



**BRIDGE PRESERVATION
STARTS @ 28+1**

Starting Your Own Bridge Silane Program

Advanced Chemical Technologies

Brad Ehle VP Regional Development

OUTLINE

BUILDING A TEAM AROUND A CULTURE OF PRESERVATION

EDUCATION AND SHARED BEST PRACTICES

**INTEGRATING A SILANE PROGRAM WITH CURRENT BRIDGE
MAINTENANCE**

**BENEFITS OF USING SILANE WITH EPOXY HEALER SEALER AND
EPOXY OVERLAY REHABILITATION**

BRIDGE PRESERVATION

Preventive maintenance is a more planned — and generally more cost-effective — approach to maintaining bridges. It is proactive rather than reactive. Maintenance is done to preserve (not simply repair) entire bridges and their components, prevent future deterioration, and sustain or improve their condition

ALKYLTRIALKOXYSILANE

Organo-functional reactive chemical

Isobutyl

Tri-methoxy

Tri-ethoxy

Noctyl

Tri-methoxy

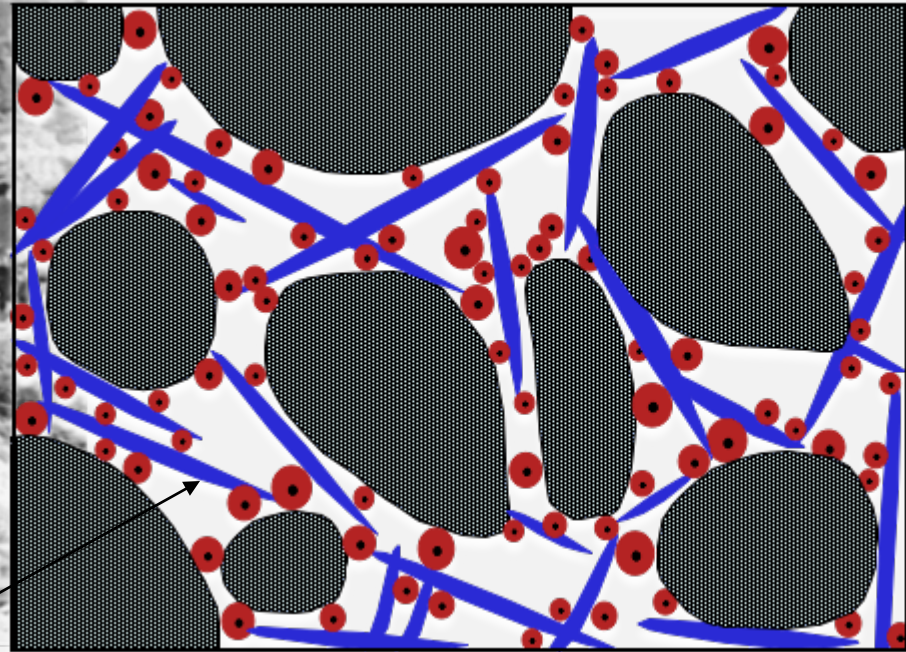
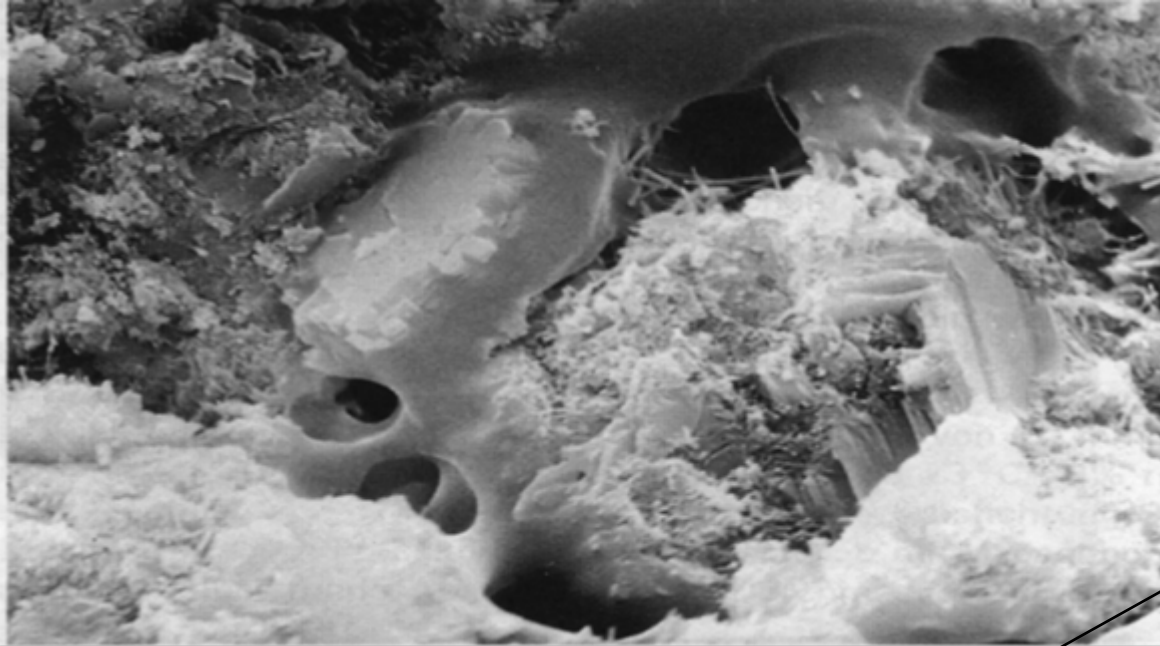
Tri-ethoxy

