CONSIDERING THE LONG GAME

Innovative Concrete Waterproofing Solutions

ALCHEMCO®
SUBSURFACE MEMBRANE WATERPROOFING

Concrete is one of the most widely used construction materials in the world.

The use of concrete as a building material can be traced back to Babylonian times.

The modern version of concrete has only been in use since the 1700s, when cement was added to the mixture.

While the basic composition consists of cement, aggregates and water, today's mixtures often include chemical additives that are used to increase the density, longevity the durability of the concrete.

Concrete

A BRIEF HISTORY

CONCRETE CAN BE SPECIFIED FOR USE IN MANY DIFFERENT CONFIGURATIONS AND FOR A WIDE-RANGE OF PURPOSES.

Non-flammable

Resilient

High compressive strength

Ease of fabrication

Formability

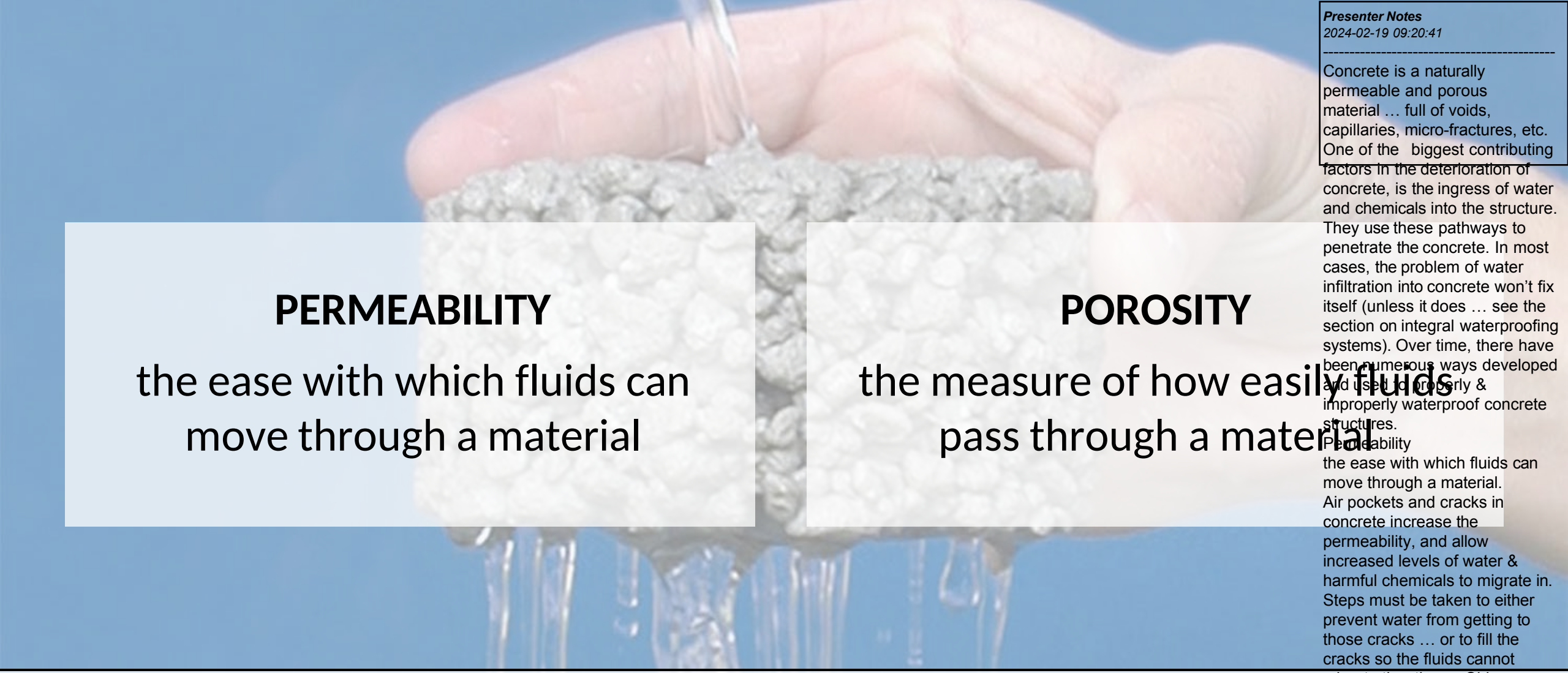
Low tensile strength

Brittleness

Carbon footprint concerns

Concrete

GENERAL CAPABILITIES AND LIMITATIONS



PERMEABILITY

the ease with which fluids can move through a material

POROSITY

the measure of how easily fluids pass through a material

WHY WATERPROOF CONCRETE?

Presenter Notes
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Concrete is a naturally permeable and porous material … full of voids, capillaries, micro-fractures, etc. One of the biggest contributing factors in the deterioration of concrete, is the ingress of water and chemicals into the structure. They use these pathways to penetrate the concrete. In most cases, the problem of water infiltration into concrete won't fix itself (unless it does … see the section on integral waterproofing systems). Over time, there have been numerous ways developed and used to properly & improperly waterproof concrete structures.

