

Super-Krete® Products

Crack Repair Guide

Concrete Cracks. Simply stated, concrete cracking is a complete or partial separation of a concrete element into two or more parts known as breakage or fracturing of the concrete. Some material scientists do not believe concrete cracks, they prefer to call a "crack" ... a "fabric tear".

Arizona Polymer Flooring makes this general guideline for the repair of cracked concrete. However, for the rehabilitation of "structural concrete cracks in critical elements" Arizona Polymer Flooring endorses that it be done in conjunction with the sound judgment of a professional engineer.

This document is intended to be an impartial pragmatic review of why concrete cracks and what work should be performed prior to topping it with a coating or surfacing systems. It is intended to reject the construction industry's misnomer that states: "All cracks in concrete must be repaired before ..."

Arizona Polymer Flooring believes that before attempting to restore "all cracks" the owner, specifier, general contractor and specialty subcontractor need to be familiar with American Concrete Institute's documents and recommendations. The ACI 224R means cracks equal to or larger than 0.012 inch (0.30 mm) should be addressed when placing coatings or surfacings on concrete slabs on grades. By definition ACI 224R does not state all cracks!

American Concrete Institute		
ACI 224R.01 Control of Cracking in Concrete Structures		
Guide to reasonable crack widths, reinforced concrete under service loads		
Exposure condition	Crack width	
	in.	mm
Dry air or protective membrane	0.016	0.41
Humidity, moist air, soil	0.012	0.30
Deicing chemicals	0.007	0.18
Seawater and seawater spray, wetting and drying	0.006	0.15
Water-retaining structures (Exclusive non-pressure pipes)	0.004	0.10

(Also see ACI 224.1R Causes, Evaluation and Repair of Cracks in Concrete Structures and ACI 224.2R Cracking of Concrete Members in Direct Tension.)

Cracks in concrete have a number of causes which may affect the aesthetic appearance of the concrete and not the performance of the concrete element, or the crack can indicate structural distress within the element which can lead to additional distress. Cracked concrete can be characterized as the total extent of the damage, or they may point to problems that if not taken care of can become a greater problem.

Arizona Polymer Flooring makes the distinction between repairing a cracked concrete element and fixing a crack so it can be coated or surfaced successfully.

- a. To repair cracked concrete is to return the element to its original design intent.
- b. To fix or restore cracks in concrete is to route and fill it, bridge it or patch it.

In order to "repair it" or "fix it" it is important to understand why the concrete cracked. The proper repair or fix of concrete cracks depends on knowing the causes of the cracks and selecting the best or most economical procedures into account; otherwise, the repair may only be temporary. Successful long-term



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repair procedures must deal with the causes of the concrete cracks and the long-term resulting crack repairs or fixes. To aid the owner, specifier, general contractor and specialty contractor in pinpointing the best solution to a cracking problem, this guideline discusses the causes, evaluation procedures, and methods of repair or fixing cracks in concrete.

Concrete Cracks Before it Hardens and After it Hardens:

Listed below is a brief and limited overview of when concrete cracking occurs (before or after hardening). Arizona Polymer Flooring acknowledges that it does not address every reason for concrete cracking.

- a) Before Hardening
 - a. Plastic
 - (1) Shrinkable Aggregate
 - (2) Drying Shrinkage
 - (3) Cracking
 - b. Freeze
 - (1) Early Frost Damage
 - c. Movement
 - (1) Plastic Shrinkage
 - (2) Plastic Settlement
- b) After Hardening
 - a. Physical
 - (1) Shrinkable Aggregate
 - (2) Drying Shrinkage
 - (3) Cracking
 - b. Chemical
 - (1) Corrosion of Reinforcement Steel
 - (2) Alkali-Silica Reaction
 - (3) Cement Carbonation
 - c. Thermal
 - (1) Freeze-Thaw Cycles
 - (2) External Seasonal Temperature Variation
 - (3) Early Thermal Contraction - External Restraint
 - (4) Early Thermal Contraction - Internal Temperature Gradients
 - d. Structural
 - (1) Accidental or Intentional Overload (Exceeding Design Loads)
 - (2) Creep
 - (3) Restrained from Movement
 - (4) Loss of Reinforcement (Post tension strands relaxed, loss of rebar coverage, etc.)
 - (5) Raw Material(s) Below Design Minimum Requirement

Not all of the concrete cracks should be repaired or fixed if the concrete itself is deemed not sound or durable. See ACI 201.2R Guide to Durable Concrete.