Isooctyl

Tri-methoxy

Tri-ethoxy

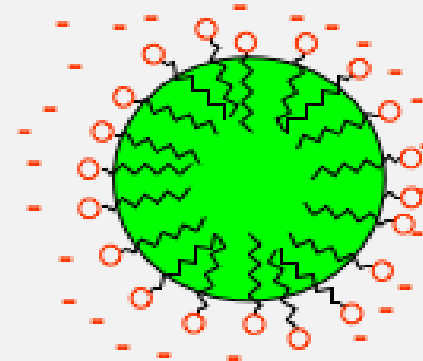
The process of hydrolysis and condensation of Alkoxy Silane and cement



- Polymer
- Cement
- Sand



Silane reacts with Silica in cement creating a covalent bond and a “hydrophobic tail”



The surface is changed from inorganic & porous to Hydrophobic with an organic interface

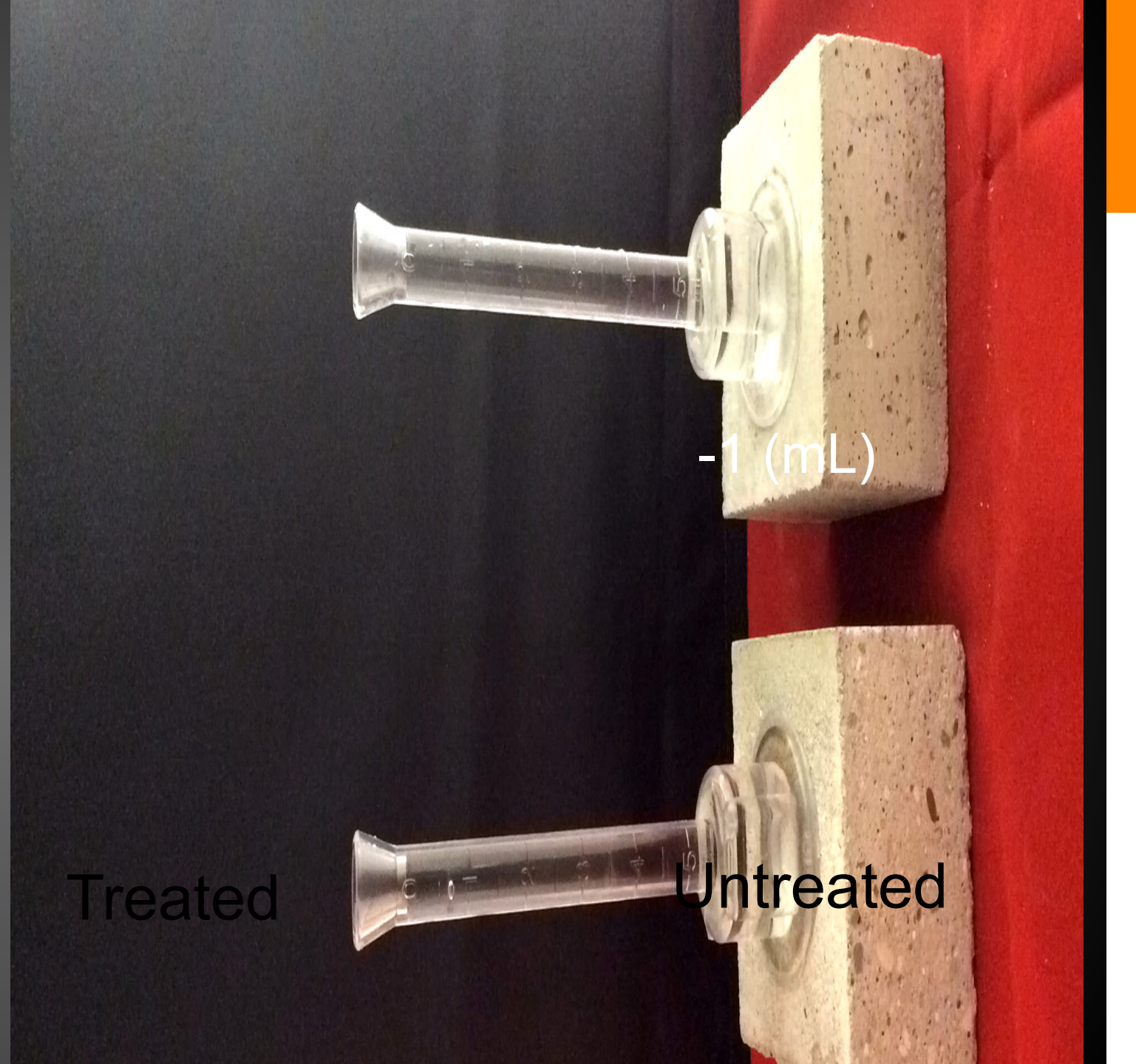
Treated Block

- 100% Silane
- 250sq ft. per gallon
- 3-hour time lapse
- **Zero water absorption.**

Untreated Block

- 3-hour time lapse
- **5 mL of water absorbed.**

OVERALL RESULT
91% reduction in water absorption.



SOLVENT VS WATER

Solvent based Silanes

- **Fast dry times**
- **Re-coatable**
- **VOC compliant**
- **Deeper Penetration**

Water based silanes

- **Lower VOC**
- **Slower dry times**
- **Use solvent based to recoat**

COSTS OF SILANES BASED UPON ACTIVITY

40% Silanes

**Apply at 125 square feet
per gallon**

**11.14 grams of Silane per
square foot**

\$20.00 per gallon

\$0.16 per square foot

Retreat every 6-10 years

100% Silanes

Apply at 300 square feet per gallon

11.61 grams of Silane per square foot

\$35.00 per gallon

\$0.12 per square foot

Retreat every 6-10 years

BUILD A TEAM

Dedicated team members take ownership

Develop Specialized skills

Provide efficiency



EDUCATE AND IMPLEMENT

Use industry *professionals* for *classroom training* and on-site installation demos