Permeability
the ease with which fluids can move through a material.
Air pockets and cracks in concrete increase the permeability, and allow increased levels of water & harmful chemicals to migrate in. Steps must be taken to either prevent water from getting to those cracks … or to fill the cracks so the fluids cannot migrate thru them. Older concrete is generally more permeable than newer concrete.
Porousness
the measure of how easily fluids pass through a material.

However, it has more to do with the number and size of the pores in the concrete. The level of

Numerous factors can contribute to the premature deterioration of concrete.

- Weather (temperature & moisture)
- Improper concrete mix
- Chemical interactions (corrosion, carbonation, chlorides, etc.)
- Design flaws
- Poor construction / installation practices

Concrete Deterioration

NUMEROUS CAUSES

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the measure of how easily fluids pass through a material. However, it has more to do with the number and size of the pores in the concrete. The level of porousness of concrete is determined largely by the amount of water that is used when it is first installed.

WHY WATERPROOF CONCRETE?

CORROSION' of the steel reinforcing rods is one of the main causes of premature concrete deterioration. 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. '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.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.

Corrosion | Carbonation | Chlorides

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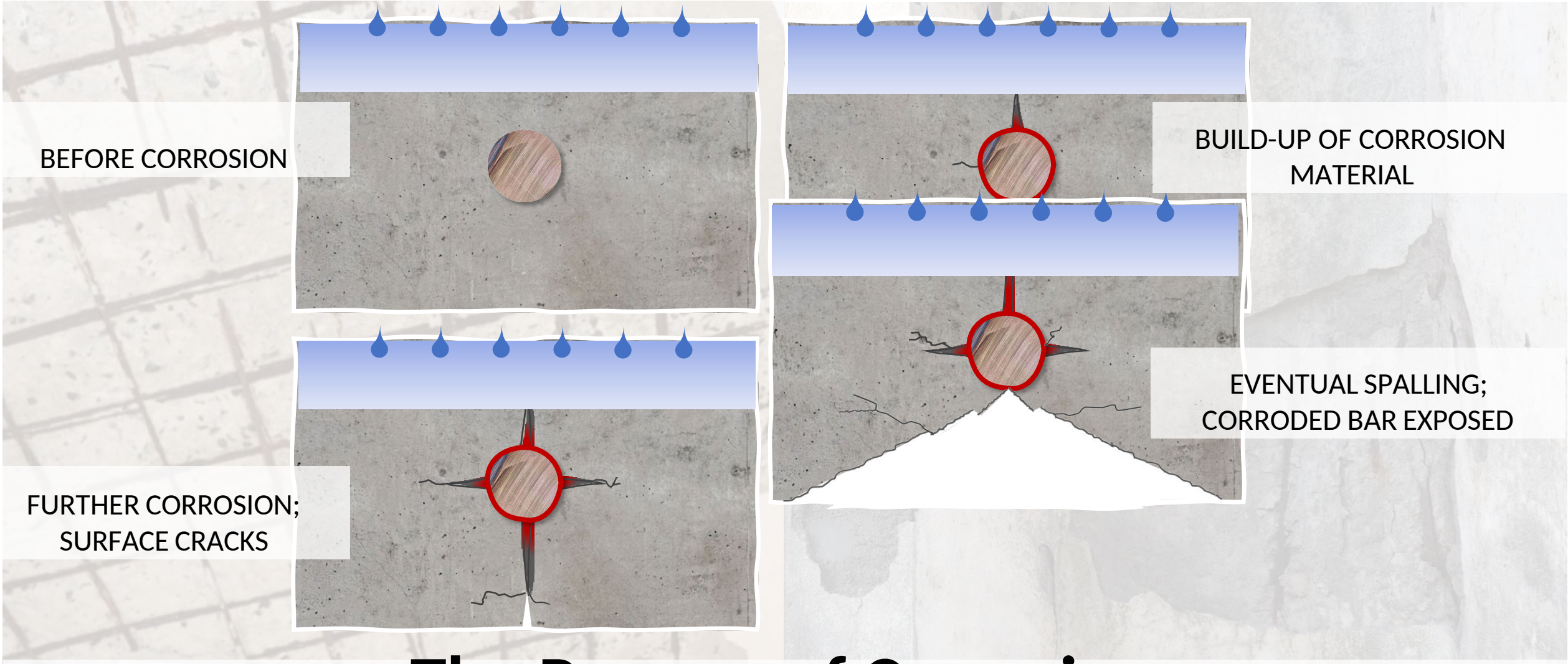