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Arizona Polymer Flooring understands that it necessary to understand the definitions (names) of the types of concrete cracking to facilitate proper communication between individuals in the field and your APF representative. Arizona Polymer Flooring recognizes that there may be additional definitions.

- A. **Checking** – Shallow cracks closely spaced at irregular intervals on the surface of the concrete slab.
- B. **Craze Cracks** – Fine random cracks at the surface of the concrete.
- C. **D-Cracking** – Cracks at or near the perpendicular (right angle - 90 degree) joints that visually appear as the letter "D", usually associated with edge curl of the concrete slab.
- D. **Delamination Cracks** – Delamination cracks occur horizontally to the surface in the concrete.
- E. **Dynamic and Static Cracks** – The sophist argument of Dynamic and Static Cracks. Static cracks subjected to thermal movement are always dynamic cracks. Dynamic cracks subject to no loads or thermal changes are static cracks. There are two outcomes:
 - 1. A dynamic crack that is structurally repaired ceases to function as a dynamic crack and the concrete element is restored to its design intent.
 - 2. A dynamic crack may require that other structural elements be repaired or the load redesigned prior to repairing the crack.
- F. **Hairline Cracks** – Cracks having a width that is less than 10 mils when the concrete is at its coolest point.
- G. **Non-Structural Cracks** – Cracks that do not initially represent a failure, only a potential nuisance, however, over time can cause major problems.
- H. **Plastic Cracks** – Cracks that occur in the concrete surface that appear while the concrete is in the plastic state (uncured).
- I. **Shrinkage Cracks** – Cracks that occur due to tension caused by external or internal restraints, such as, volume changes, rapid loss of moisture, excessive carbonation, etc.
- J. **Structural Cracks** – A cracked element that results in the concrete's failure to perform as designed, which may lead to catastrophic failure of the element.
- K. **Temperature Cracks** – Cracking due to tensile failure, caused by temperature gradients in the concrete subjected to external restraints or by temperature differential of concrete slabs subjected to internal restraints.
- L. **Transverse Cracks** – Cracks that develop at right angles to the direction of the concrete element.

The intent of this guide is help the specialty contractor familiarize themselves with the industry terminology in order to help them in their communication with APF sales and technical service representatives.

Crack and Adjacent Surface Preparation

All concrete substrates surfaces will require surface preparation prior to crack restoration, including crack, spall and control joint. The first step in these operations is extremely critical. The best materials correctly mixed and applied are doomed to fail unless the concrete substrate is properly prepared. At a minimum, the concrete substrate must be prepared in compliance with minimum standards for the system to be placed per ACI, ASTM, ICRI, NACE and SSPC Standards.

Deleterious surface contaminants and deteriorated concrete must be removed, repaired if necessary and the surface roughened and cleaned. There are many different techniques, methods, and types of equipment, which can be used to effectively prepare concrete.



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Method of Restoration:

