges, etc. Cannot come apart at the seams!
- Can be applied to the positive or the negative side ... although we highly recommend applying it to the positive side

CONS

- **Concrete surface must be dry to the touch, in order to begin application of waterproofing products (*timing varies*)**

CASE STUDIES

Modified Silicate Gel Technology

CASE STUDIES

Modified Silicate Gel



Lowes Corporate Headquarters - Mooresville, NC

Approximately **95,000 square feet** of parking deck was waterproofed in **2006** using a spray applied Modified Silicate Gel.

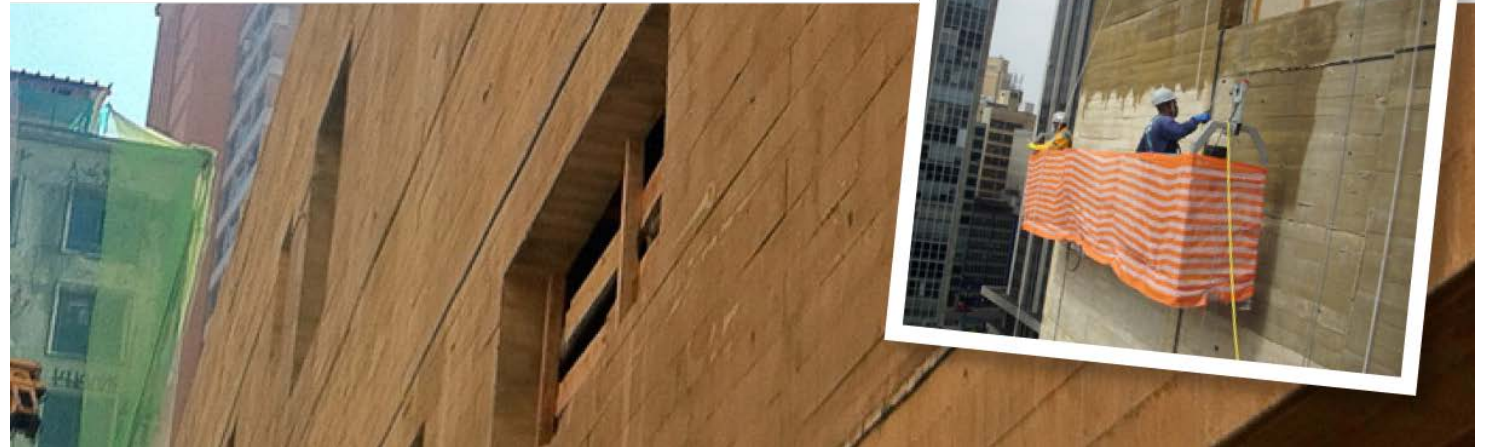
CASE STUDIES

Modified Silicate Gel



SAP Office Facility – São Leopoldo, Brazil

A spray applied Modified Silicate Gel was applied in 2009 to protect this beautiful concrete structure that houses the global software company SAP -



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Waterproofing
with **Aesthetics**
making it dry and appealing to the eye

CASE STUDIES

Modified Silicate Gel

Miami International Airport - Miami, FL

A spray-on Modified Silicate Gel was applied to **700,000 square feet** on the Dolphin and Flamingo parking ramps between **2010 - 2015**.

The parking ramp was already more than 25 years old when the waterproofing project was undertaken.

This type of integral waterproofing systems was selected because the project issues to be overcome included:

- High humidity
- Salt environment
- Many areas are susceptible to ponding and contaminants ... including jet fuel residue



CASE STUDIES

Modified Silicate Gel

Fountain of China, Lima - Peru

The restoration of this historic fountain back in **2000** (in the Peruvian capital Lima) saw a spray-on Modified Silicate Gel applied to all concrete on and around the fountain, ensuring its protection from the ingress of water and salts ... as well as air-borne pollutants.

Nineteen years later, we see that it is keeping this historical monument looking as good as new. Pollutants, mold spores and even smog are unable to penetrate the surface. This beautiful monument now requires much less cleaning and maintenance.



CASE STUDIES

Modified Silicate Gel



Petersen Event Center – Pittsburgh, PA

In October of **2007**, a Modified Silicate Gel product was applied to protect the exterior of this building on the University of Pittsburgh campus

Approximately **48,000 square feet** of the surrounding concourse, deck and steps were treated with the spray applied waterproofing.



CASE STUDIES

Modified Silicate Gel

Museum of Art & Archaeology - Portugal

A spray-on Modified Silicate Gel was applied shortly after the construction of the Museum of Art & Archaeology in Portugal in **2010**. Due to its bare concrete finish, no other solution could achieve complete waterproofing without compromising the artistic quality of this amazing **67,000 sq.ft.** structure.

To build the Museum of Art and Archeology in the stunning Coa Valley, many factors had to be considered: topography, accessibility and the environment. The result was a museum installation within the landscape.



CASE STUDIES

Modified Silicate Gel

Prince Resort – North Myrtle Beach, SC

In **2006**, a Silicate Gel waterproofing material was spray applied to over **144,000 sq.ft.** of this beachfront parking structure. Because the gel waterproofs the concrete 'below the surface' ... there is no deterioration of the product from surface traffic.





