ICRI Spring Convention - Reno, Nevada

PARKING GARAGE REPAIRS

- **Evaluation**
- **Owner Requirements**
- **Surface Preparation**
- **Bonding Agents**
- **Material Selection & Repair**
- **Curing & Sealing**
- **Crack Repair**
- **Aesthetics**
- **Specifications**
- **Etc.**

EUCLID CHEMICAL

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Manager Southwest Region
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Dave Flax

- Civil Engineering Degree from RPI
- Over 35 years experience with concrete
- Years as a Field Engineer
- Years with a contractor
- Years with the Corps of Engineers doing research
- Published dozens of articles
- Specialized in concrete
- Earned CDT and CCPR from CSI

THE CONCRETE REPAIR PROCESS

EVALUATION

What is the True Cause of the Problem?

It is imperative that the causes, not the symptoms be identified.

Then they can be dealt with.


STOP

Measure the Crack

Determine if the crack is moving.

If it is, can you can stop it from moving.

OWNER REQUIREMENTS

Function

- Cosmetic
- Non-Structural
- Structural

Appearance

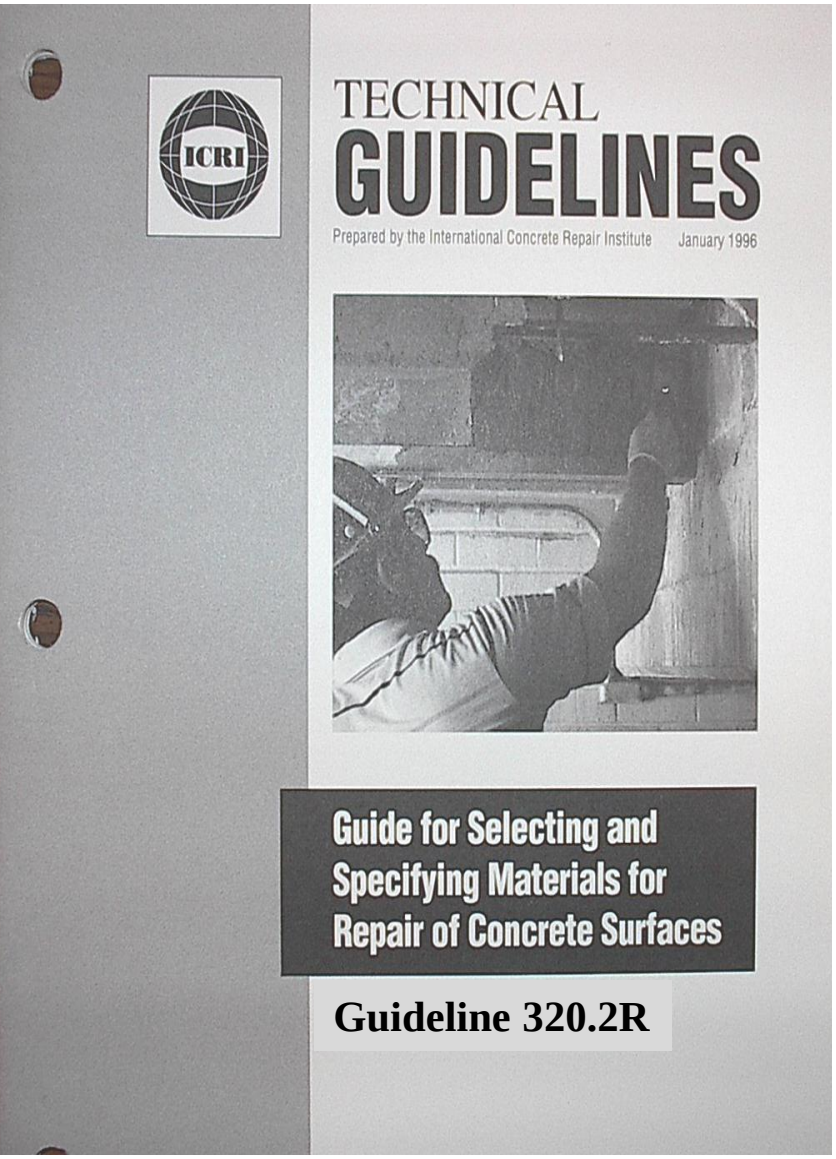
- Color
- Texture

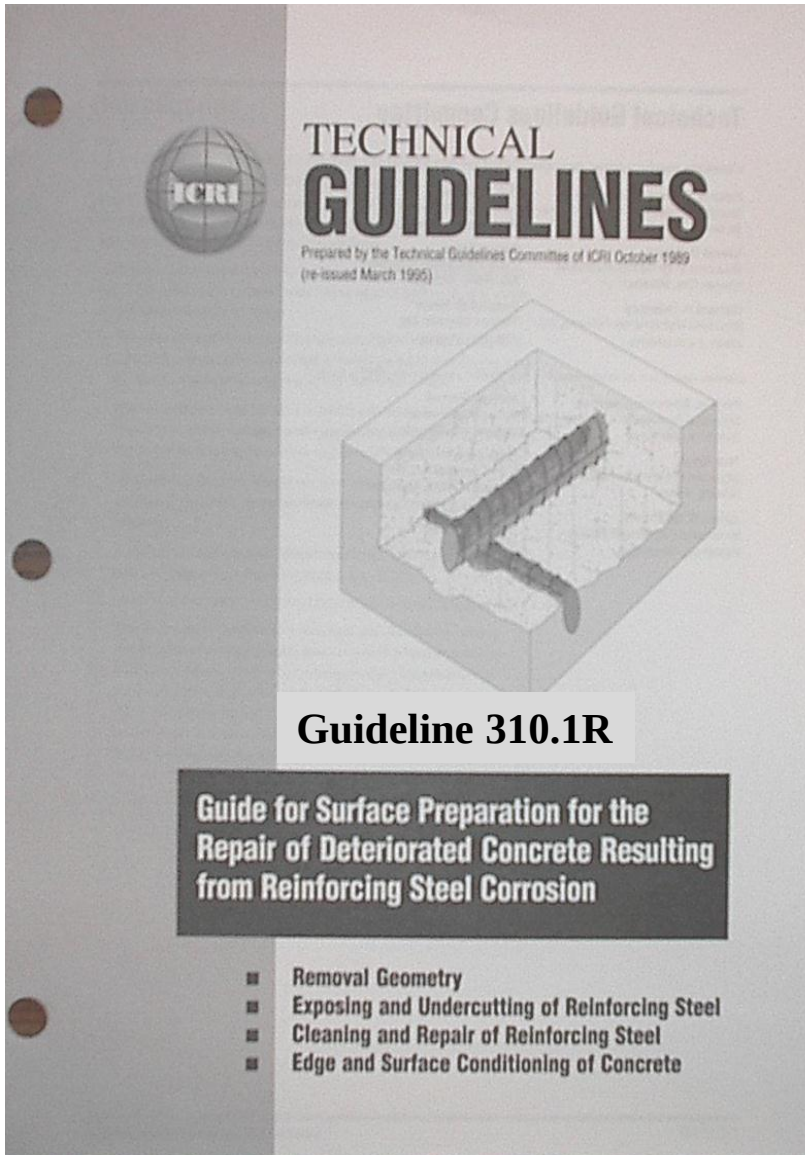
Environment

- Freeze/Thaw
- Temperatures
- Chemical Attack
- Wear and Abrasion

SURFACE PREPARATION

Suggested Reading

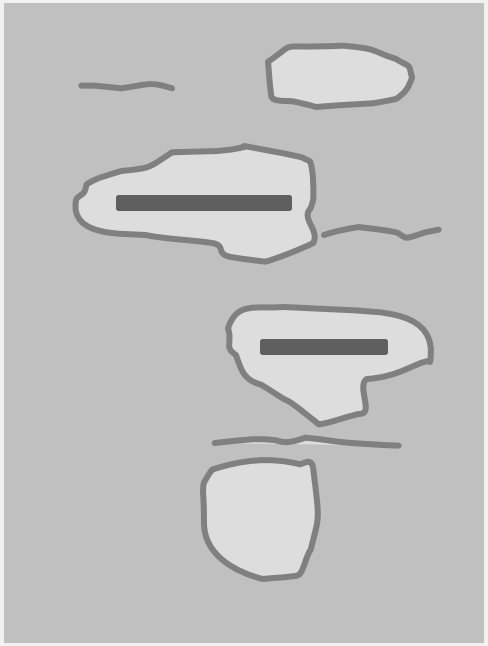




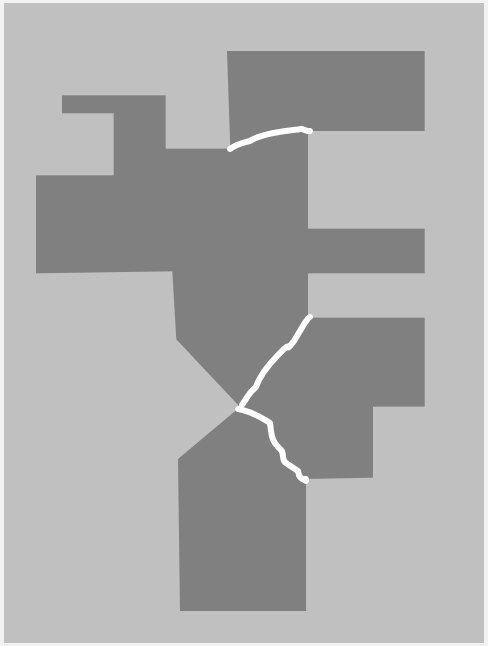
International Concrete Repair Institute Guidelines

