

# The Science of Saving Money

## *A Split Slab Waterproofing Project*



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# About Chula Vista Center

- One of the most highly recognized regional outdoor shopping malls in San Diego County.
- Serves a trade area that is home to one million residents within a 10 mile radius.
- Houses the closest full line departments stores to the Mexican border.
- Extremely popular mixed-use retail and entertainment attraction with both local and Mexican national shoppers.



# The Structure



- Construction consisted of a structural concrete slab with an applied sandwich waterproofing membrane.
- Followed by a cast-in-place 3” decorative concrete topping slab.
- Initial design issues and as-built conditions contributed to the leakage problem.



## The Problem

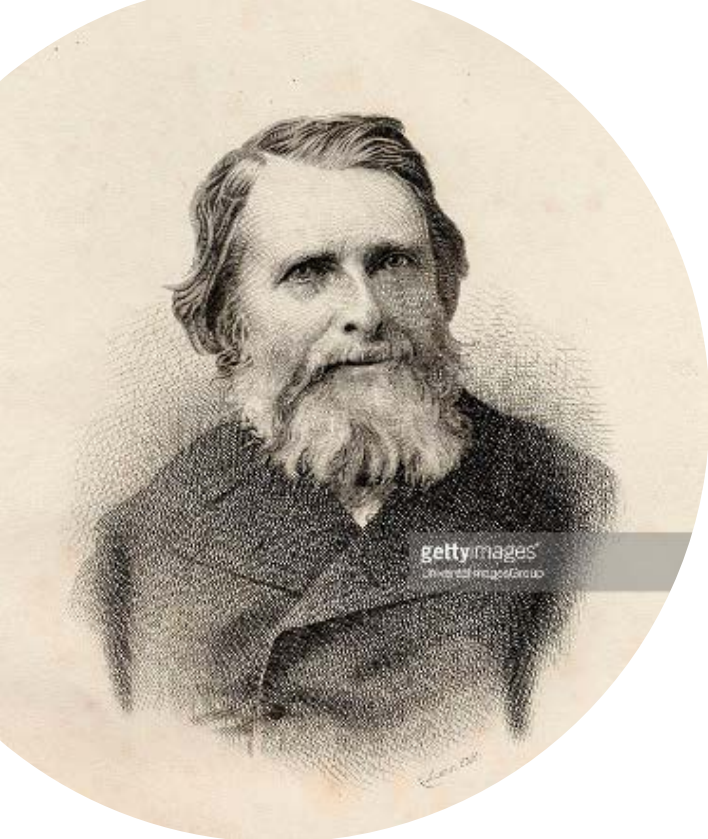
- 14,000 SF 2<sup>nd</sup> story pedestrian plaza deck was leaking profusely into occupied retail tenant space with every rain event.
- This was causing a negative impact on business making it difficult to retain and attract tenants.
- Previous attempts to mitigate the problem were unsuccessful.

# Split Slab Waterproofing Failure

“The Damage – Leakage into Occupied Spaces”



# The Common Law of Business Balance



**John Ruskin**  
1819-1900

**“It's unwise to pay too much, but it's worse to pay too little.**

**When you pay too much, you lose a little money - that's all.**

**When you pay too little, you sometimes lose everything, because the thing you bought was incapable of doing the thing it was bought to do.**

**The common law of business balance prohibits paying a little and getting a lot - it can't be done.**

**If you deal with the lowest bidder, it is well to add something for the risk you run, and if you do that you will have enough to pay for something better.”**



## The Solution

- Retain the services of an expert local waterproofing consulting engineer.
- Consulting engineer acquire service and support of a waterproofing materials manufacturer.
- Invite a limited and selective bid list of local restoration/waterproofing contractors.
- Develop a restoration and waterproofing strategy between the three member firms.

# CHALLENGES

## WHEN SPLIT SLAB WATERPROOFING FAILS

What To Do?