CASE STUDIES

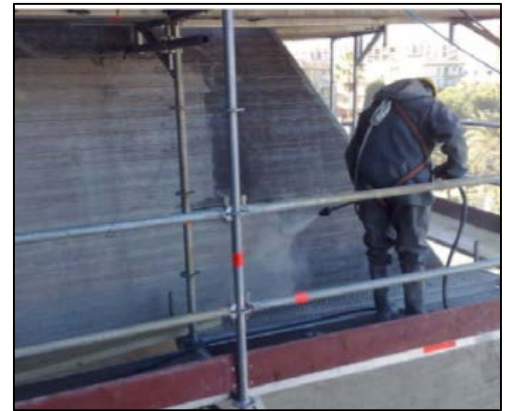
Modified Silicate Gel

Our Lady of Tears Sanctuary - Syracuse, Italy

Spray-on Modified Silicate Gel was used in **2010** to rescue the **330,000 sq.ft.** facade (*with concrete that is 50+ years old*) at the Our Lady of Tears Sanctuary in Syracuse, Italy.

All the concrete surfaces were first water-blasted and treated with acetic acid, before applying the waterproofing.

The facade was then waterproofed with a Spray-on Modified Silicate Gel



CASE STUDIES

Modified Silicate Gel

Northside Hospital-Forsyth near Atlanta, GA

50,000+ sq.ft. of parking ramp was waterproofed in 1999.

The engineer on the project (*Sedki & Russ*) opted to use a Modified Silicate Gel product instead of their normal sprayed polyurethane 'trafficable membrane' because they believe 'membrane' and 'traffic' are not compatible.

"Those systems are complex, time consuming, expensive and not particularly reliable". Whereas the Modified Silicate Gel product was fast, reliable and cost efficient.



CASE STUDIES

Modified Silicate Gel

Stamford Grand Resort Hotel – Sydney, Australia

Pond over a Car Park

Following completion of this project in **1988**, the pond was filled with water plants and many different species of fish, proving the ***non-toxicity*** of Modified Silicate Gel products.

This entire pond is built on top of a parking ramp, so it is possible to walk under the lake and inspect the underside of the concrete. **Thirty years later** the product is still performing flawlessly.

This is a great example of Modified Silicate Gel's ability to provide concrete structures with long-term waterproofing, while at the same time being ***environmentally friendly***



CASE STUDIES

Modified Silicate Gel



Garden Communities Condo & Hotel Complex – San Diego, CA

300,000 square feet of podium decks
(with *post-tension cables*). Parking decks, and
walkways were waterproofed using a spray applied
Modified Silicate Gel, during the three construction
phases of this project: **1999 – 2001.**

The post-tensioned podium decks were allowed to
cure ... and were then waterproofed & pond tested.

The decrease in cost, combined with the
increase in ‘speed of application’, made this
a very attractive option for the contractor.



CASE STUDIES

Modified Silicate Gel



Top Level of Parking Ramp - Australia

In **1988**, a Modified Silicate Gel product was spray applied to the **21,500+ square foot** top level of this parking ramp in Australia.

The watertight status of the parking deck was confirmed by Roger Scerri from the Building Research Centre, University of New South Wales in August **1993** ... and a 100% watertight seal was once again confirmed by Mahaffey Associates in April **2017**.

There has now been over **30 years of watertight performance** **without any interim maintenance** being performed on this project.

CASE STUDIES

Modified Silicate Gel

Pittsburgh International Airport – Pittsburgh, PA

In 1986, a Modified Silicate Gel waterproofing was applied to protect **1 million square feet** of runway at this important U.S. airport.