Repair Geometry

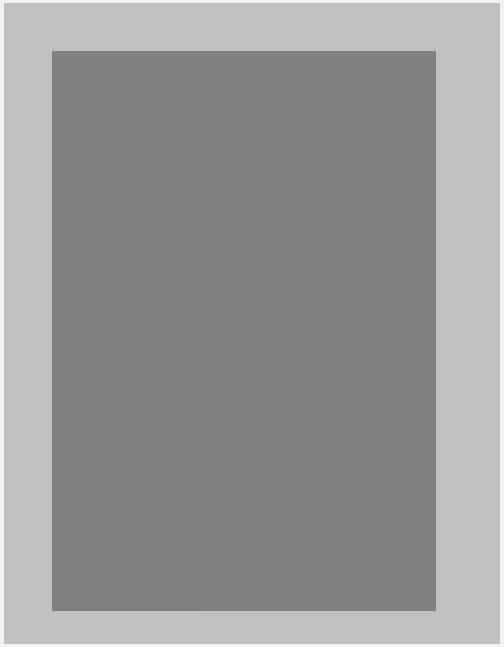
Delaminations



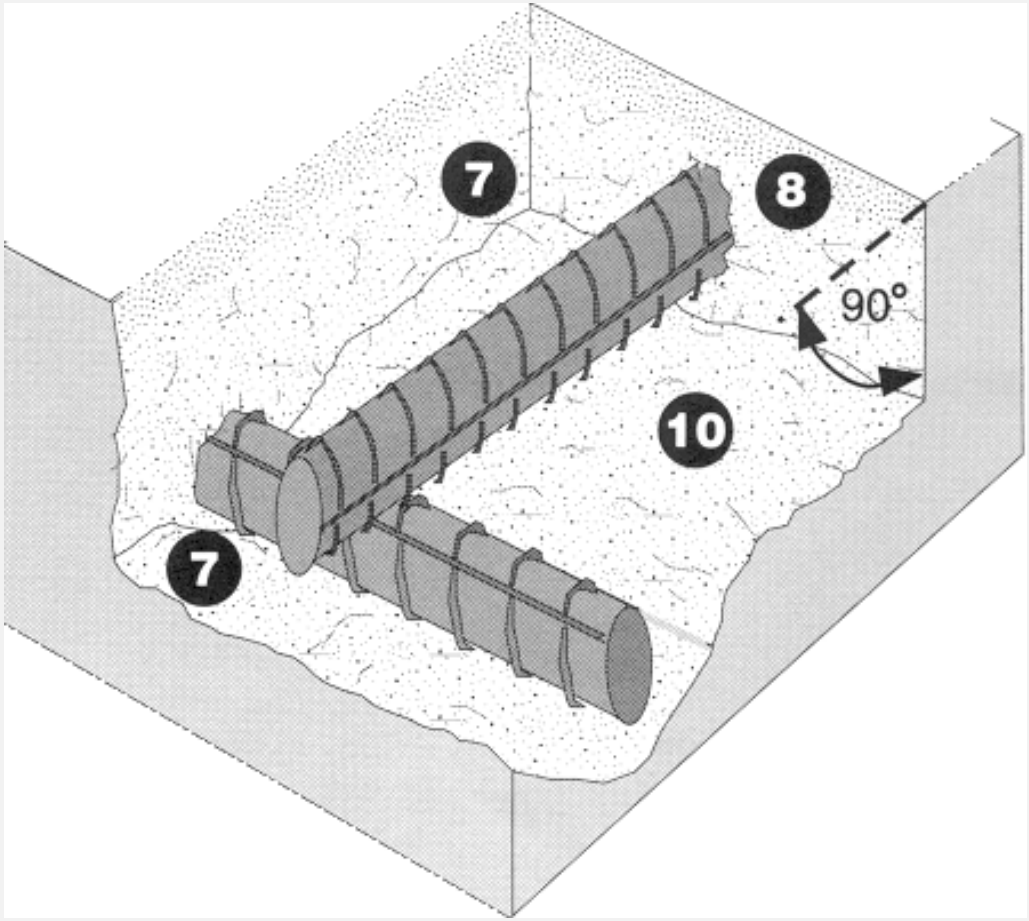
Incorrect



Recommended



Edge and Surface Conditioning of Concrete

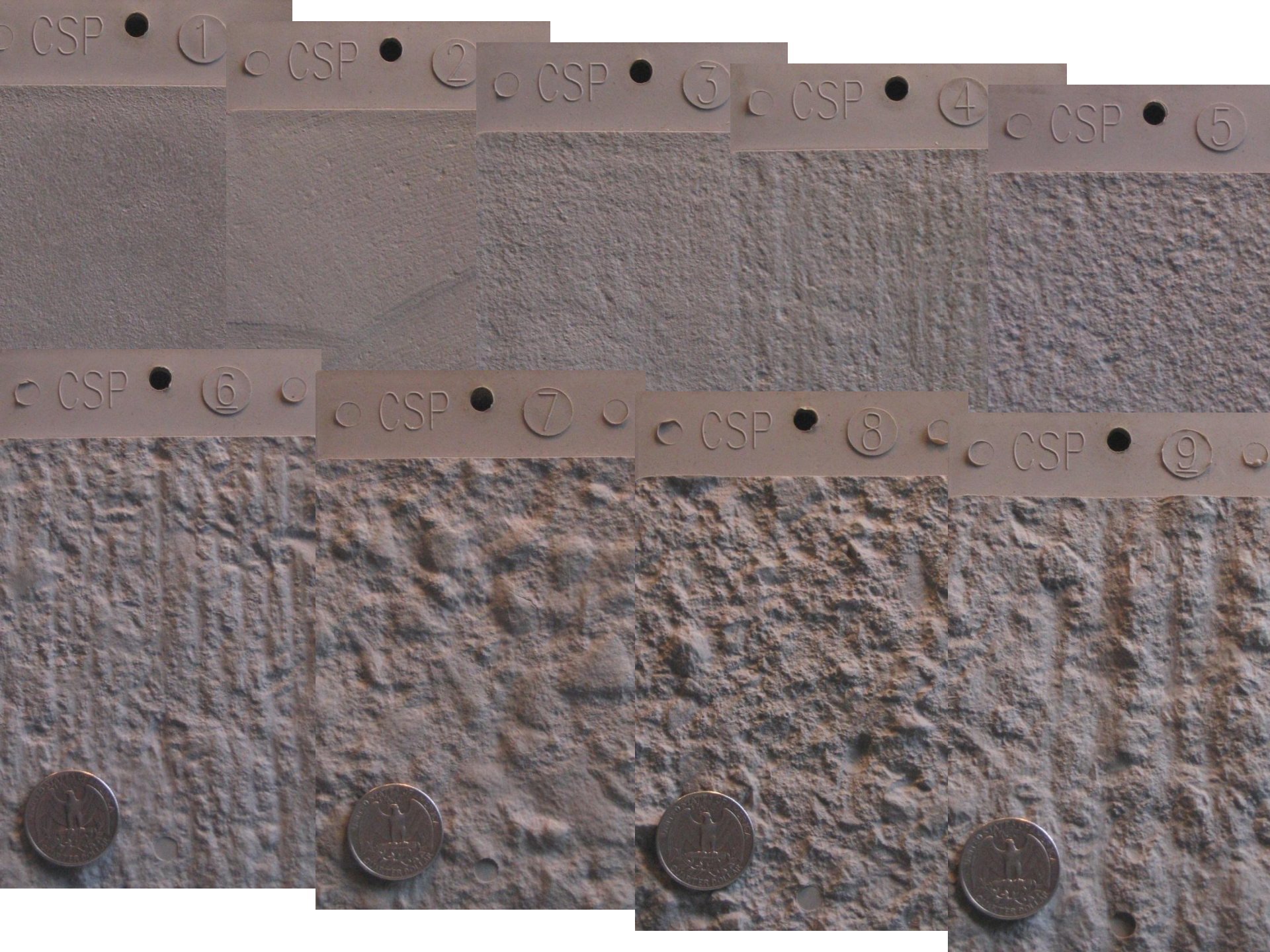


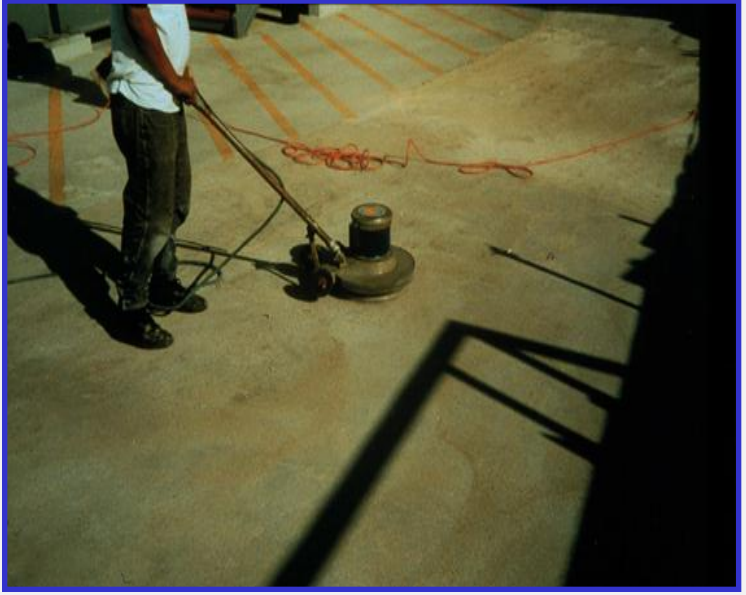
- **Remove bond inhibiting materials (dirt, dust, concrete slurry, loosely bonded aggregate, etc.)**
- **Remove corrosion**
- **90 degrees**
- **Space behind rebar**

Guideline No. 310.2R

Concrete Surface Preparation Profile Guidelines

Complete With Chips


CSP 1
CSP 2
CSP 3
CSP 4
CSP 5
CSP 6
CSP 7
CSP 8
CSP 9



Grinding

High
Pressure
Water

Steel
Bead
Blasting

Scabbling

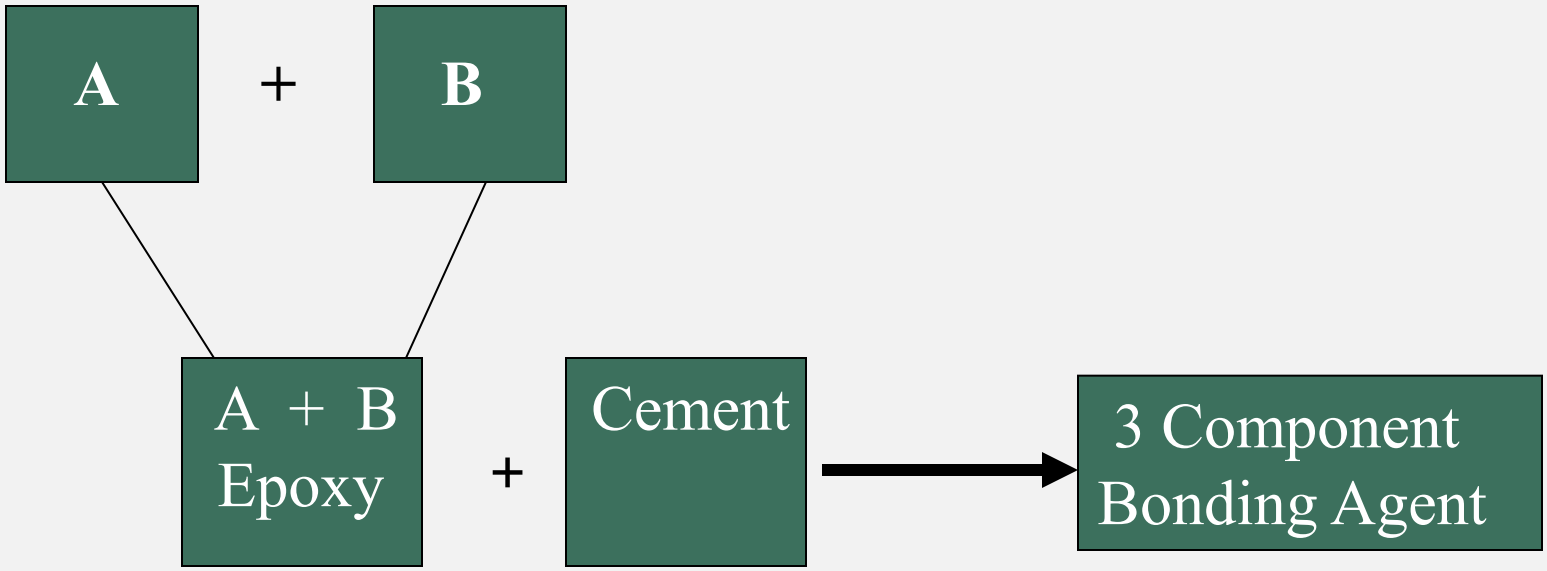
BONDING AGENTS

Many of the Choices have Drawbacks

- **Scrub Coats**
- **Latex**
- **Epoxy Adhesives**

Epoxy/Cement

- **Portland Cement dispersed in a water based epoxy to provide mechanical and chemical bond.**