### Option #1 – Total Replacement

- HIGH REPLACEMENT COSTS
- IMPACT ON OPERATIONS & OCCUPANTS
- ENVIRONMENTAL CONCERNS
- STRUCTURAL INTEGRITY
- CONDITION ASSESSMENT OF THE TOPPING SLAB
- JOINTS DESIGN AND MAPPING OF CRACKS
- DETERIORATION AND CONTAMINATION

*“Where there’s construction –  
there’s disruption”*

*“WHERE THERE’S CONSTRUCTION –  
THERE’S DISRUPTION”*



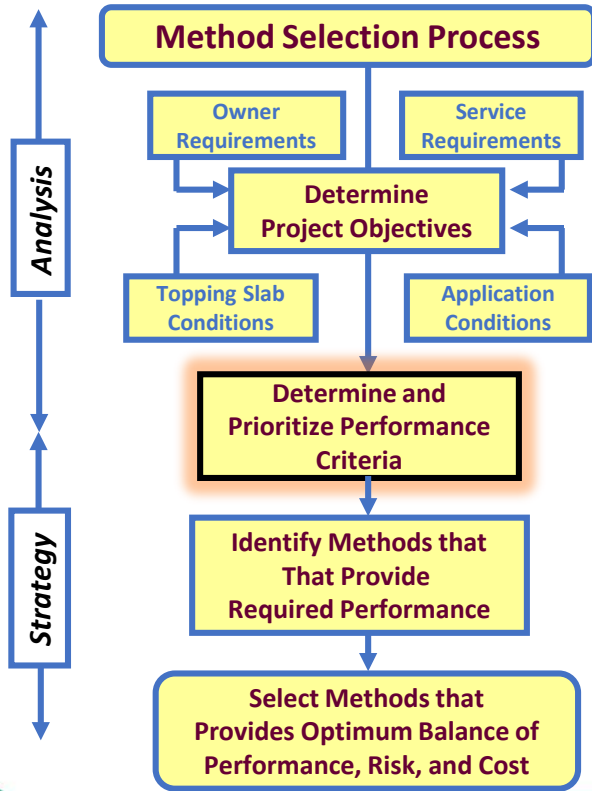
# CHALLENGES

WHEN SPLIT SLAB WATERPROOFING FAILS - What To Do?

Option #2 – Restore Topping Slab & Install Waterproofing Membrane

- Lower Cost – Less Impact on Operations & Occupants – More Environmentally Friendly
- Structural Integrity of the Topping slab – Joints Design, Cracks, Deterioration, Contamination
- Installation of a Topical Waterproofing System - Limited Material Options.
- Moisture Vapor Permeability Essential

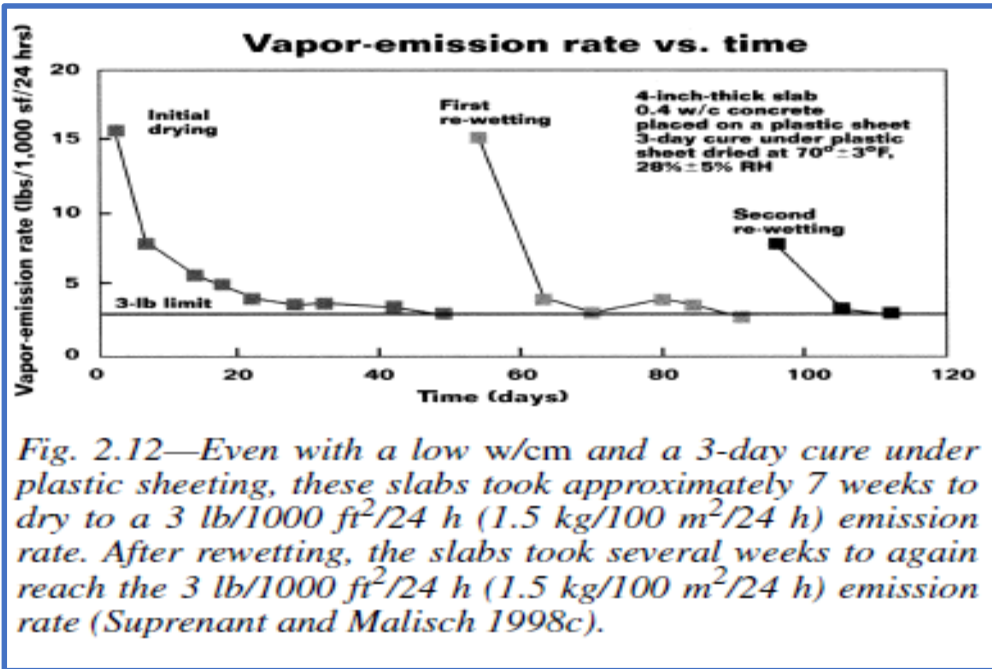
# Waterproofing Method Selection Flow Chart