1. **Cementitious Overlayment (S-9300 or S-9302 Bond-Kote with S-3500 Elastique Matting)** – Bone-Kote crack restoration requires that all surfaces be thoroughly cleaned with S-12000 Heavy Duty Degreaser followed by flushing with clean water, followed by the placement of S-1300 Pene-Krete and then Bond-Kote. It is important that this type of application take place over a concrete slab on grade with a moisture vapor barrier that meet ASTM E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs and the concrete not exceeding ASTM F1869 moisture vapor transmission (MVT) in excess of 3.0 lbs/1000 ft²/per 24 hr. period or ASTM F2170 reading not in excess of 79% relative humidity per ASTM F2170. See S-9900 Crack Treatment System Technical Data Sheet.
2. **“Veed”** – Is a method of concrete or cementitious overlayment crack chasing used to route-out a crack as a surface preparation technique. A piece of equipment, such as, EDCO C-10 8” Crack Chaser or a specialty manufactured “V-Shaped” Diamond Saw Blade used for dry cutting concrete or cementitious overlayments. The “Veed” cut must be clean of dust and rubble, as well as free of bond-breaking contaminates.
3. **Steel Staples** – Are used to structurally restrain concrete movement and the staples work as a load transfer device between the cracked elements. The staples can be created on the jobsite or purchased various thicknesses from slight to robust, from Torque Lock Structural Systems or Concrete Product Resource. Steel Staples are normally used in conjunction with other methods of cracked concrete rehabilitations, such as, epoxy gravity flow.
4. **Bond Break Tape** – Is used to reduce and transfer unit stress over a larger area than the crack itself. Bond Break Tape is not recommended for sealers or thin film coating, since they cannot hide the Bond Break Tape profile.
5. **Scrim Cloth (S-3500 Elastique Matting)** – Is used to reinforce the concrete elements separated by a crack(s) subject to insignificant thermal or load induced movement. It is also used over static control over control joints that are filled with semi-ridged epoxy joint fillers and subjected to insignificant movement. Refer to S-3500 Elastique Matting Technical Data Sheet.
6. **VaporSolve Joint Filler** - VaporSolve® Joint Filler is a specially formulated, non-shrinking, semi-flexible epoxy paste used for filling joints and cracks in concrete that will receive the VaporSolve coating system. It is cured with a hydrophobic curing agent that allows it to cure fully in the wet, alkaline environment found in concrete with moisture problems. VaporSolve Joint Filler is modified with a novel raw material that is able to provide flexibility with minimal effect on the water and alkalinity resistance of the material. See VaporSolve Joint Filler Technical Data Sheet and Application Instructions.
7. **SK-E300 Flex and SK-E300 Flex Paste (Regular and Fast Cure) Crack and Joint Filler** – Are used to fill cracks and control joints that have excellent elongation, hardness and impact resistance. The semi-rigid technologies are designed to reinforce cracks and control joints from edge deterioration caused by heavy loads and steel wheel impact. Since the concrete slab on grade cracks are unsealed on the bottom of the cracks, multiple filling of the crack is to be expected. Fine sand can be poured into the cracks prior to placement of the filler to reduce the epoxy flow. Refer to SK-E300 series Technical Data Sheets and Application Instructions.
8. **SK-E400 (Regular and Thixotropic) Crack and Joint Filler** – Since the concrete slab on grade cracks are unsealed on the bottom of the cracks, multiple filling of the crack is to be expected. Fine sand can be poured into the cracks prior to placement of the filler to reduce the epoxy flow. Refer to SK-E300 series Technical Data Sheet. SK-E400 is a low viscosity, high strength resin. Historically, its primary use is as solvent diluted primer and as a binder or top coat. As a gravity filled crack filler it



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is intended to bond the cracked elements together. SK-E400 Thixotropic (paste) is high viscosity, high strength resin. The high viscosity means that it will not readily flow through the cracks. Refer to SK-E400 series Technical Data Sheets and Application Instructions.

9. **SK-E400 (optional dilution with 10% to 15% acetone) Healer Sealer** – Is a low viscosity high strength epoxy resin material that can be placed with or without a skim cloth (S-3500 Elastique Matting) over the concrete slab on grade as a “sealer healer” to treat surface cracking only. It is important that this type of application take place over a concrete slab on grade with a moisture vapor barrier that meet ASTM E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs and not exceeding requires compliance to ASTM F1869 and ASTM F2170, moisture vapor transmission (MVT) in excess of 3.0 lbs/1000 ft²/per 24 hr. period per ASTM F1869 or reading in excess of 79% relative humidity per ASTM F2170.

Please refer to **Appendix A** which includes fourteen (14) drawings of crack restoration.