- **Provides long open time, so it is the only choice for “form and pour”.**



Bonding Agents

All substrates should be SSD except when using 100% solids epoxy primers

MATERIAL SELECTION

Simply choose a material that is compatible with the concrete and the required application method.

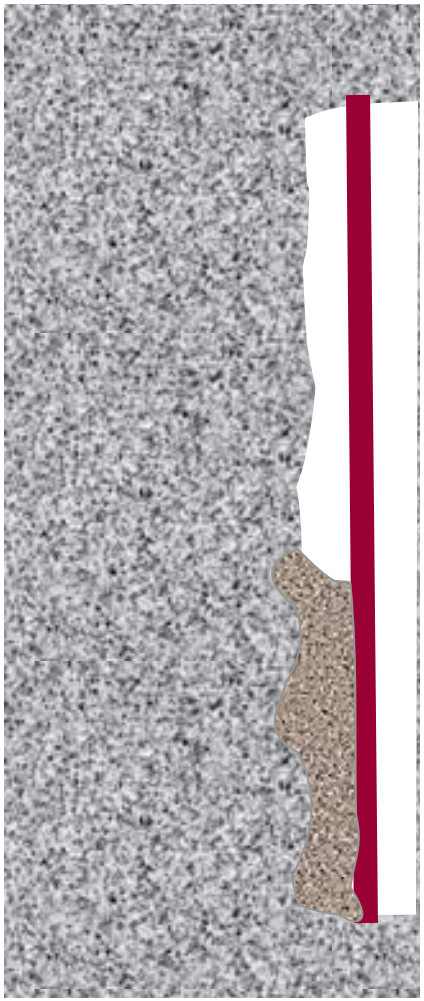
Just a few of the things you will need to consider:

- Modulus of Elasticity
- Shrinkage
- Bond Strength
- Flexural Strength
- Compressive Strength
- Permeability
- Sulfate Resistance
- Impact & Abrasion Resistance
- Coefficient of Thermal Expansion
- Chemical Resistance
- Freeze/Thaw Resistance
- Etc.

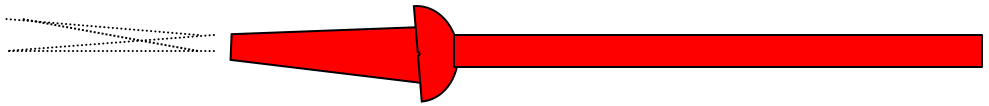
- Placability
- Consistency
- Repair Thickness
- Pumping
- Set time
- Viscosity
- Stickiness
- Aggregate Extension
- Etc.

Sounds complex.
But no problem.
Just call me.