Seek and use best practices from other County and State agencies

Use PPE – KN95 Solvent Vapor Respirator!



COORDINATING WITH STATE, COUNTY AND MUNICIPAL AGENCIES



County Engineers
Association of Ohio





LUNCH & LEARN ON-SITE BRIDGE PRESERVATION AND CONTROLLING INVASIVE WEEDS TRAINING COURSE

This on-site field demonstration bridge training is intended for WCHA counties to get updated on using silane sealers for bridge preservation (see attachment). The training will also include a presentation on controlling invasive weeds on roadsides without increasing the budget.



5 SESSIONS, 8:00 AM TO 1:00 PM

OCTOBER 6, 2021

Iron County Highway Department
607 3rd Avenue N., Hurley, WI 54534

OCTOBER 12, 2021

St. Croix County Highway Department
300 Oak Ridge Pkwy, Baldwin, WI 54002

OCTOBER 13, 2021

Waupaca County Highway Department
2670 County Road A, Waupaca, WI 54981

OCTOBER 19, 2021

Barron County Highway Department
260 North 7th Street, Barron WI 54812

OCTOBER 20, 2021

Walworth County Highway Department
W4097 County Road NN, Elkhorn, WI 53121

**Registration fee \$95 per person*



Please send registration to:

Gary Kennedy
WCHA Prof. Development Director
1355 N. 16th Street
Manitowoc, WI 542



Regional and County
Training Sessions
Lunch and Learn
1.5 hours

Bridge Installation
Demonstrations
3000 SF
2-3 hours

Sponsored by:
Advanced Chemical Technologies, Inc. and 4 Control Inc.