DISCLAIMER:

Arizona Polymer Flooring Technical Bulletins are developed in good faith for the sole purpose of assisting others with products, systems and industry standards. The information published herein is gathered from different sources that are thought to be reliable, but the reader should not assume that the information absolves the reader from validating information from other sources, such as listed below, before making a decision. Since information from others can change without notice, Arizona Polymer Flooring cannot be held at fault if any of the information conveyed in good faith is deemed in error. Listed below is a number of trade association organizations that can provide additional assistance to the reader.

AMERICAN CONCRETE INSTITUTE STANDARDS:

ACI 201.1R	Guide for Making a Condition Survey of Concrete in Service
ACI 201.2R	Guide to Durable Concrete
ACI 302.1R	Guide for Concrete Floor and Slab Construction
ACI 302.2R	Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials
ACI 318	Building Code Requirements for Structural Concrete
ACI 364.1R	Guide for Evaluation of Concrete Structures Prior to Rehabilitation
ACI 503R	Use of Epoxy Compounds with Concrete
ACI 503.1	Standard Specification for Producing a Skid Resistant Surface on Concrete by the Use of a Multi Component Epoxy System
ACI 503.4	Standard Specification for Repairing Concrete with Epoxy Mortars
ACI 546R	Concrete Repair Guide

ACI (American Concrete Institute)

P.O Box 9094
Farmington Hills, MI 48331
www.aci-int.org

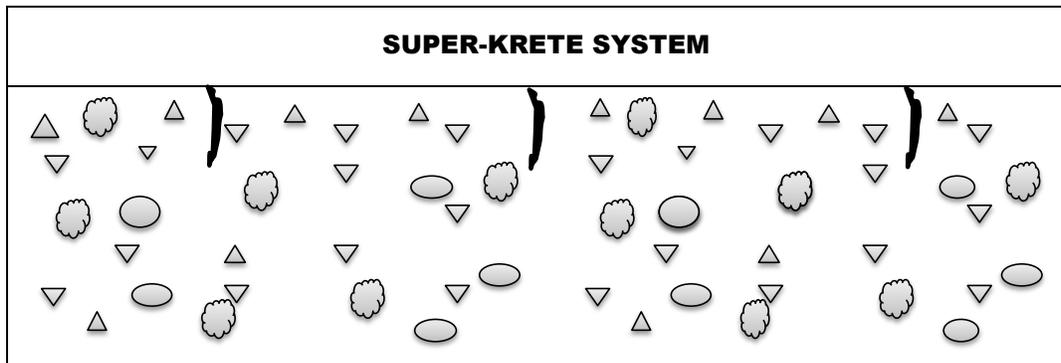


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CRACK RESTORATION 1. SMALL TIGHT CRACKS NOT FULL DEPTH SUBJECTED TO SLIGHT MOVEMENT
Interior Small Cracks, Such As, Cracking Cracks Subjected Small Amount of Thermal or Load Movement

1. SK-400 CLEAR or SK-VAPORSOLVE DEPENDING ON MOISTURE MITIGATION, WITH or WITHOUT 30 MESH AGGREGATE FOR ANCHORING OF NEXT APPLICATION
2. JOINT & CRACK FILLER - SK-E300 Flex or Paste (Regular or Fast Cure) or VAPORSOLVE JOINT FILLER
3. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP



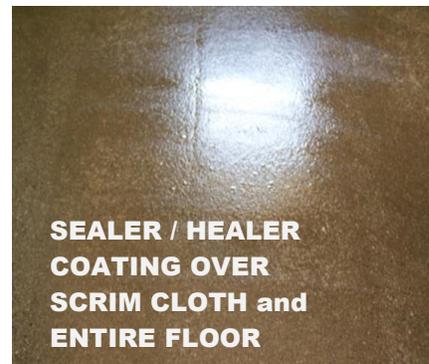
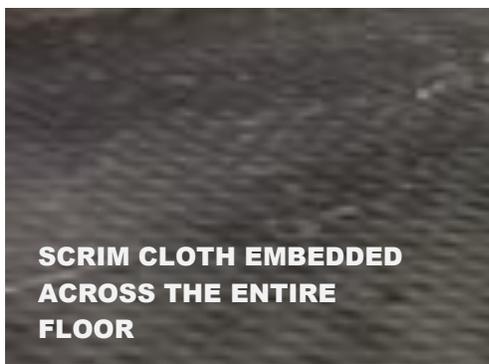
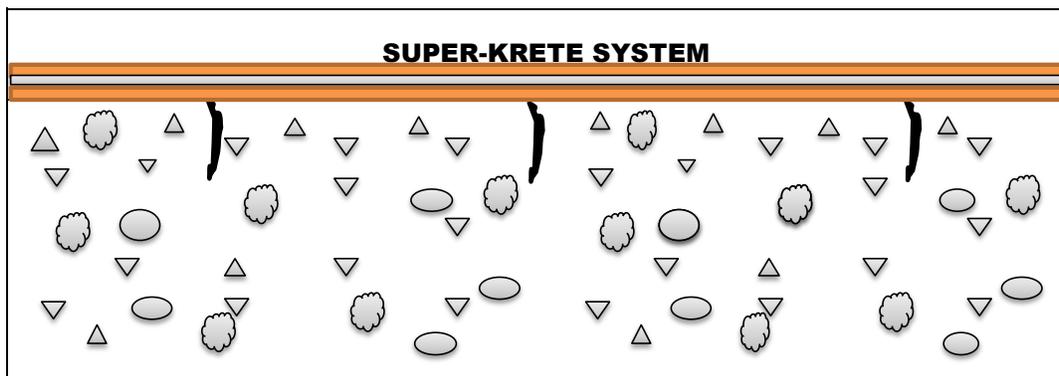
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**CRACK RESTORATION 2. TIGHT and NON-MOVING CRACKS
DESIGNED TO ADDRESS THE POTENTIAL SEISMIC CRACK DAMPENING or OTHER MOVEMENT**

Small Cracks Potential Subjected To Unknown, but Expected Seismic Movement

Small Cracks Subjected To Machine Vibration, Such as, Mechanical Equipment Rooms

- 1. SK-E400 CLEAR or SK-VAPORSOLVE PRIMER DEPENDING ON MOISTURE MITIGATION CONSIDERATIONS**
- 2. S-3500 Elastique Matting SCRIM CLOTH, DIMENSIONAL REINFORCEMENT COST EFFECTIVE CRACK SUPPRESSION**
- 3. SK-400 CLEAR SCRIM COAT SATURANT COAT, WITH or WITHOUT 30 MESH AGGREGATE**

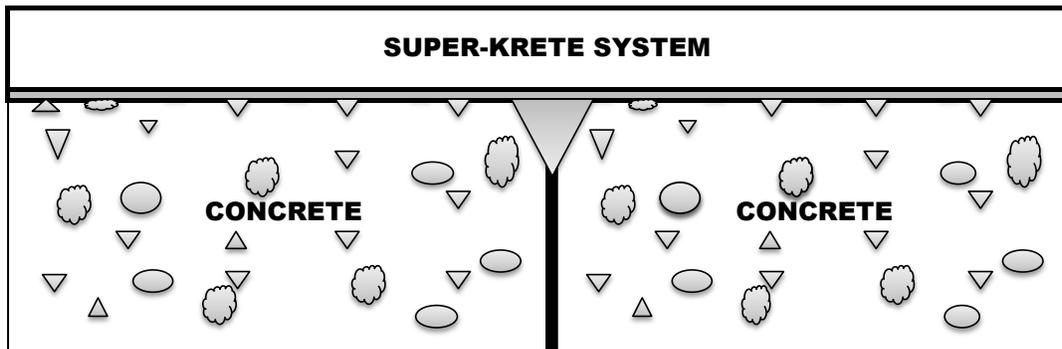


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CRACK RESTORATION 3. SLIGHT TO NON-MOVING CRACKS

Cementitious Overlayment Fills "Veed" Out Crack and Provides Protective Coating

1. "Veed" OUT CRACK
2. "Veed" OUT CRACKS and CONCRETE SURFACE CLEANED WITH S-12000 Heavy Duty Degreaser
3. COLLOIDAL SILICATE S-1300 Pene-Krete Penetrating Sealer and Adhesion Promoter
4. CEMENTITIOUS OVERLAYMENT Bond-Kote (S-9300 Gray or S9302 White)