Concrete Repair Mortar Shotcrete

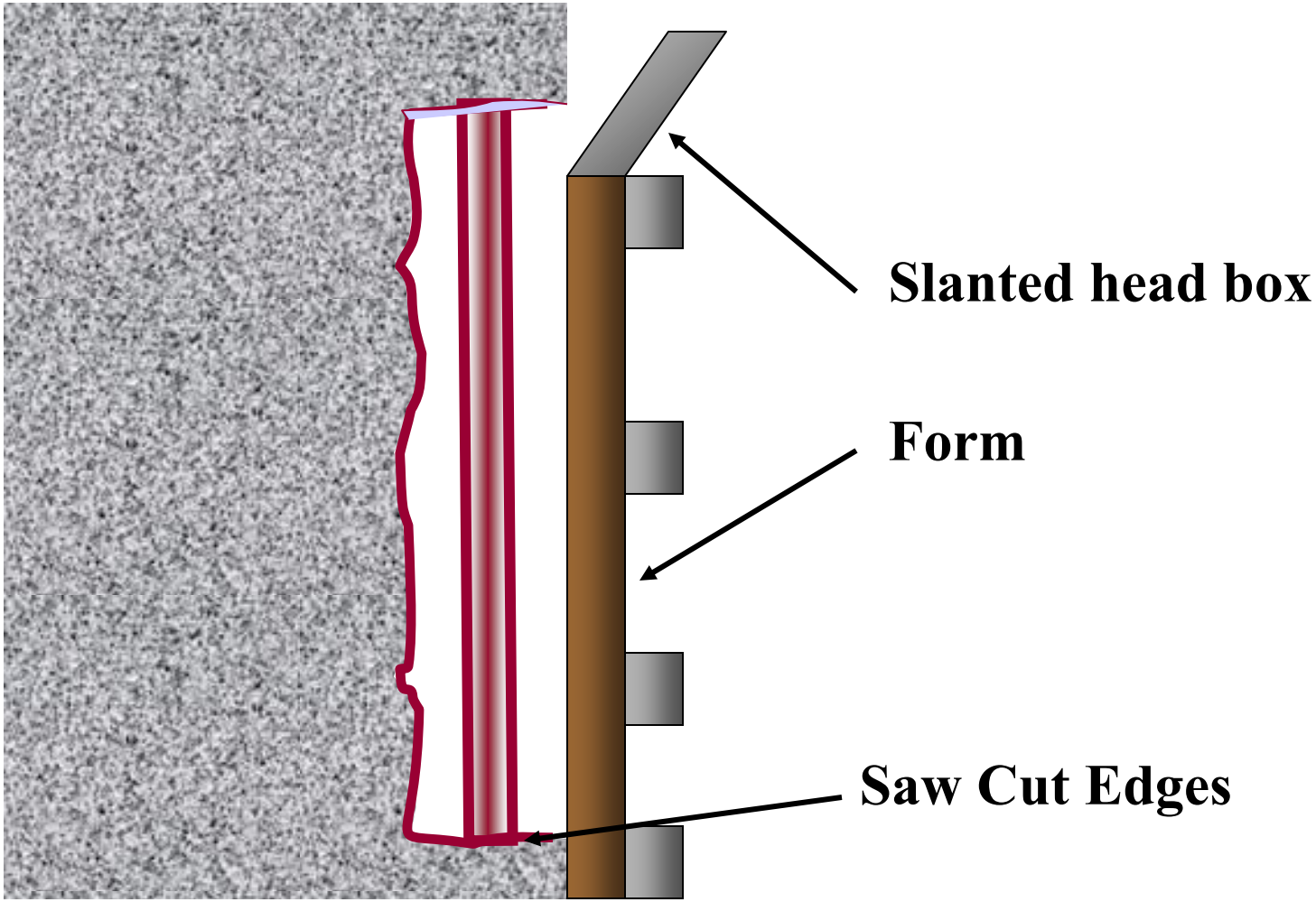


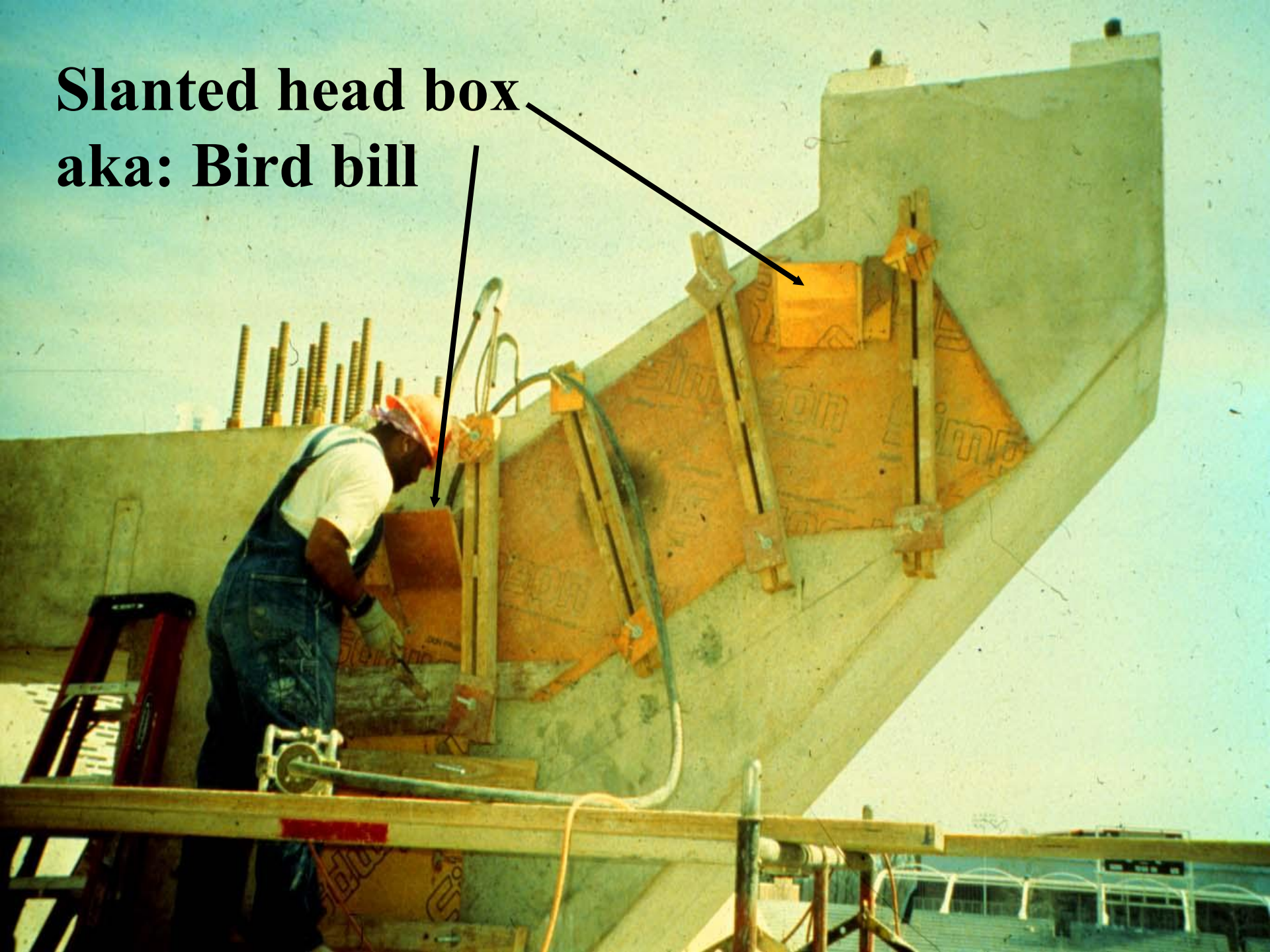
Minimum 1/2” Thickness



Or could hand trowel into place

Concrete Repair Mortar Form and Pour




Slanted head box
aka: Bird bill

What Were the Most Important Engineering Properties?