- Cost for Complete Replacement
- Cost for Topical Waterproofing
- Impact on Operations
- Impact on Occupants
- Project Completion Time
- Waterproofing Material Options
- Longevity
- Exposure Conditions
- Durability
- Wear resistance
- Environmental – VOC's – Odor

# Guide to Specification Issues for Architects and Engineers

## Concrete International - April 2003



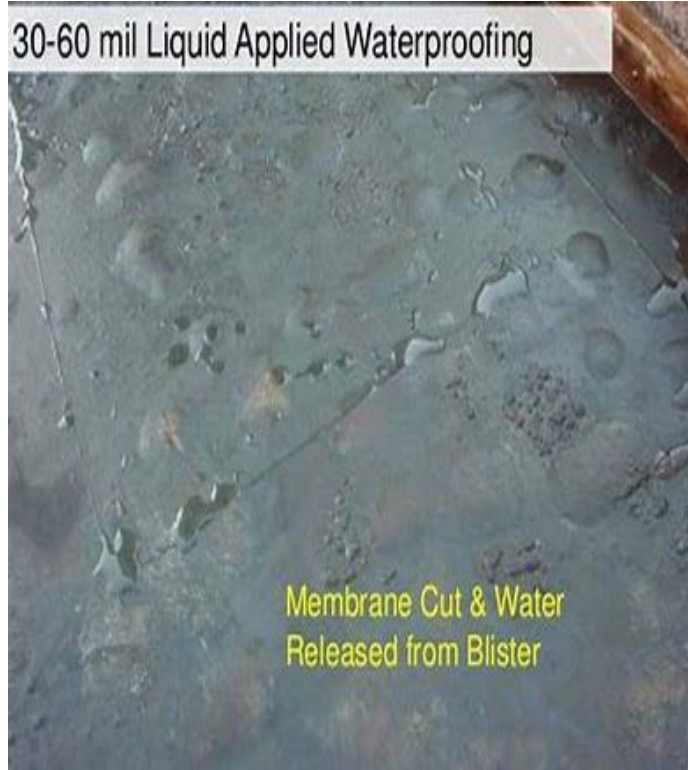
Concrete Slab Moisture Content  
and  
Failure of Vapor Impermeable Membranes

Treat Split Slabs the same as slabs-on-grade

# Concrete Encapsulation and Failure of Vapor Impermeable Membranes



# Trapped Moisture Issues



- Moisture trapped in between split slab membranes and impermeable topical waterproofing membranes can cause bond issues!

# The Selected System

*Cementitious, Decorative, Moisture Vapor Permeable!*



# Common Problems and Issues

## Joint Design, Joint Conditions, Cracks



Inadequate Joint Design – Leads to Moving Cracks

# COMMON PROBLEMS AND ISSUES

## *JOINT DESIGN, JOINT CONDITIONS, CRACKS*

- Cracks may develop due to shrinkage, thermal cycles, insufficient joint design, settlement and live loads.
- With the likelihood that most cracks are active, they should be treated and detailed to prevent reflective cracking through the deck coating.
- Additional information regarding joint and crack anticipated movement is available in ACI 224R, ACI 302.1R and ACI 504R.