The Process of Corrosion

WHY WATERPROOF CONCRETE?

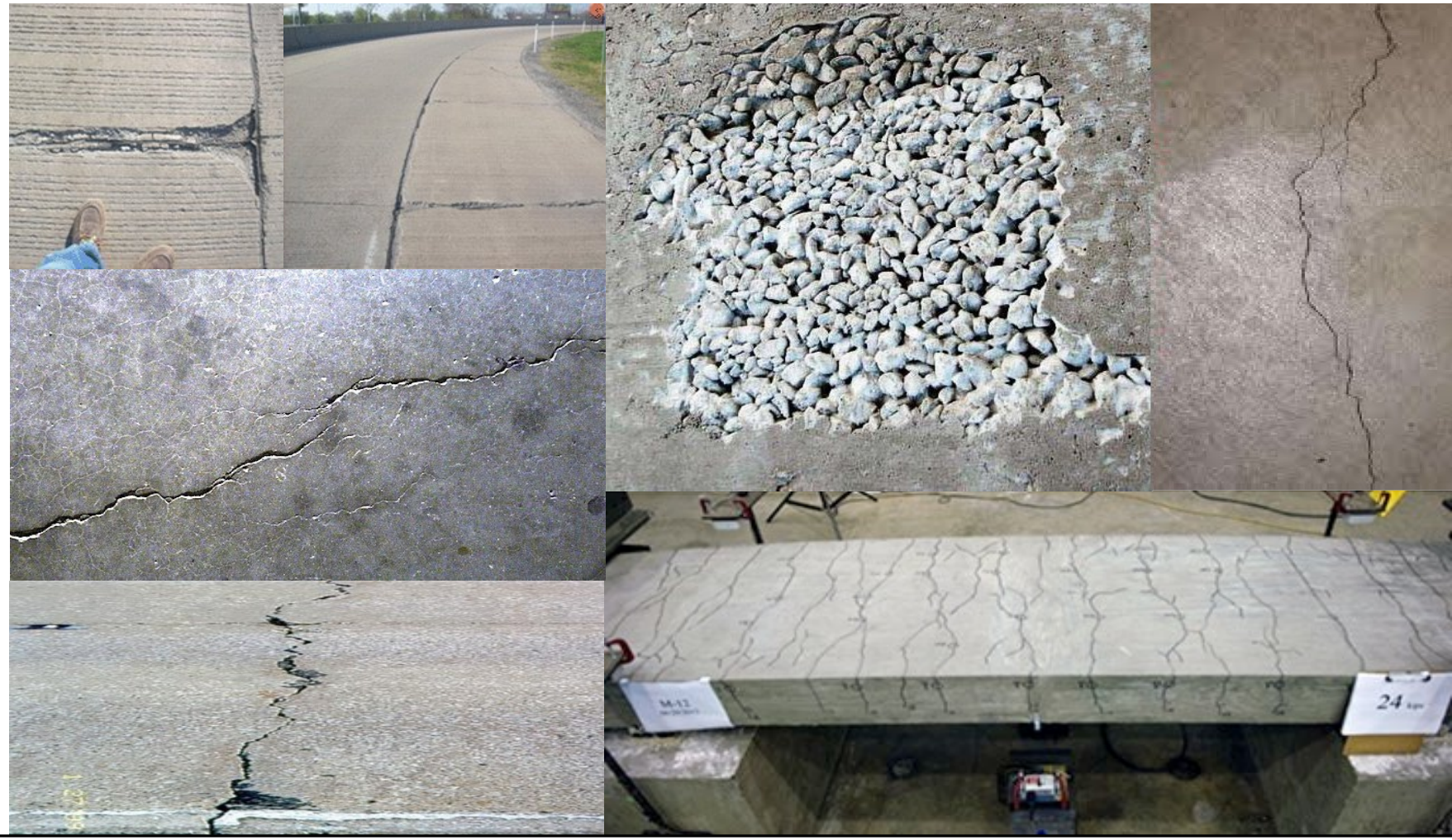
DESIGN FLAWS can also cause the deterioration of concrete. Some of the common factors attributed to this are: Not properly designing for structural capacity. Not adequately accommodating for movement caused by thermal shifts Not planning properly for shrinkage and/or settling
Even if the project is designed properly, problems can be caused by POOR CONSTRUCTION and INSTALLATION PRACTICES: Pitting or honeycombing Stress cracks Shrinkage cracks Thermal stress cracks Tension cracks