INTEGRATE A SILANE PROGRAM WITH OTHER BRIDGE MAINTENANCE WORK

Vegetation Control

Power-washing decks

Cleaning drains

Inspecting bearings

SURFACE PREPARATION FOR CONCRETE SILANE APPLICATION



Sweeping

GOOD

Power washing

BETTER

Shot blasting

BEST

APPLICATION



- Hand Spray
- Walk behind spray bar – preferred for efficiency*
- Truck or trailer mounted spray bar
- Grid bridge area based upon desired application rate



6' and 12'
Professional
Spray
Equipment
optimizes
Deck and
Parapet wall
synchronized
Application –
saving time.









IDENTIFYING AND SHARING BEST PRACTICES – WALWORTH COUNTY, WI



IMPACT OF CONCRETE MIX INGREDIENTS AND SURFACE TREATMENT ON EPOXY OVERLAY PERFORMANCE

DEPARTMENT OF CIVIL AND CONSTRUCTION ENGINEERING
WESTERN MICHIGAN UNIVERSITY
MAZUMDER, M.SC, ATTANAYAKE, PH.D., P.E.

Overview:

Evaluating tensile bond pull-off strength ≥ 250 psi ASTM C1583 at room temperature (73F) and elevated temperature (110F) :

- Two (2) mix designs
- Two (2) substrate pretreatments
 - Silane
 - Epoxy primer

Findings:

1. Irrespective of mix design or substrate pretreatment all specimens showed a decrease in tensile strength at elevated temperature
2. The penetrating silane sealant is effective in improving the bond strength under elevated temperatures of up to 56 days of concrete age. **Therefore, a 100% silane penetrating sealant application is recommended** as a pretreatment before application of an epoxy overlay on young concrete.

MDOT REGIONAL MAINTENANCE TEAM = INNOVATION & BEST PRACTICE



- **Surface profile**
Shot Blasting CSP 7/8
- **“Brush-Blast”**

- **Cost \$3,500 - \$5,000**
per day

- **Estimated production:**
2500 SF/hour



SHOTBLAST SUBSTRATE TO CSP 7/8 WHEN INSTALLING SILANE + EPOXY



USING COMPRESSOR TO BLOW OFF RESIDUAL FROM SHOTBLASTING



ORGANIC VAPOR RESPIRATOR – REQUIRED FOR SAFE APPLICATION



LOW VISCOSITY HEALER SEALER SAME DAY APPLICATION OVER SILANE



APPLYING AGGREGATE TO REJECTION COMPLETING A SILANE + HEALER SEALER INSTALLATION



RULES OF THE ROAD

1. Mix on ratio

- When using plural component pumps a “ratioed” pump is not the same as a “ratio monitored” pump