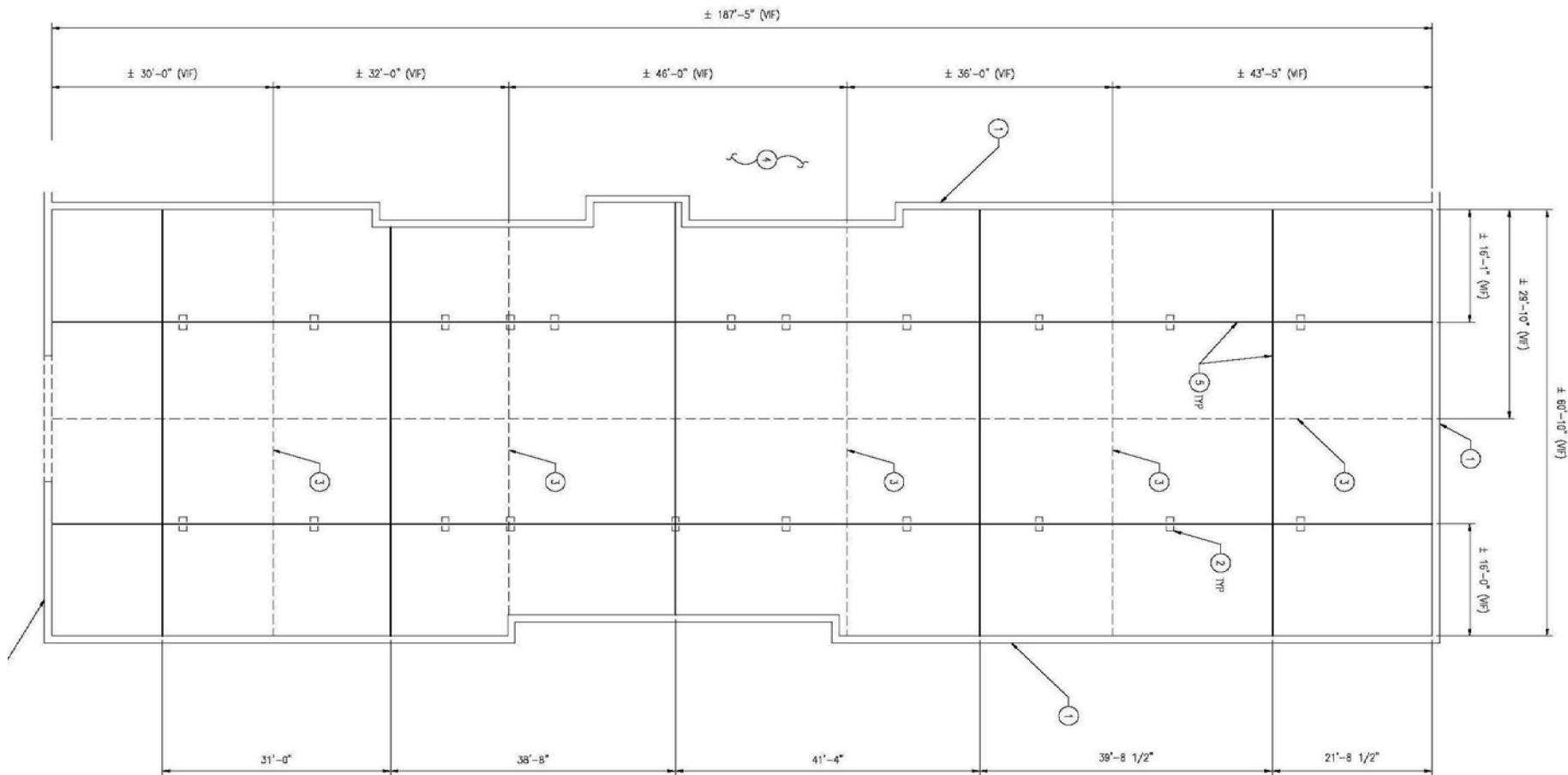
# COMMON PROBLEMS AND ISSUES

## *JOINT DESIGN, JOINT CONDITIONS, CRACKS*

### Insufficient Joint Details

- Deck dimensions: (L)188' X (W) 61'
- Joint spacing: 1 (Longitudinal) - 30' o/c  
4 (Transverse) – 46' o/c
- Coefficient of Expansion (5.5 millionths/° F)
- Assuming a 100° F annual temperature swing
- $LF \times 12'' \times 100^\circ F \times .0000055$
- Unrestrained contraction 1.24'' (L) and .41'' (W)
- Timing and Proper Saw-cut Depth are Crucial
- Install Additional Relief Joints, as required.