Design Flaws

- Improper design for structural capacity
- Improper accommodations for movement caused by thermal shifts, shrinkage, and/or settling

Poor Installation

- Pitting or honeycombing
- Stress and shrinkage cracks
- Thermal stress cracks
- Tension cracks



Design and Installation Flaws

WHY WATERPROOF CONCRETE?






AVOID THE CONSEQUENCES!

Allowing water and chemicals to continuously penetrate concrete over time will cause the concrete to prematurely deteriorate.

Spalling

Stress cracking

Freeze/thaw cracking

Chloride penetration

Hydrostatic pressure

Steel reinforcement corrosion

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 …

Assist in preventing the premature deterioration of concrete structures, a variety of waterproofing systems have been utilized over time

Systems can either be 'non-integral' (applied to surface of the concrete) or 'integral' (inside the concrete)

The intent of these various waterproofing systems is the same: to prevent water, chemicals, etc. from penetrating into the concrete and halting premature deterioration before it starts

Common waterproofing types

SOLUTIONS

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.

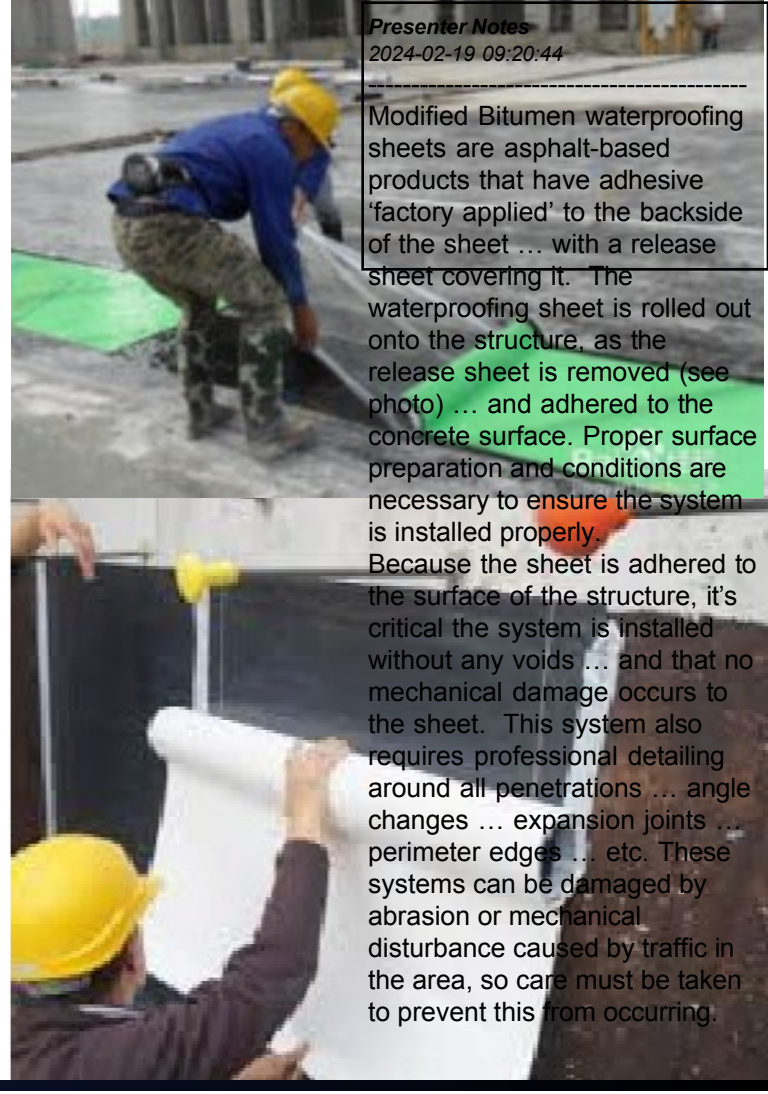
SHEET	FLUID APPLIED	INTEGRAL
Self-adhesive (peel and stick) Membranes	Hot Rubberized Asphalt	Crystalline Technology