Modulus of Elasticity

Shrinkage

Bond Strength

Flexural Strength

Compressive Strength

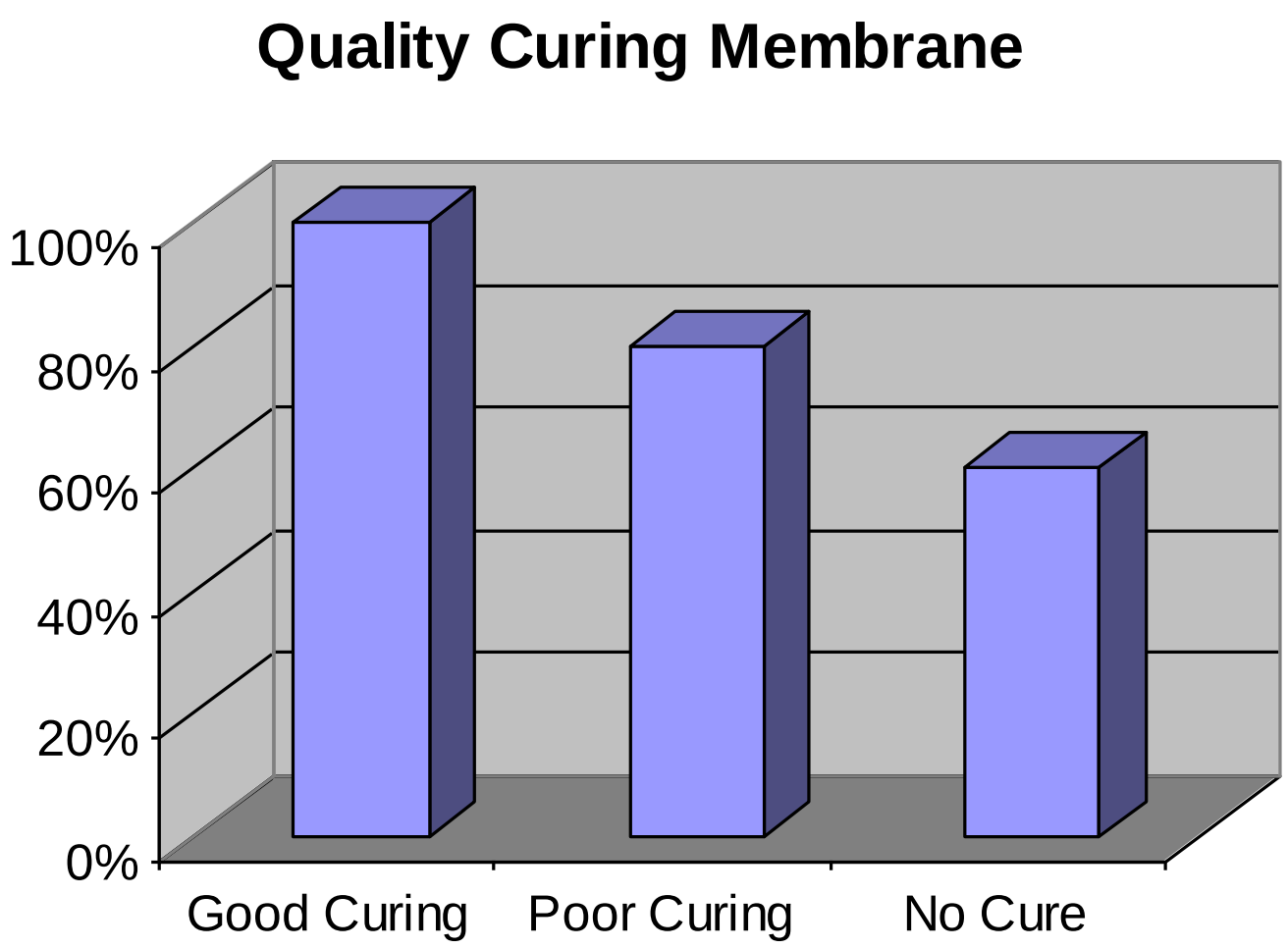
As ICRI Likes to Say:

“Repair Like With Like.”

CURING

Poor Curing = Dusting

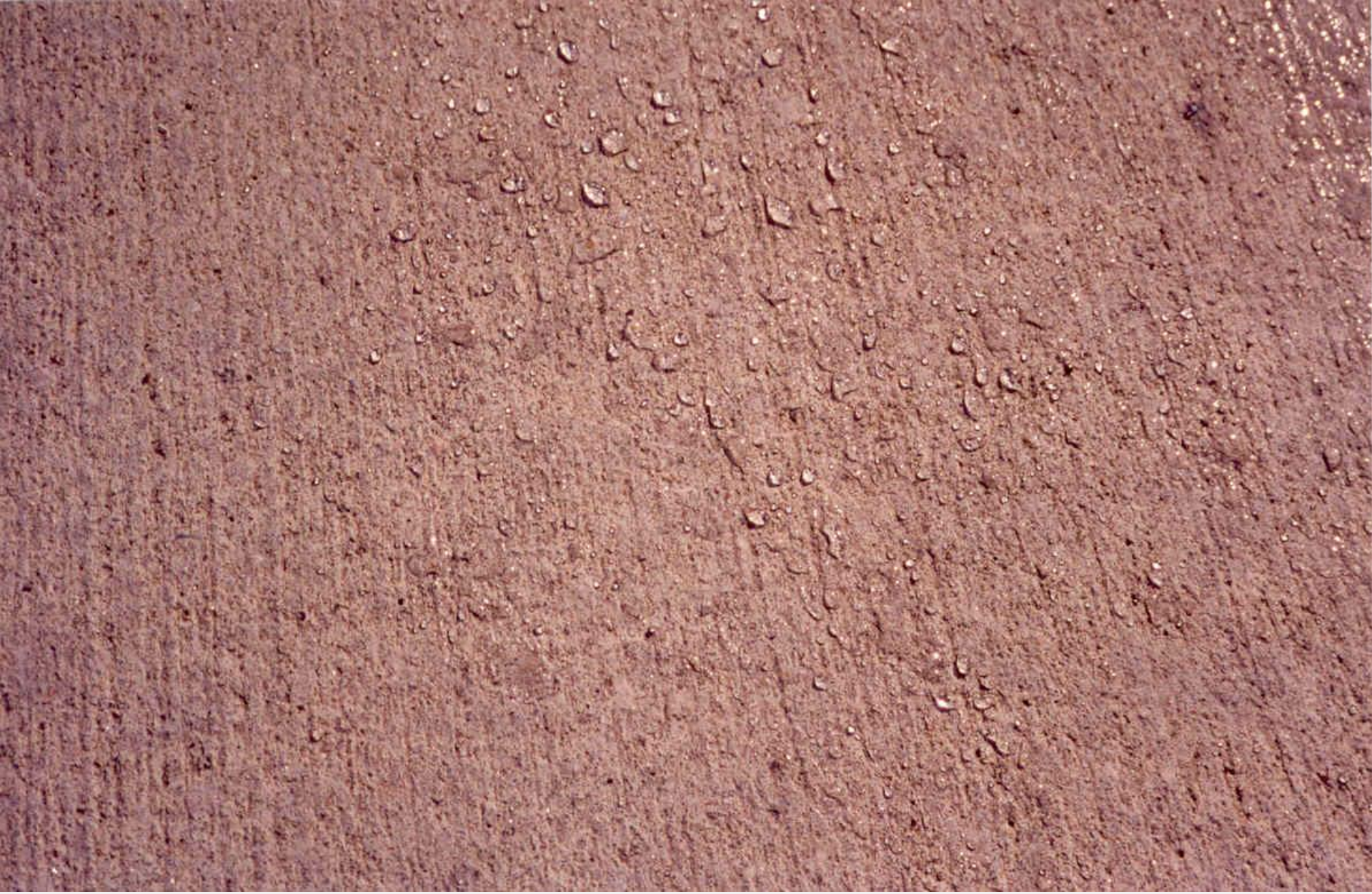
Effect Of Curing
On Surface Strength Of Concrete



SPEC NEEDS TO SAY:
“Backroll with short nap roller.”

This will make the coverage uniform.

SEALING

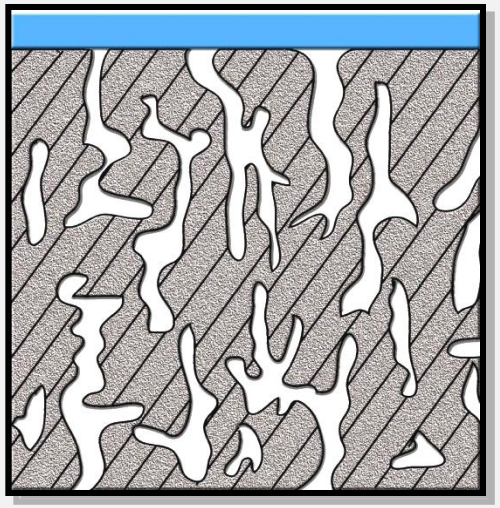


Sealer can be applied as part of the Curing/Sealing Compound or as a separate Sealer after the concrete cures

HEALER/SEALER

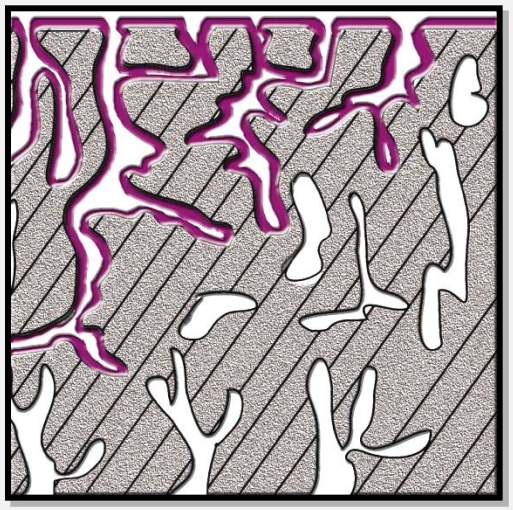
Coating, Repellent & Healer/Sealer

Waterproofing Coating



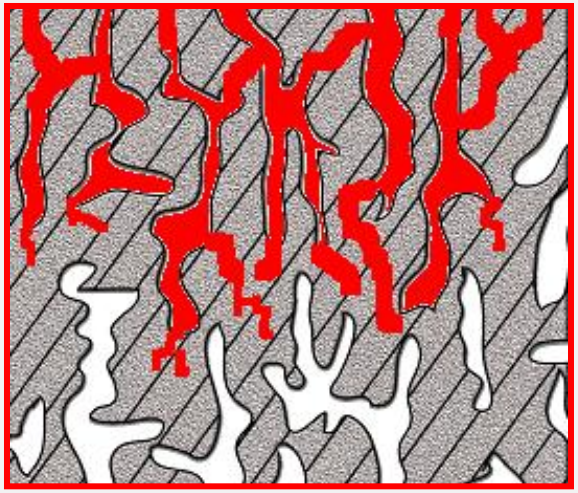
Acrylic Coatings

Impregnating Repellent



Silane or Siloxane

Healer/Sealer



Epoxy, MMA,
LM Epoxy ...