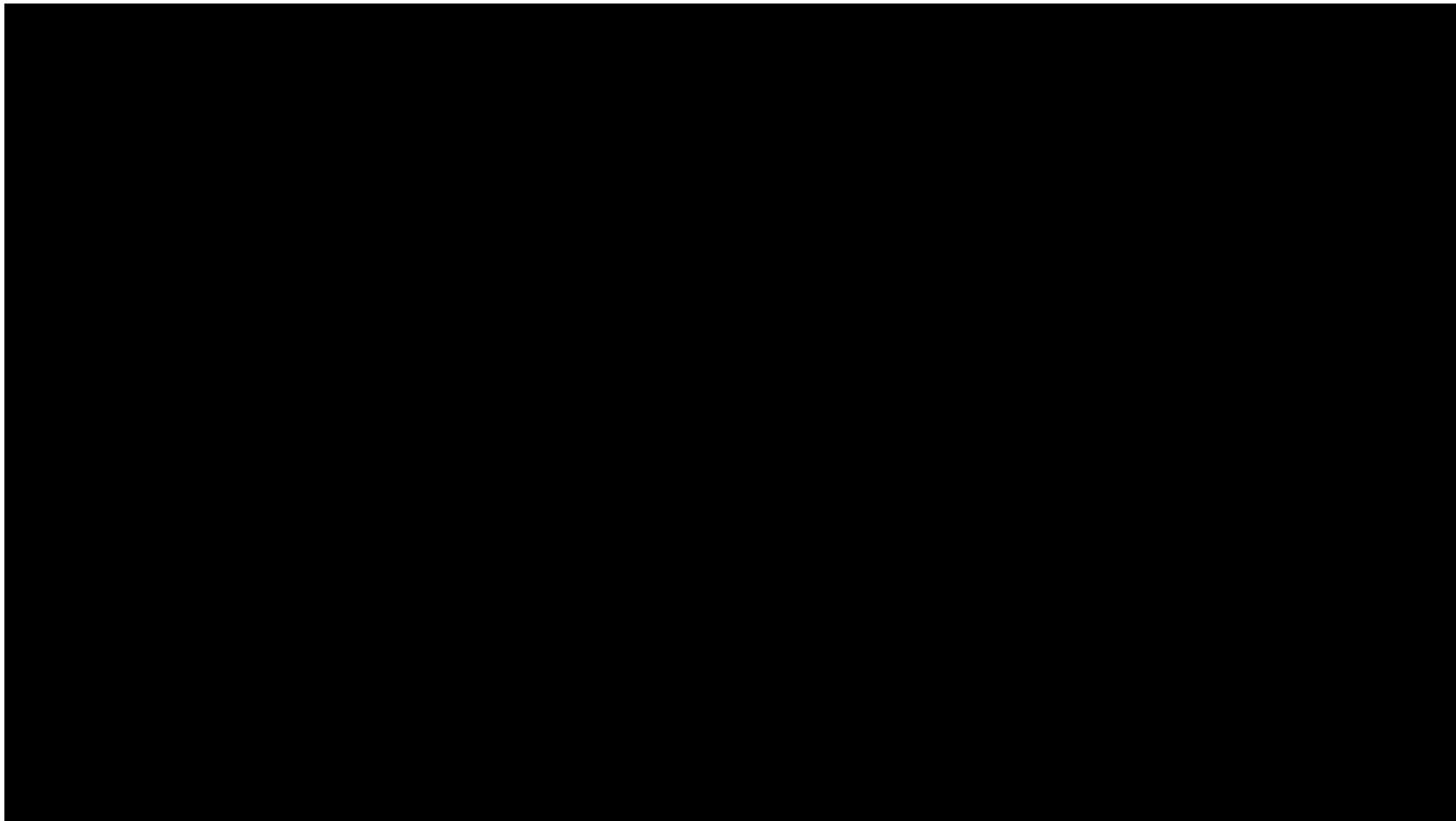




## Common issues with cementitious membranes

# Scope of Work

- Remove existing sealant joints
- Profile substrate via shot blasting
- Install custom made 26' long stainless steel trench drain
- Complete detailing at column covers utilizing extruded silicone
- Apply colloidal silicate reactive primer
- Install sealant in control joints
- Install breathable polymer modified cementitious waterproofing system with texture and pigmented top coat
- Install sealant in expansion joints



2019 Spring Convention | April 8-10 | Jacksonville, Florida

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

San Diego broke its all-time July rainfall record Saturday when 1.03 inches fell. That broke not only the July single-day record of 0.83 inches set July 25, 1902, but also the record for an entire July's rainfall, which was 0.92 inches July 1-31, 1902.

It's also more rain than San Diego saw in all of January this year; on average, January is the second-wettest month and July the second-driest, with January averaging 66 times more rainfall than July. The only other time July has out-dampened January in San Diego was 1976, when July had 0.02 inch to January's trace.