Thermofusible (torch applied) Membranes	Cold Fluid Applied Membranes & Coatings	Modified Silicate Gel Technology

Common Waterproofing Types

Common Waterproofing Types

SURFACE APPLICATION – SELF-ADHERED SHEET

- Modified bitumen sheet with factory-applied adhesive on backside
- Temperature limitations
- Detailing challenges
- System can subsequently be damaged



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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 ensure the system is installed properly.
Because the sheet is adhered to the surface of the structure, it's critical the system is installed without any voids … and that no mechanical damage occurs to the sheet. This system also requires professional detailing around all penetrations … angle changes … expansion joints … perimeter edges … etc. These systems can be damaged by abrasion or mechanical disturbance caused by traffic in the area, so care must be taken to prevent this from occurring.

- Modified bitumen sheet applied by open flame to melt backside of sheet and subsequently adhere to concrete surface
- Open flame concerns (insurance)
- Skilled applicator and detailing challenges
- System can subsequently be damaged

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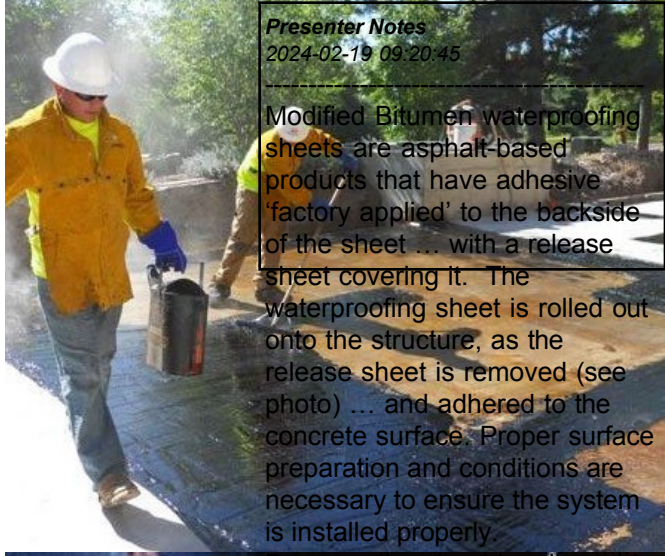
Common Waterproofing Types