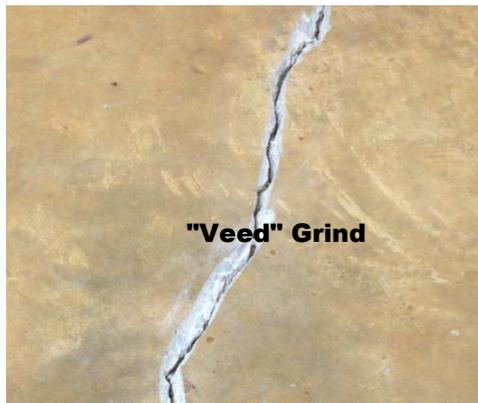
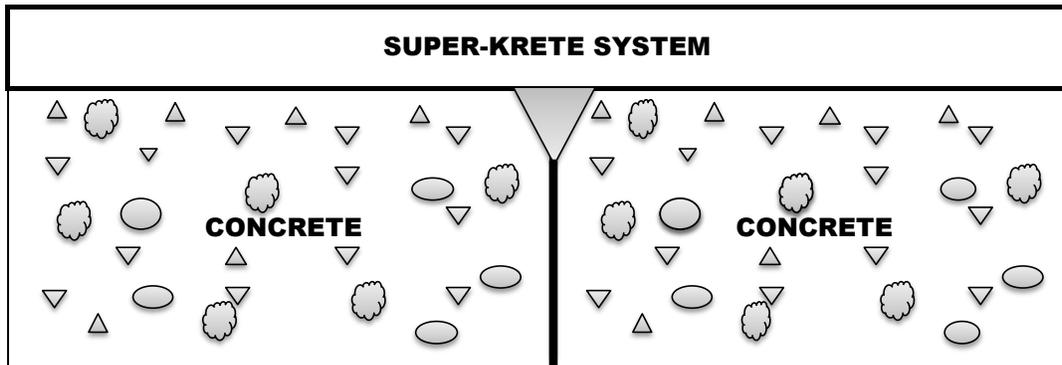


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CRACK RESTORATION 4. NON-MOVING CRACKS ARE "Veed" OUT and FILLED

Non-Moving Cracks Are Not Subjected to Thermal or Load Movement

1. "Veed" OUT CRACK
2. FILL JOINT & CRACK FILLER - SK-E300 Flex or Paste (Regular or Fast Cure) or VAPORSOLVE JOINT FILLER
3. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP

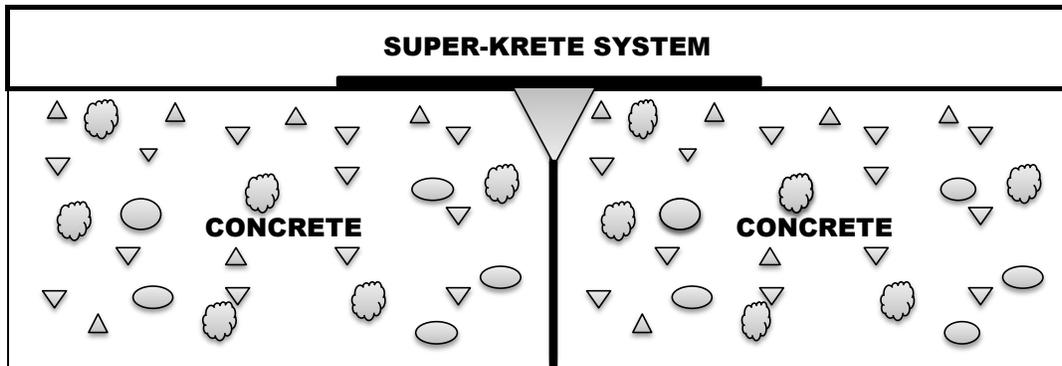


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CRACK RESTORATION 5. CRACK REPAIR BY SEMI-RIGID EPOXY JOINT and CRACK FILLER
Slight Movement Expected at Crack - Crack is "Veed" Out, Filled and Bond Breaker Tape