San Diego added to its total Sunday with another 0.66 inch of rain as of 11 p.m. The month-to-date total of 1.70 inches, which fell in less than 36 hours, is more rainfall than San Diego had seen in the previous 101 Julys combined; a total of 1.68 inches fell during July from 1914 through 2014 in San Diego.

# Moisture in Concrete Slabs

- High moisture content in concrete substrates can lead to premature failure, discoloration, interfere with polymerization of deck coating, compromise adhesion, and potential for delamination.
- The source of moisture content can be internal (mix water) or external (environmental).
- It's not about 28 days – consider moisture content, factor that influence evaporation, concrete slab thickness and permeability.



# On Site Moisture Testing

**#3 Plastic Sheet Test**



Sheet  
LP2

Status  
Description  
4

Created  
Aug 01, 2015 @ 15:48  
bkennedy@appliedrestoration.com

[Open](#)



August 01, 2015 at 15:49

**#4 Plastic Sheet Test**



Sheet  
LP2

Status  
Description  
5

Created  
Aug 01, 2015 @ 15:52  
bkennedy@appliedrestoration.com

[Open](#)



August 01, 2015 at 15:52





# Osmosis in Action



Water Line

# “1st Line of Defense”

Internal (Integral)  
Waterproofing

Penetration Based

Colloidal Silicate

Hydrophilic

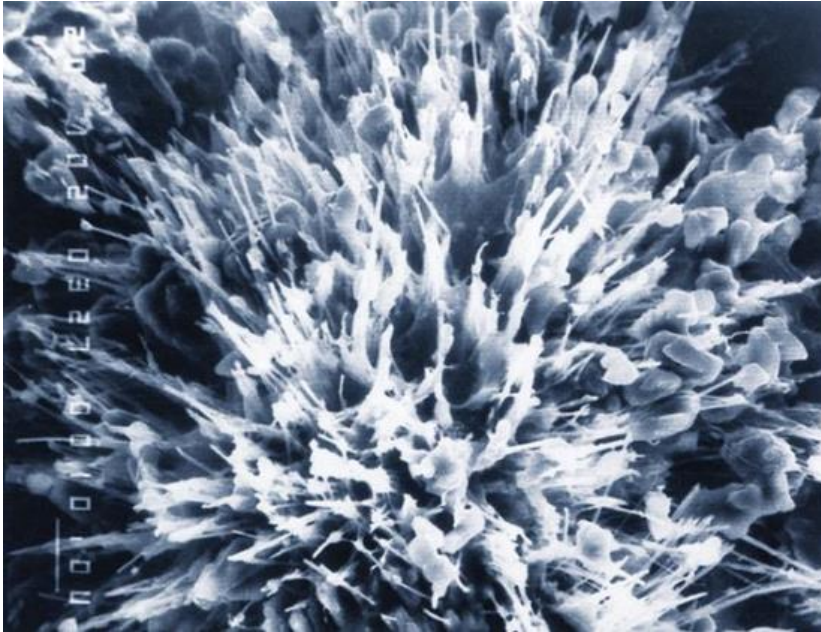
Hydro Gel

# Precondition Existing Concrete Topping Slab

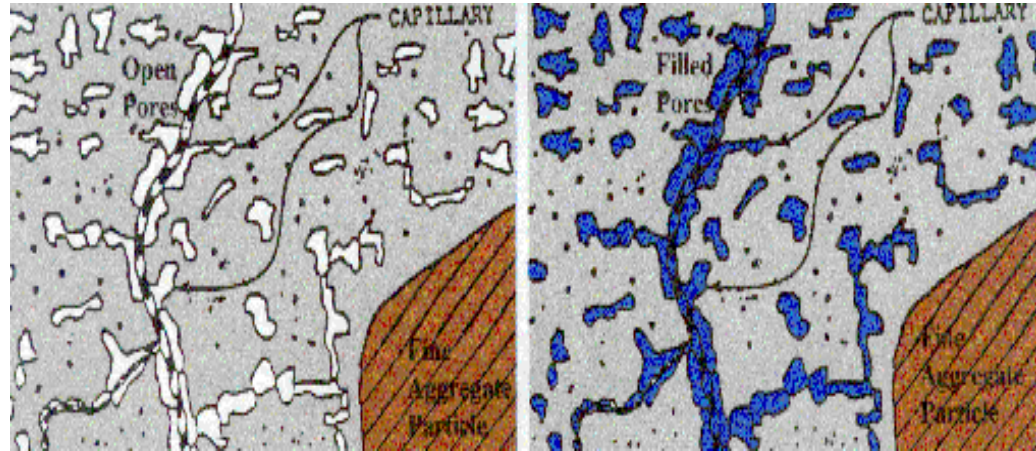


# What is a Colloidal Silicate

- **Colloidal** always refers to a liquid material.
- Contains suspended particles of **solid silica**. Will not settle.
- **Nano-size** (5 nm) solids in permanent liquid suspension.
- Colloidal Silicates – **Not to be Confused** with Crystalline Powder Formulations.
- **Powder** Formulations – **Hydrophobic** and exhibit **Shallow Penetration**.
- **Colloidal Silicates** – **Hydrophilic and Migrate Deep** into the Concrete.