SURFACE APPLICATION – TORCH APPLIED SHEET

Common Waterproofing Types

SURFACE APPLICATION – HOT RUBBERIZED ASPHALT

- Rubberized asphalt is heated and applied to prepared concrete surface, creating a seamless application
- Temperature sensitive application that requires skilled applicators
- System can subsequently be damaged



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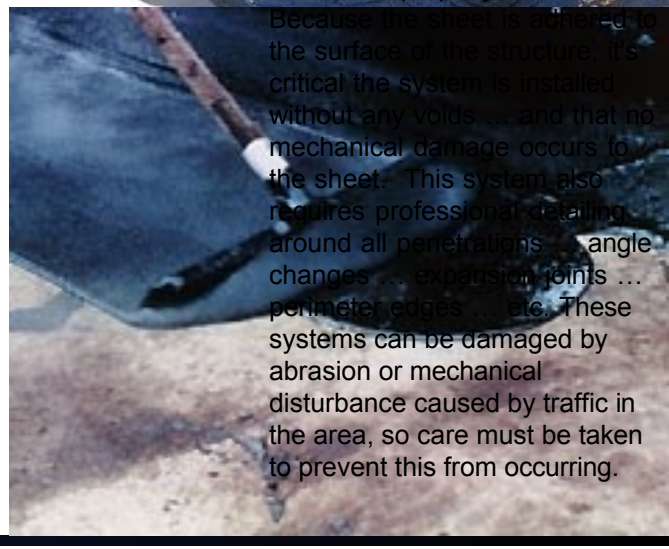

- Cold adhesives form seamless liquid membrane
- Positive side application to existing concrete structure
- Highly skilled labor required to ensure proper application rates
- System can subsequently be damaged

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Common Waterproofing Types

SURFACE APPLICATION – COLD FLUID APPLIED

YEARS?
OR DECADES?

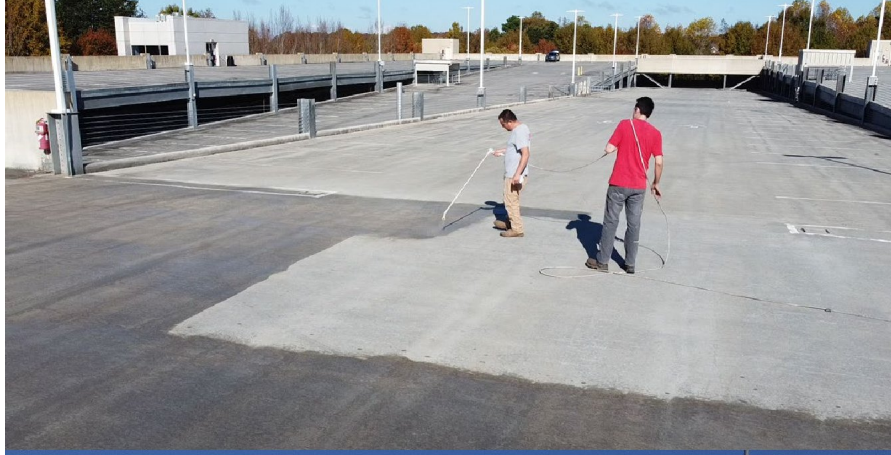
Non-integral coating systems attempt to prevent water and chemicals by creating a barrier to protect the concrete. If properly applied and maintained, non-integral systems can accomplish this goal, but often for a relatively short period of time.