CRACK SEALER FILL CHARACTERISTICS

State Research

SRS 500-230

by

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June 2010

4.0 CONCLUSIONS

This laboratory investigation provided the following conclusions:

- Regardless of viscosity, crack sealing resins leaked through a nominal 0.010 in. wide crack when the resins were applied to the top of an 8 in. long concrete cylinder. Though higher viscosity resins showed less resin leakage than lower viscosity resins, resin leakage could be a concern in field applications.

- Thinner crack widths were more likely to be filled than wider crack widths.

- The extent of crack fill was independent of the distance below the resin reservoir at the top of the cylinder.

- A minimum of 70% crack fill was needed to prevent water leakage.

- Only one of the eleven crack sealers tested consistently met the 70% threshold.

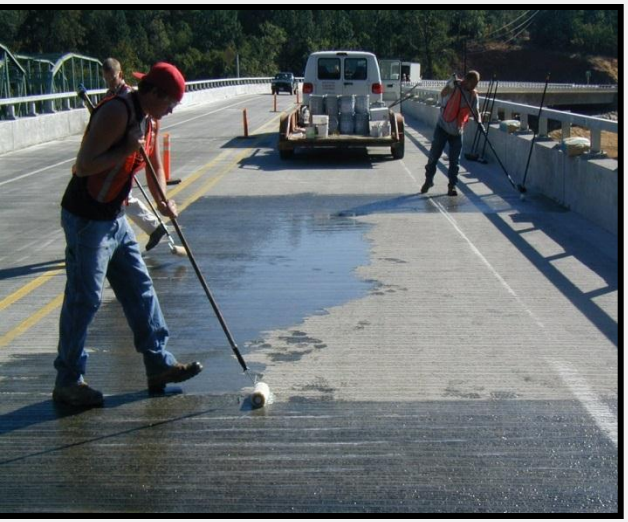
Table 3.1: Range of crack length filled for each product compiled from all cut surfaces.

Product Name	Material Type	Range of Crack Length Filled (%)
New Generation Healer Sealer	Methyl Methacrylate	20-90
	Methyl Methacrylate	1-25
	Urethane	20-90
	Epoxy	70-98
	Epoxy	30-90
	Epoxy	5-80
	High Molecular Weight Methacrylate	5-40
	High Molecular Weight Methacrylate	5-50
	High Molecular Weight Methacrylate	5-30
	High Molecular Weight Methacrylate	5-70
	High Molecular Weight Methacrylate	0-80

Typical Application at the Grand Ronde River Bridge in Oregon

Pre-treat larger cracks if necessary

Flood surface with properly mixed epoxy



Use rollers or squeegees to distribute

Remove excess epoxy and immediately apply fine sand into the wet epoxy

When cured, remove excess sand and open to traffic

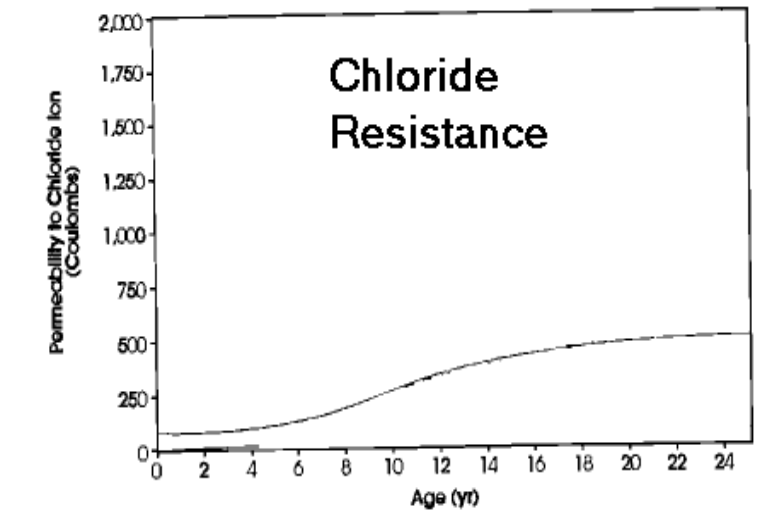
EPOXY POLYMER CONCRETE FOR DECK OVERLAYS

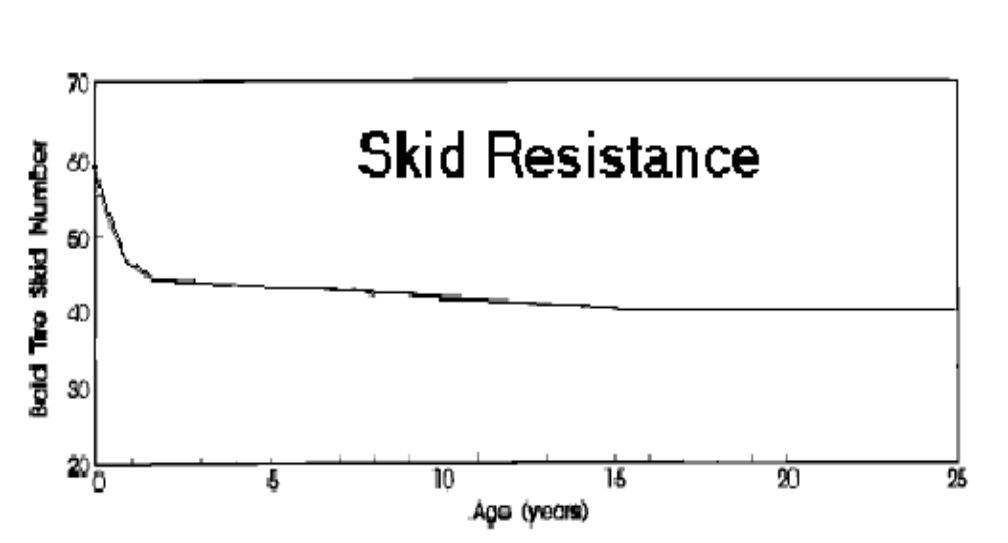
Bridge Deck, Iowa – Broadcast Method – typical ¼” & 3.25 lb/sf

Epoxy Polymer Concrete Overlay

"Polymer concrete overlays can provide skid resistance and protection against chloride intrusion for 25 years"

- Michael Sprinkel (Virginia Transportation Research Council)