1. "Veed" OUT CRACK
2. FILL JOINT & CRACK FILLER - SK-E300 Flex or Paste (Regular or Fast Cure) or JOINT FILLER
3. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP
4. BOND BREAKER TAPE SPREADS DIMENTIONAL STRESS

VAPORSOLVE

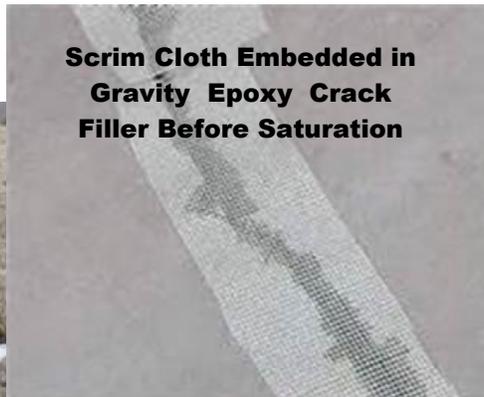
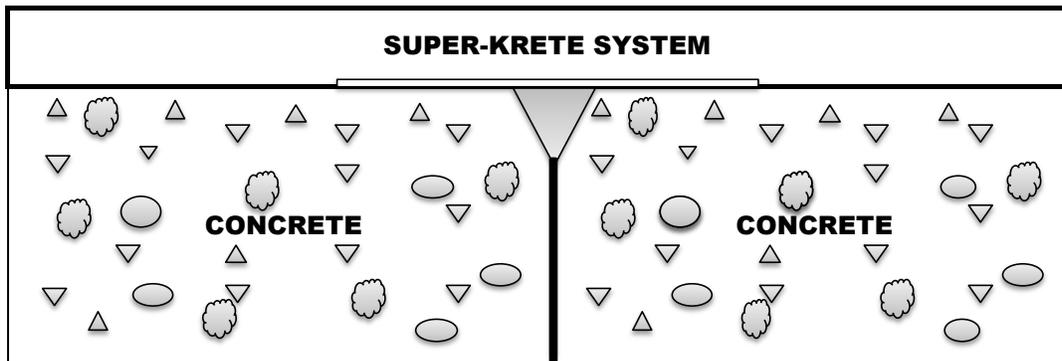


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CRACK RESTORATION 6. DIMENSIONAL STABILITY REINFORCED With SCRIM CLOTH

Slight Movement Expected at Crack - Crack is "Veed" Out, Filled and Scrim Cloth

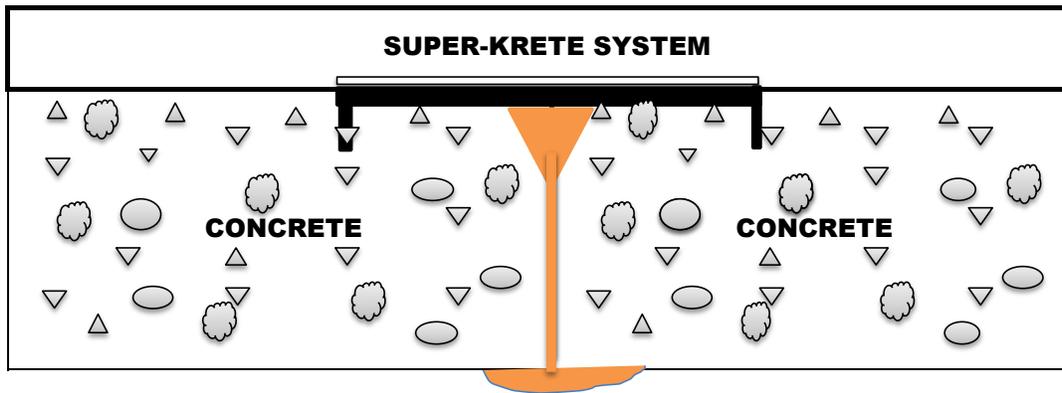
1. "Veed" OUT CRACK
2. JOINT & CRACK FILLER - SK-E300 Flex or Paste (Regular or Fast Cure) or VAPORSOLVE JOINT FILLER
3. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP
4. SCRIM CLOTH - S-3500 Elastique Matting