Integral systems penetrate below the surface of the concrete and forming a waterproofing matrix that becomes part of the concrete itself. As a result, these systems cannot be damaged, delaminate, blister, or deteriorate.

The importance of sustainability

NON-INTEGRAL VERSUS INTEGRAL

- Chemically bonds with concrete
- Material penetrates the pores and capillaries present in the concrete
- Active ingredients react with calcium hydroxide that forms during initial concrete hydration process
- Chemical reaction fills existing micro-cracks and voids



Integral Waterproofing

UNDERSTANDING THE BENEFITS

- Spray-applied
- Colorless – does not change exterior appearance of concrete
- Forms an impermeable and flexible waterproofing matrix INSIDE of the concrete
- Effectively blocks water penetration for the life of the structure

Modified Silicate Gel

INTEGRAL WATERPROOFING

- Concrete surface temperature, relative humidity, dew point, vapor drive from inside the slab
- Surface preparation; cleanliness of the slab (dirt, grease, oil, etc.); removal of existing coating systems
- Improper mixing of multi-component products: primer, base-coat, mid-coat and top-coat
- Not allowing proper drying/curing time between layers
- Not back rolling properly and/or not applying sand properly
- Dirt and debris being blown into the wet coating by the wind
- Applying multiple layers too thick or too thin
- Rain during or within several hours after application
- UV exposure to non-UV rated materials
- Too much moisture in the concrete slab; vapor drive causing blistering
- Application below dew point; or curing in excessive heat
- Mechanical damage - e.g., snowplows

Product, Application, and Site Conditions

COATING SYSTEM CHALLENGES

- Improper mixing
- Insufficient surface preparation
- Contamination (wind blown dirt and debris)
- Moisture present
- Incorrect system selection
- Improper surface preparation of existing coating
- Missed recoat window
- Insufficient inter-ply adhesion

Delamination and Debonding Issues

COATING SYSTEM CHALLENGES

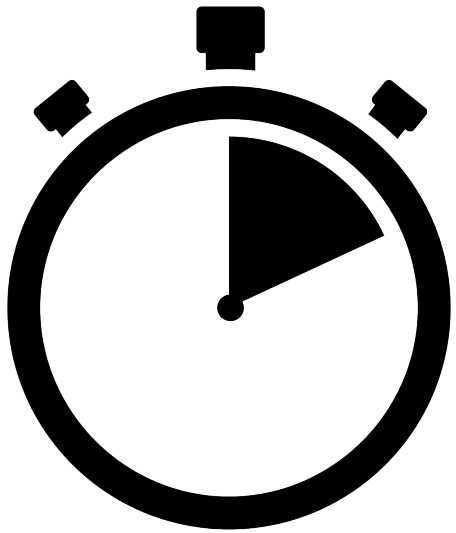
- Over-application of one or more coating layers
- Excessive vapor drive
- Incompatibility with existing coating
- Improper mixing
- Curing at high heat

Blistering and Wrinkling Issues

COATING SYSTEM CHALLENGES

Long-Term Wearing Issues

COATING SYSTEM CHALLENGES



COATING SYSTEMS – LIFE EXPECTANCY

- Acrylic Coating Systems: 2-3 years
- Urethane Coating Systems: 3-5 years
- Polyurea Coating Systems: 7-10 years

INTEGRAL SUBSURFACE SYSTEMS

- Some subsurface applications and technologies can function up to the ‘design life’ of the concrete structure!

Coatings are Short Term Solutions

LIFE EXPECTANCY COMPARISONS

- Premature deterioration of the waterproofing system, allowing moisture and chemicals into the concrete matrix, causing corrosion of the steel reinforcement, freeze/thaw issues, and ultimately leading to a shorter functional lifespan for the structure.
- Potential safety hazards, when the structure is in a state of disrepair, combined with potential closures of parts or all of the facility
- Increased ongoing costs for maintenance and repair of the structure, as well as expansive costs for repeatedly cleaning, repairing and re-waterproofing the structure several times over its lifespan.