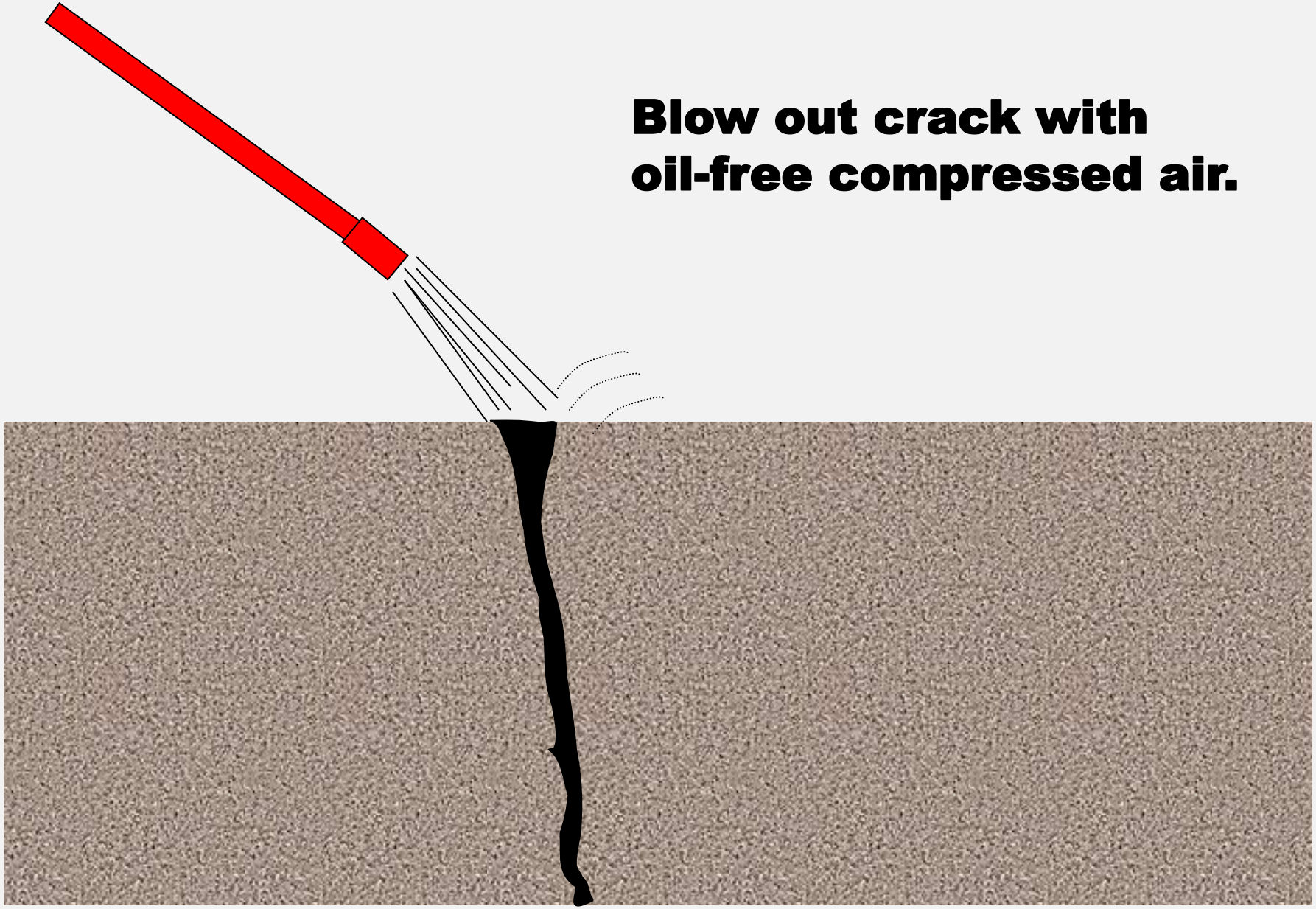
139 bridges

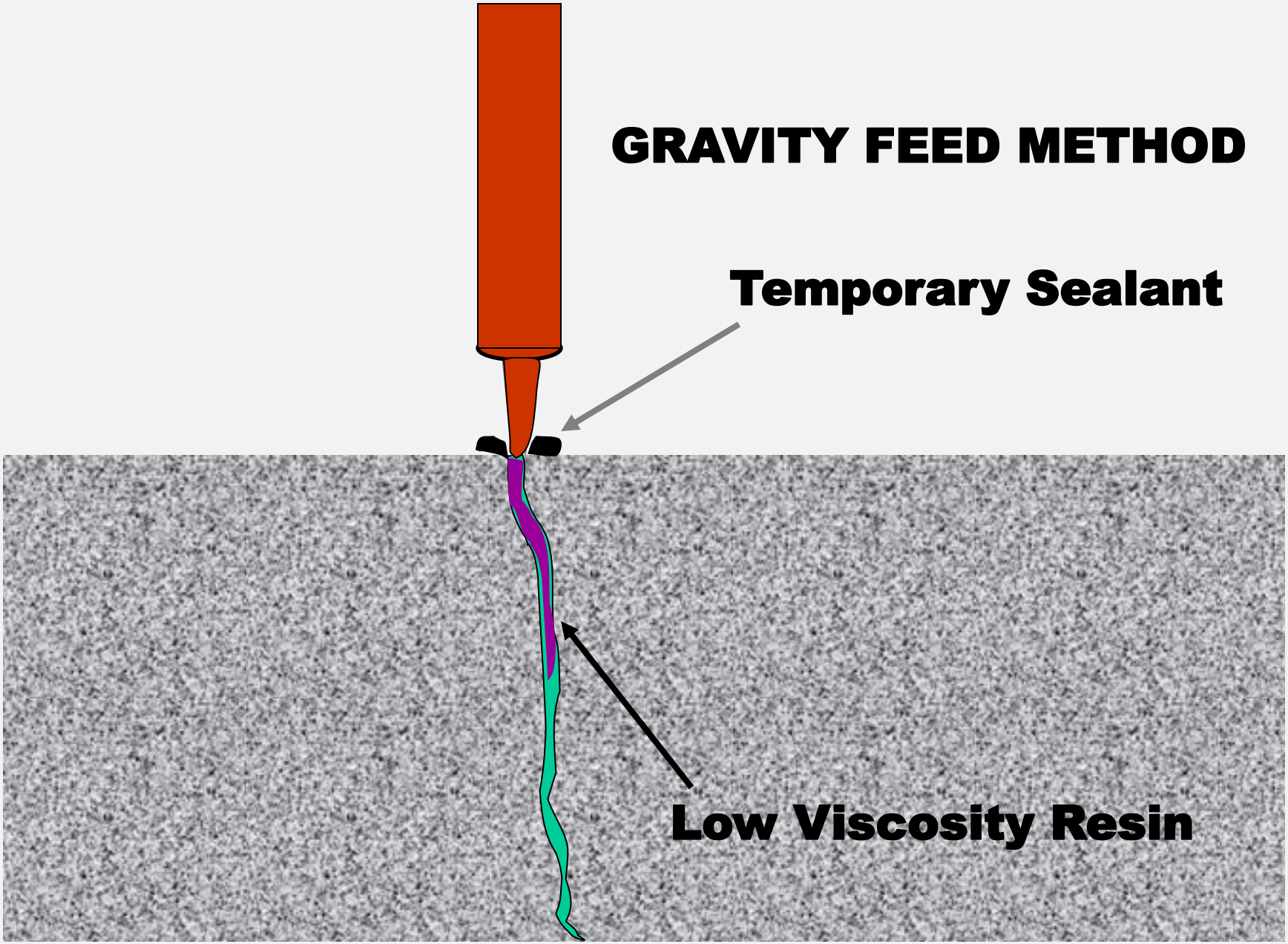
416 bridges

PARKING DECK
SPRINGFIELD, PENNSYLVANIA

CRACK REPAIR

Blow out crack with oil-free compressed air.

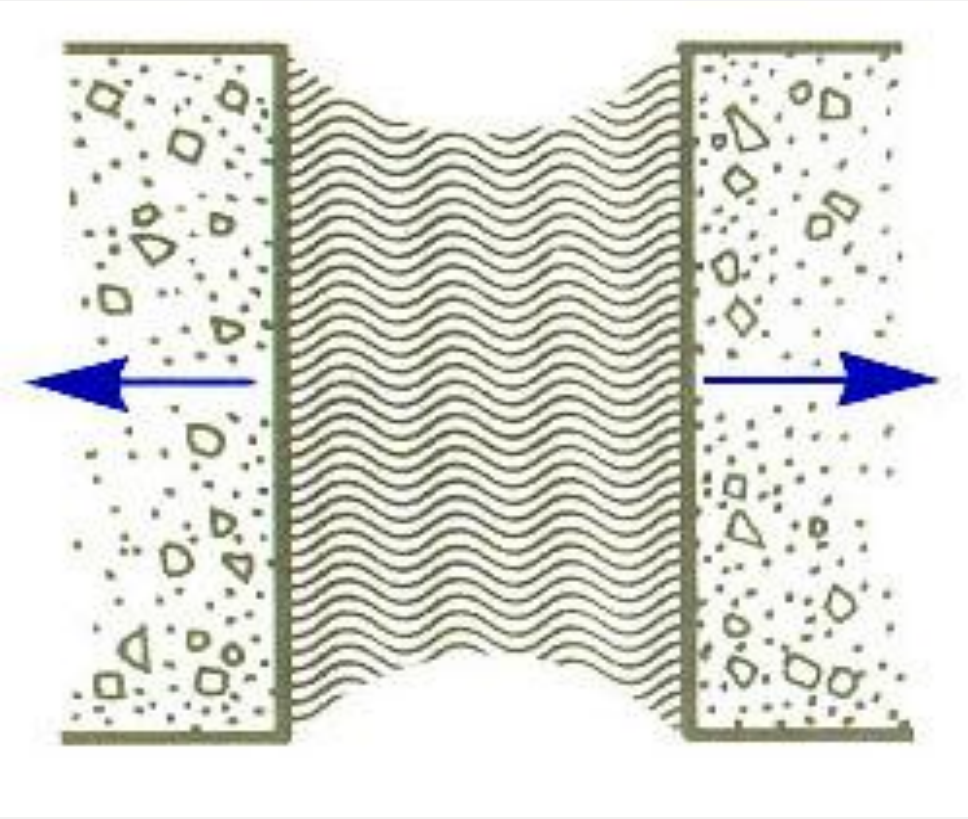



GRAVITY FEED METHOD
Temporary Sealant
Low Viscosity Resin

Use a Sophisticated Dispenser!

Flexible sealants and crack fillers are used to seal against intrusion of foreign materials and liquids.