## PROCESS OF MIGRATION & CHEMICAL REACTION

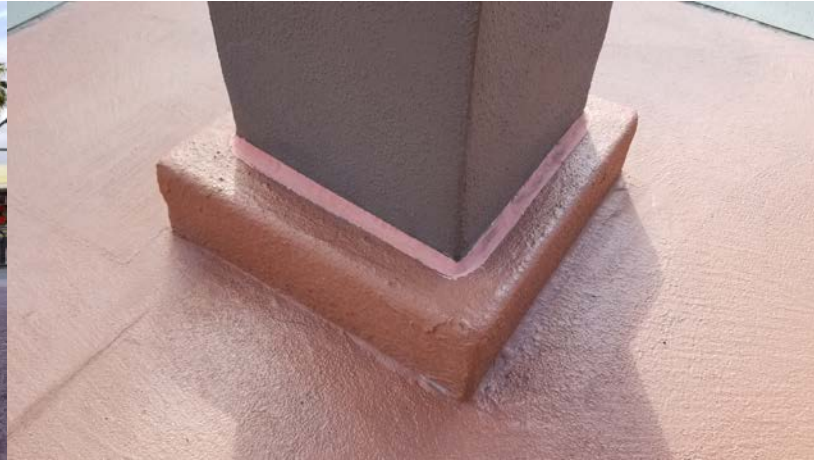


## CRYSTALLINE COLLOIDAL SILICATES

# Terminations and Detailing



- 'L' Metal flashing installed behind weep screed



- Sealant termination at square columns

# Terminations and Detailing



- Extruded silicone was used
- Works but subject to vandalism

- Proper termination to earthquake joint body

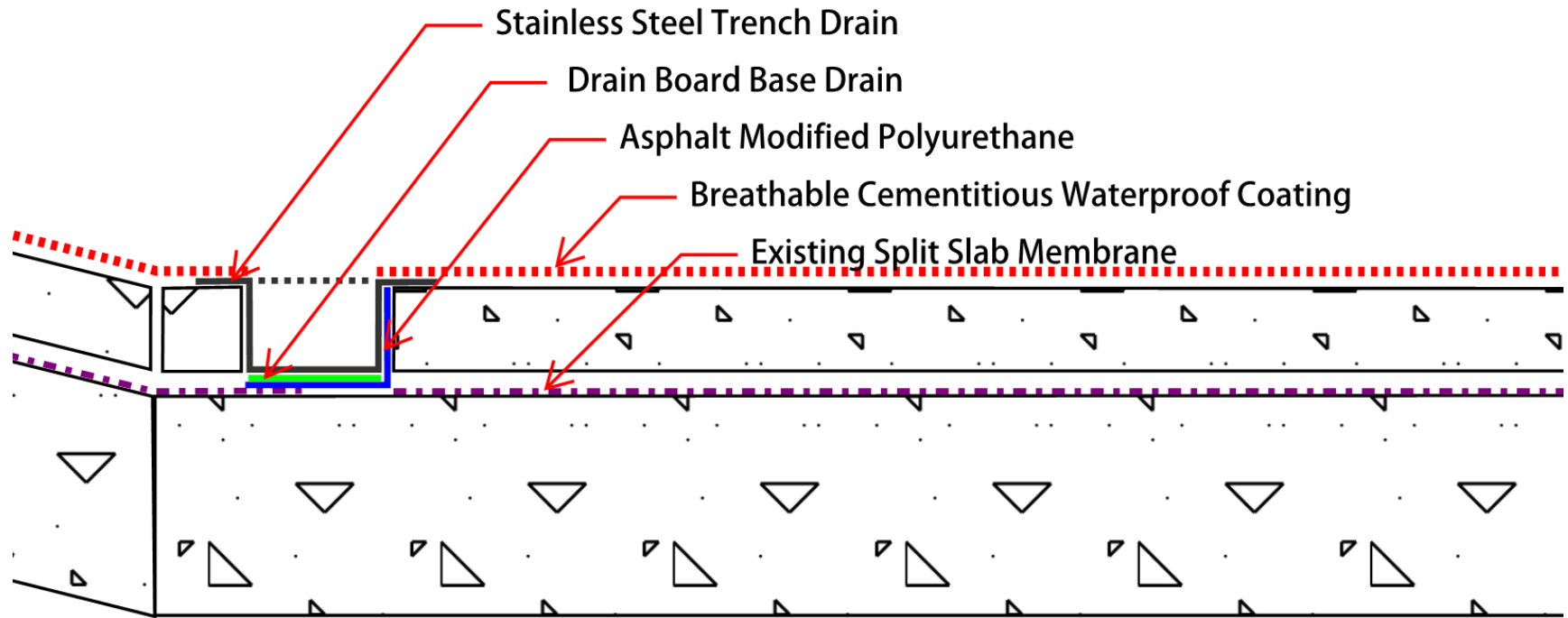


# Terminations and Detailing

- Dual level drainage installed



- 6" wide drain board collector installed below trench drain, routed out dual level scupper



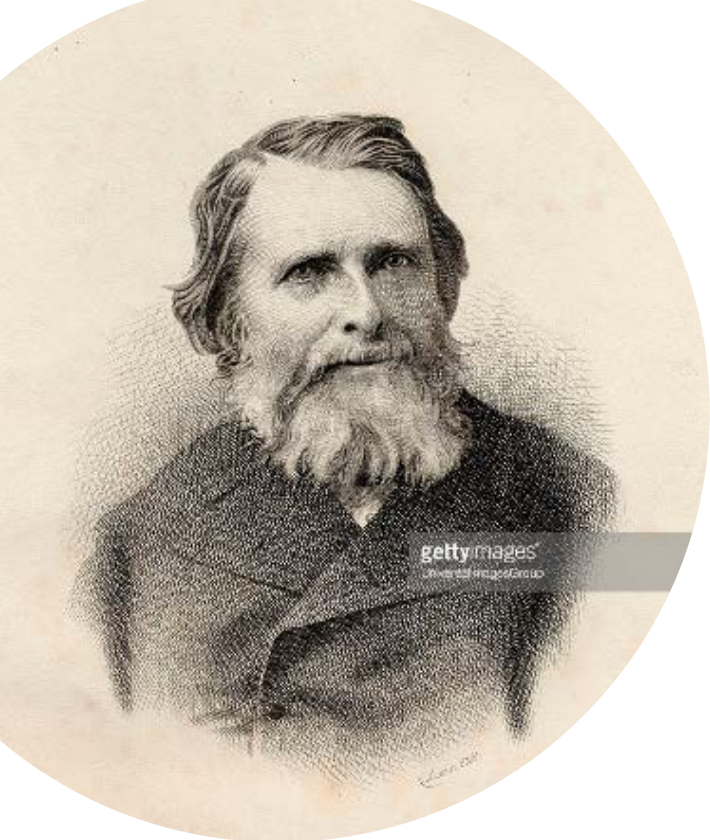


# Today



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



**John Ruskin**  
1819-1900

**“Quality is never an accident; it is always the result of high intention, sincere effort, intelligent direction and skillful execution; it represents the wide choice of several alternatives, the cumulative experience of many masters of craftsmanship.**

“At the end of the day, we were able to stop the leaks, keep the tenants happy, and provide a great looking coating at a small fraction of the projected cost to remove and replace the existing waterproofing. We were extremely pleased with the outcome and wouldn't hesitate to recommend this type of waterproofing membrane system for any pedestrian or vehicular traffic coating applications.” *Chula Vista Center Operations Manager*