2. Do not install film forming membranes when the ambient temperature is within 5°F of the Dew Point and falling

3. Moisture content in substrate < 6%

4. Precondition material to 75°F - 90°F – Manage viscosity and achieve successful installation and performance.

1:1 Type III Epoxy Overlay

2:1 Type I, II, IV, V Epoxy Overlay Systems

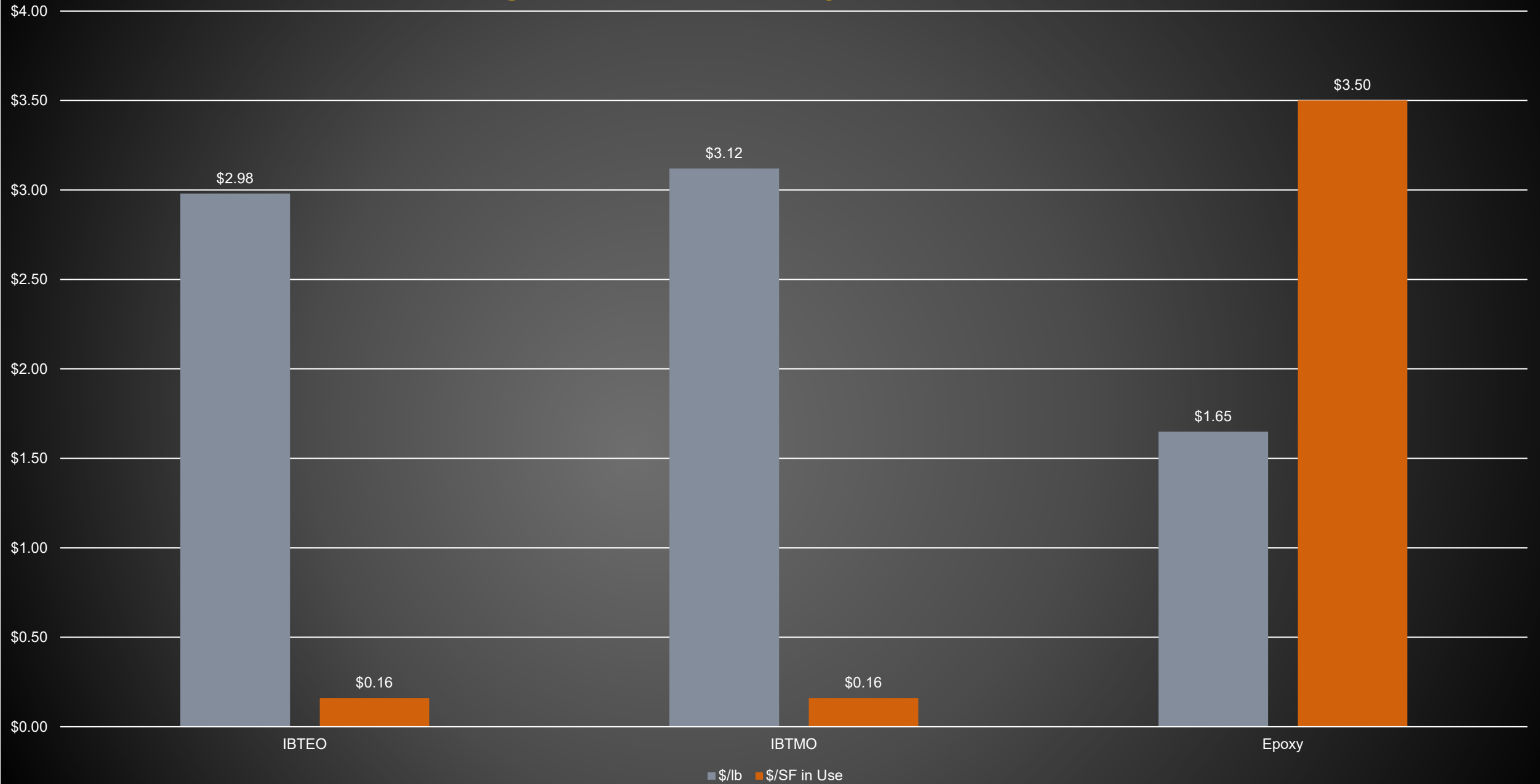
Temperature (°F)	Part A	Part B	Part A	Part B	Part A	Part B	Part A	Part B	Part A	Part B
	<i>cPs</i>		<i>cPs</i>		<i>cPs</i>		<i>cPs</i>		<i>cPs</i>	
50	37500	940	24200	1100	24200	3400	20000	3400	20000	1100
60	12400	580	9780	589	9780	3200	10400	3200	10400	589
70	6300	365	5040	374	5040	1400	6200	1400	6200	374
80	4300	230	2500	229	2500	750	3350	750	3350	229
90	1880	145	1470	159	1470	500	1900	500	1900	159
100	1000	105	839	108	839	300	1650	300	1650	108
110	700	77.5	552	79	552	165	425	165	425	79
120	350	57.5	353	64	353	110	350	110	350	64
130	190	45	254	59	254	75	300	75	300	59
140	170	40	175	47	175	60	200	60	200	47

Note: The above table is laboratory data that is a starting point for operating temperatures. The actual viscosity of the material may vary due to conditions not present during laboratory measurement.