Design Consideration - Shrinkage In Joints



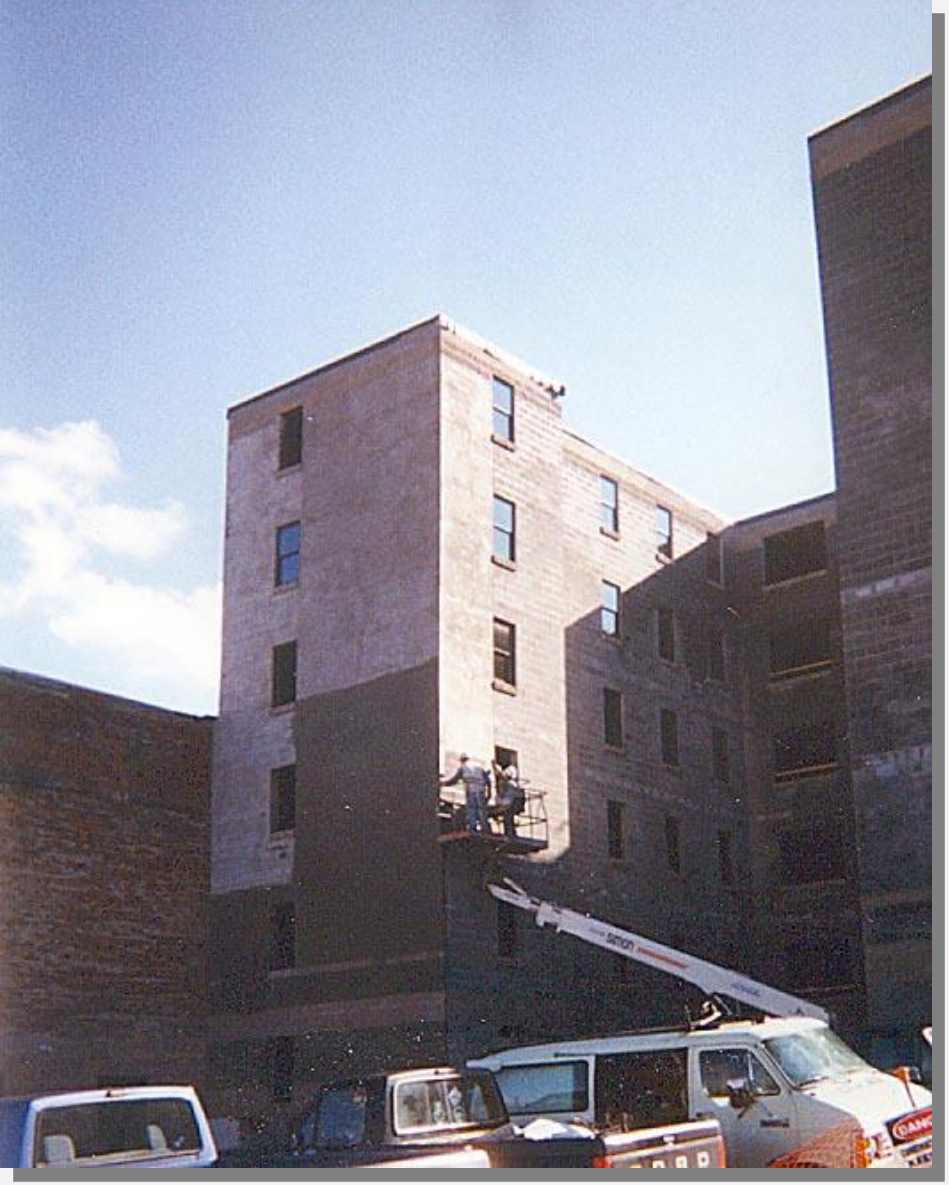
Shrinkage causes deformation. Elongation cannot prevent this. Deformation causes the edges to be vulnerable and weakened.

AESTHETIC CRACK REPAIRS

Aesthetic crack, gouge, or small spall repairs

SACRIFICIAL CATHODIC PROTECTION

AESTHETICS




Hilliard Homes
Chicago, Illinois


Start Over!

SPECIFYING CONCRETE REPAIRS

There are Two Choices

1. Wait for a problem and then jump through hoops to try to decide how to fix it and what material to use.

2. Have specifications in place that cover the materials and methods to repair all the common problems.

Specifying These Materials Will Cover About 95% of Common Problems

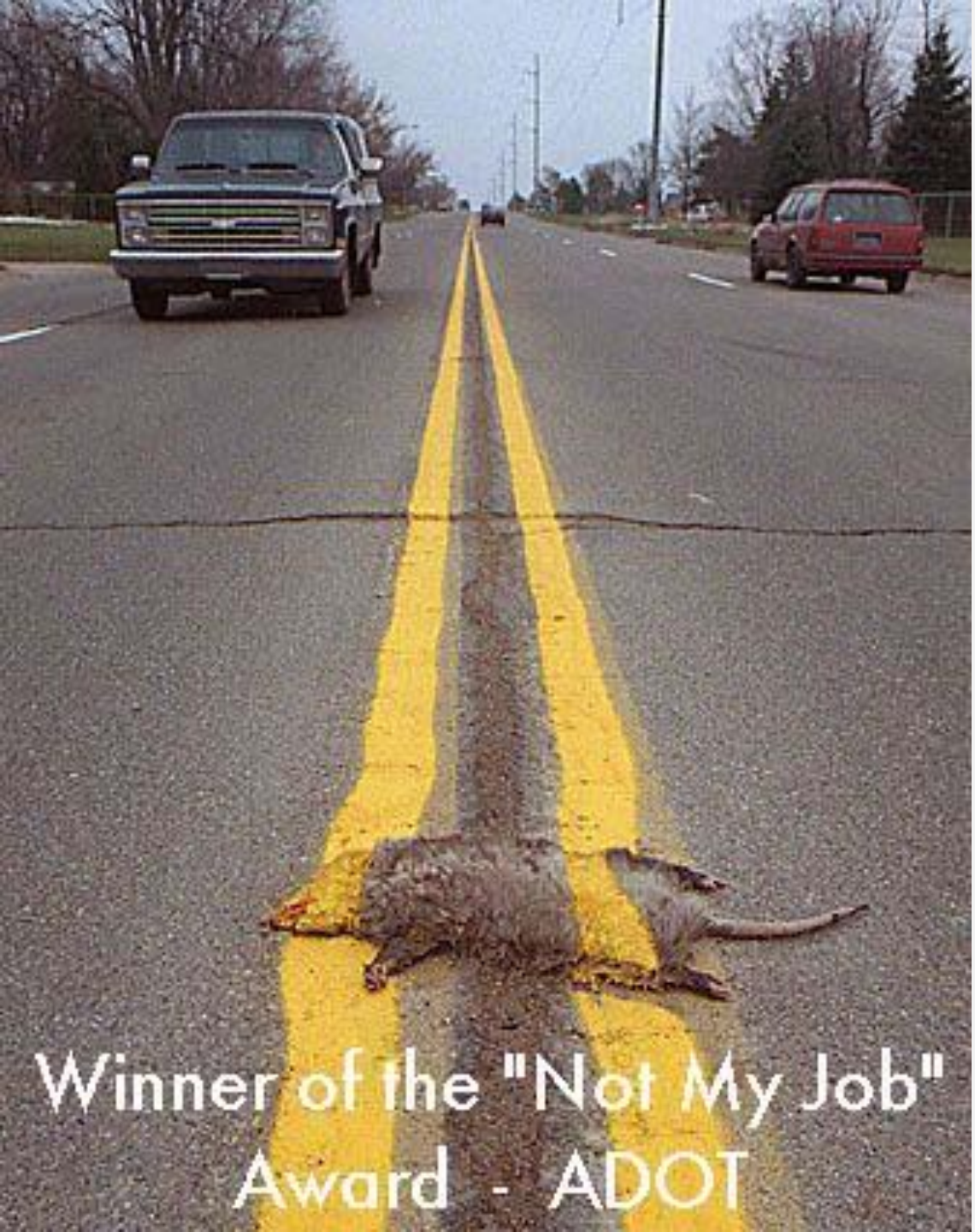
- **Horizontal Repair**
- **Vertical Repair**
- **Variable Shade Horizontal Repair**
- **Variable Shade Vertical Repair**
- **Finishing Material**
- **Bonding Agent**
- **Epoxy Adhesive**
- **Crack Repair**
- **Self-Leveling Underlayment**
- **Self-Leveling Topping**

The Specification Needs to Include:

- **Contractor qualifications & experience**

“Contractor shall provide references for 5 jobs of similar size and scope successfully completed in the prior 5 years.”

- **Pre-repair meeting with minutes**
- **Mock-up/Demo**



When it comes to construction its:

- **The contractor's job to build it**
- **The specifier's job to tell them how in the spec**
- **My job to help with product selection and the spec**

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QUESTIONS?

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