Consider the Ramifications

COATING SYSTEM CHALLENGES

VEHICULAR PARKING DECK (New Construction)
10,000 ft^2 PROJECT

- SURFACE PREPARATION – 2–4-person crew; variable timing

DAY 1
- Apply primer (1-2 hour cure)
- Apply base coat (6-10 hour cure)

DAY 2
- Apply mid-coat, broadcast aggregate, back-roll, and let dry (12–16-hour cure)

DAY 3
- Apply topcoat, broadcast aggregate, back-roll (48-72 hour cure prior to vehicular traffic)

6-person crew – 10,000 ft^2 per day

- SURFACE PREPARATION – 2–4 person crew; variable timing

DAY 1
- Spray waterproofing and let dry (1-2 hours)
- Water deck and let dry (1-2 hours)
- Water deck and let dry (1-2 hours)

DAY 2
- Address flashing and other details, treat cracks, and let dry
- Surface is trafficable after 24 hours

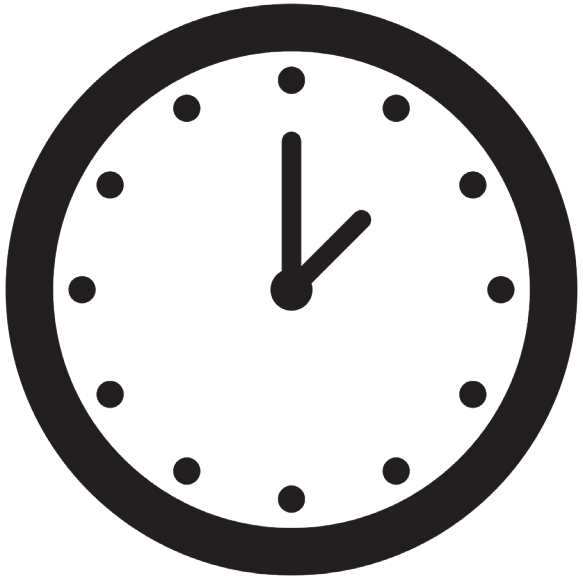
2-person crew – 10,000 ft^2 per day

The Advantages of Downtime Reduction

INTEGRAL WATERPROOFING VERSUS COATING SYSTEMS

Less aggravation for the people affected by the project, whether it's a parking structure, a water treatment plant, an airport, a highway bridge, etc. in the case of highway bridges, it doesn't only improve the aggravation of traffic backups but also has a positive affect on safety. On new construction or refurbishing projects, the more quickly the waterproofing can be completed the more quickly the other trades that come behind that step can start working. This improves the entire schedule of the project.
Faster applications are also a positive factor for waterproofing projects in the northern half of the country where they don't have a 12-month construction window. Particularly in the fall when the cold weather is starting to close in for the winter.

- Limited impact for affected people – residents, clients, facility operations
- Accelerated construction schedule – quicker application means other trades can proceed.
- Faster applications positively impact challenging weather and regional conditions



Down Time Reduction

INTEGRAL WATERPROOFING VERSUS COATING SYSTEMS

- Extremely FAST to install with short ‘dry times’ between applications
- Becomes an integral part of the structure … waterproofs the concrete matrix itself.
- Has no effect on the appearance or slip resistance of concrete surfaces
- Can be painted or coated over (surface markings, etc.)
- Increases the density and compressive strength of the concrete surface (3,500 psi to 5,000 psi)
- Area is trafficable within a few hours
- Cannot be punctured, torn, or worn down
- Environmentally friendly
  - VOC free
  - Non-hazardous
  - Fewer empty containers to dispose of at the landfill.
- Vapor permeable, allowing outgassing of moisture
- Cost effective compared to traffic coating systems

Summary

INTEGRAL WATERPROOFING VERSUS COATING SYSTEMS

Thank you for your interest!

ALCHEMCO®
SUBSURFACE MEMBRANE WATERPROOFING

Considering the Long Game

INNOVATIVE CONCRETE WATERPROOFING SOLUTIONS