Comparing Silane vs. Epoxy RM cost vs. Use Cost



CONCLUSION

Silanes are a tested, studied and proven early bridge protective treatment  28+1

Silanes for early Bridge Preservation is cost effective < \$0.16/SF – dovetails with later lifecycle bridge rehab and restoration systems

Silanes are easy for County & Municipal agencies to apply

Silanes may be applied and re-applied on a 5 year basis – final application prior to epoxy overlay rehab/restoration

Olin is the only Epoxy producer completely integrated in allylics and phenolics



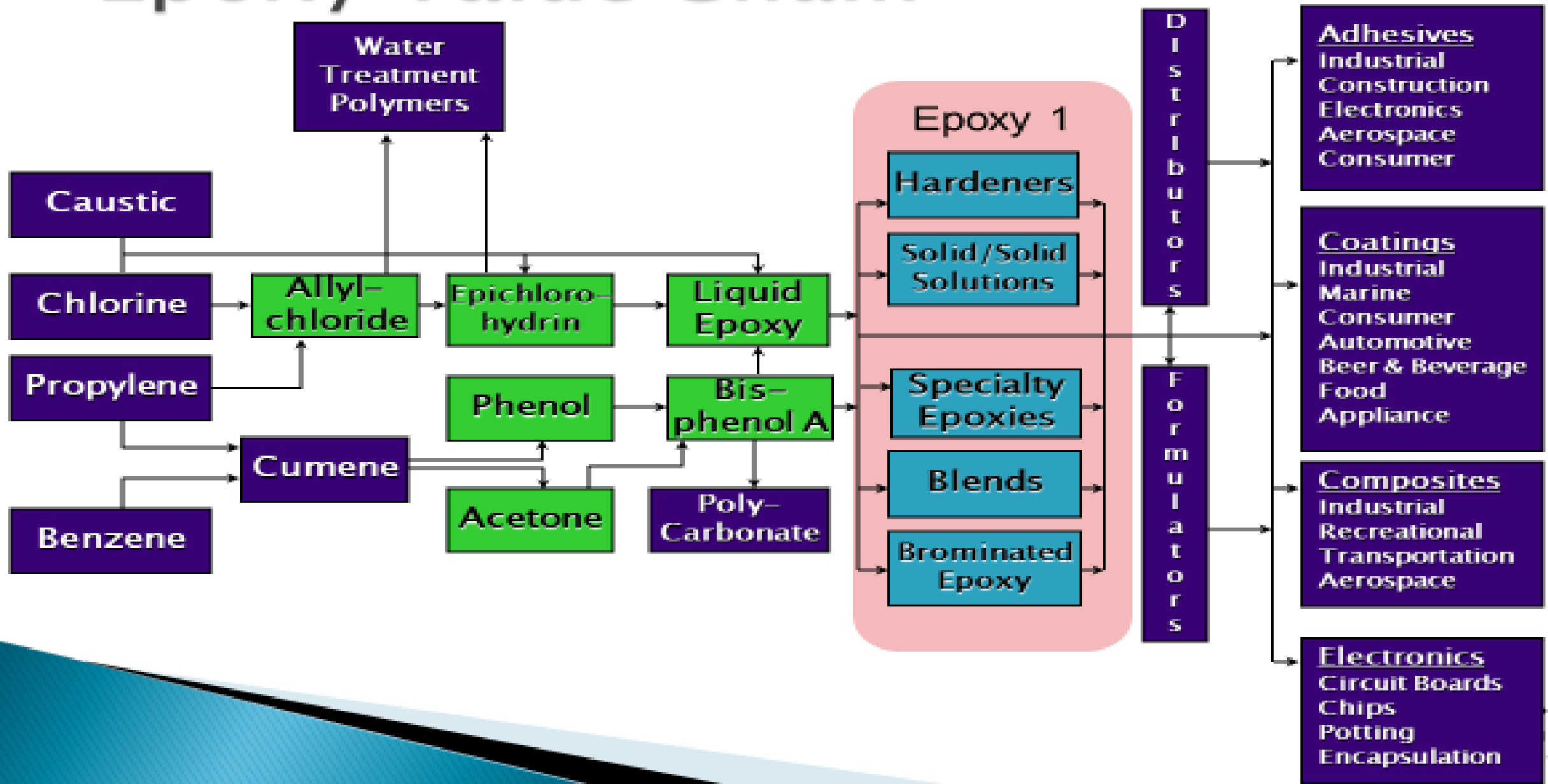
QUESTIONS?

Thank you

Brad Ehle

Advanced Chemical Technologies

Epoxy Value Chain



Units & Products

B-6200

- | | | |
|-----------------------|---------------------------|---------------------|
| • Liquid Epoxy Resins | D.E.R. 383 / D.E.R. 331 | MAC 379MMlbs |
| • Liquid Bis 1 | ER Grade Molten Bisphenol | MAC 320MMlbs |
| • Flaker | ER Grade Flake Bisphenol | <i>MAC 110MMlbs</i> |