Runways 10L - 28R



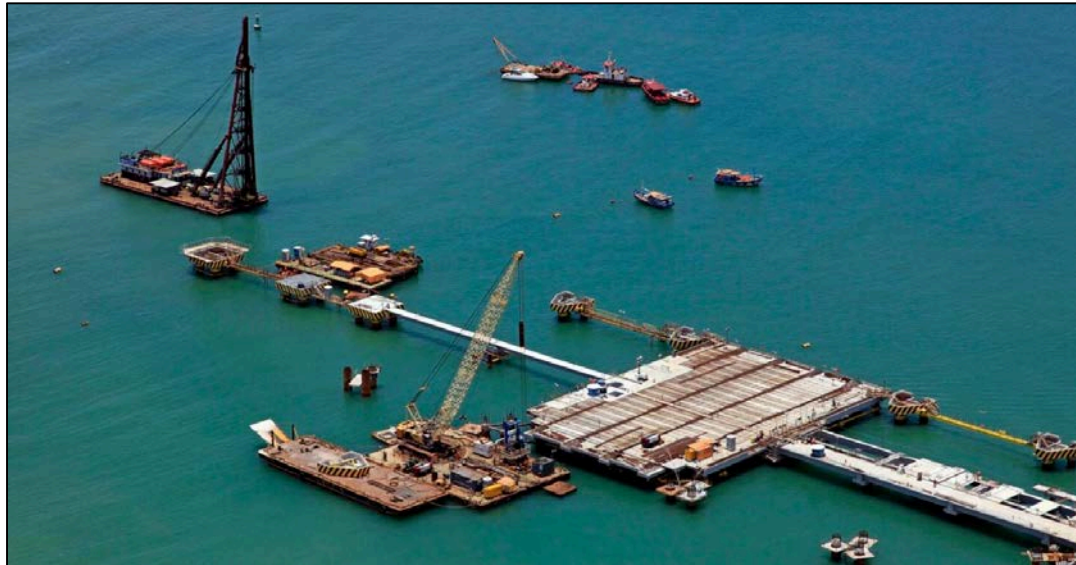
CASE STUDIES

Modified Silicate Gel

Petrobras Terminal - Brazil

This **2010** project consisted of waterproofing **33,000 square feet** with a Modified Silicate Gel.

This type of system was selected by one of the largest oil companies in the world, because of its excellent concrete **protection against chloride ions** ... and for being a 100% watertight solution.



CASE STUDIES

Modified Silicate Gel

Hatfields & McCoys Dinner Theater - Pigeon Forge, TN

This 6,000 square foot Water Containment Tank/Pool, that's an integral part of the stage, was waterproofed with a Modified Silicate Gel in **2017** ... to correct a chronic leak the owner had been unable to stop for 2 years.

The project was completed in less than 2 days, allowing the Dinner Theater to resume operations quickly.



CASE STUDIES

Modified Silicate Gel

Wahooo! Water Park – Bahrain City Center, Bahrain

In 2009, a Modified Silicate Gel product was applied 200,000 square feet of water holding areas, at this newly constructed indoor/outdoor water park.



CASE STUDIES

Modified Silicate Gel



Piedmont Hospital – Atlanta, GA

A spray applied Modified Silicate Gel was used to waterproof **163,500 square feet** of the main parking ramp for this facility.

This project consisted of waterproofing the entire parking ramp roof ... as well as a 10' wide perimeter around each of the remaining seven parking levels. It was completed in two phases between **August 2000 - March 2001**.

CASE STUDIES

Modified Silicate Gel

Alberto Braglia Stadium – Modena, Italy

This refurbished stadium located in Modena, Italy was originally built in 1936 and is currently home to Modena F.C.

In **2010**, a Modified Silicate Gel product was spray-applied on **160,000+ square feet** of pre-cast stands, after an acetic acid wash was used to remove a residual release agent. This opened up concrete pores to ensure required penetration.

The stands were then fitted with seating, following the application of a colored slip-resistant resin surfacing. The Modified Silicate Gel prevents absorption below the concrete surface without any loss of surface adhesion.



CASE STUDIES

Modified Silicate Gel



Nhat Tan Bridge – Hanoi, Vietnam

A Modified Silicate Gel product was installed on this **1 million+ square foot** concrete bridge deck (*8 lanes wide*) as it was constructed in **2013-14**.

The bridge provides a high-speed connection between Hanoi City and the Noi Bai International Airport.

CASE STUDIES

Modified Silicate Gel



Christ the Redeemer – Rio de Janeiro, Brazil

A Modified Silicate Gel product is scheduled to be applied later this year, to help protect this iconic structure. One of the contributing factors to the selection of this waterproofing material, is its ability to protect & waterproof without changing the appearance of the concrete.

SUMMARY

There are a number of different products & installation methods available to properly waterproof concrete structures ... and no one product or method is right for every project. It is important however, for the long-term sustainability of concrete structures, that they do receive the type of waterproofing system that meets their needs. In some cases, that need requires that the appearance of the concrete is unchanged.

The majority of concrete waterproofing products currently in use, are applied to the surface of the concrete, in an effort to prevent water from migrating inward. By their very nature these products are temporary solutions that are subject to damage, and/or wear & tear ... and will need to be removed & re-applied after only a few years. This is ultimately a very expensive proposition for the owner of the structure. In addition, most of these solutions change the appearance of the concrete structure ... which may not be an outcome that the owner/architect/specifier is interested in. Modified Silicate Gel technology offers a permanent & invisible waterproofing solution, that is easy to apply ... and also extremely cost effective.

We hope the time spent covering this information has helped clarify this picture for you ... and we stand ready to help guide you towards the right solution for any projects you may be working on.

DO YOU HAVE ANY QUESTIONS?



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TechCrete

Waterproofing System



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PRODUCT OFFERINGS

TechCrete 2500 Waterproofing System

WATERPROOFING

Concrete Admix
2500 Waterproofing Agent
Bridge & Deck Waterproofing Agent
Masonry Waterproofing Sealer

ENHANCERS

Accelerating Agent
Crack & Void Treatment

ACCESSORIES

Waterstop Strip
Waterstop Adhesive
PolyMembrane Flashing
WT Expansion Joint System
PolySeal Sealant

ELASTOMERIC COATINGS

PolyCote 'High Performance' Coating
PolyCote Coating
PolyMembrane Coating



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