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CRACK RESTORATION 7. DIMENSIONAL STABILITY With STEEL STAPLES Rigid Crack Repair With Gravity Pour Epoxy, Steel Staples and Scrim Cloth

1. "Veed" OUT CRACK
2. JOINT & CRACK FILLER - SK-E400 Clear (Regular or Fast Cure)
3. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP
4. LOAD TRANSFER DEVICE - STEEL STAPLES
5. SCRIM CLOTH - S-3500 Elastique Matting

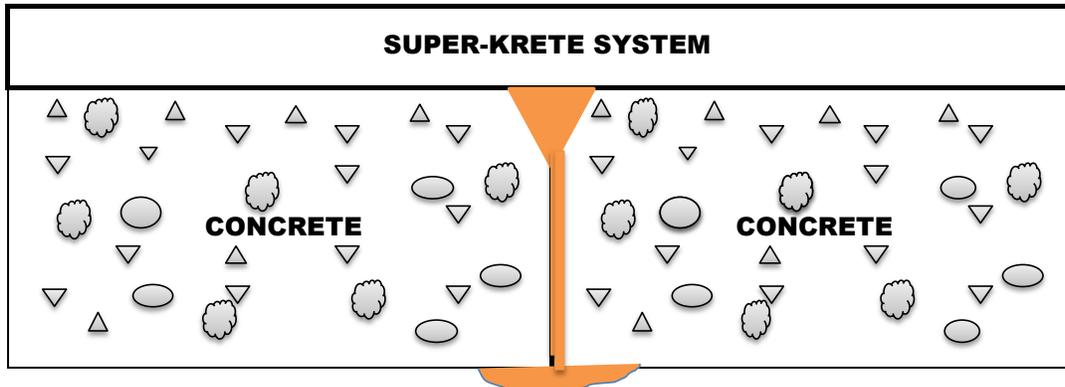


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CRACK RESTORATION 8. CRACK REPAIR BY GRAVITY POUR

Non-Moving Crack - Crack is "Veed" Out and Filled

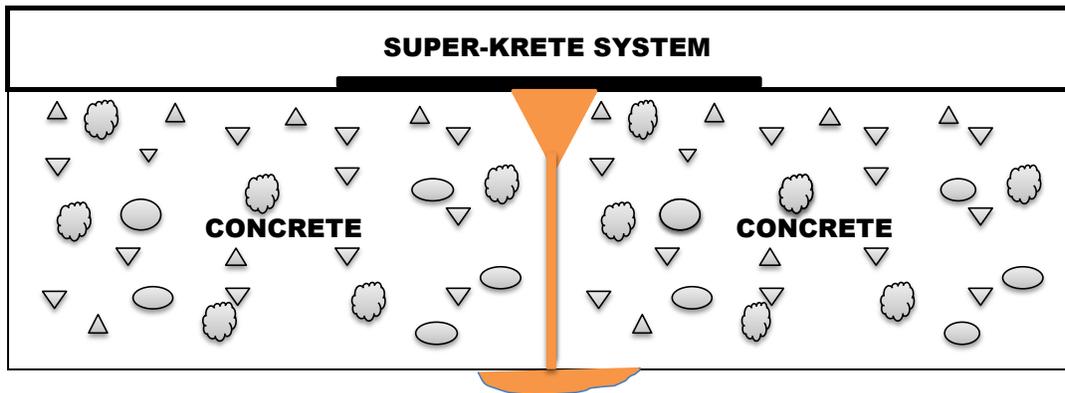
1. "Veed" OUT CRACK
2. GRAVITY FEED EPOXY - SK-E400 Clear (Regular or Fast Cure)
3. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP



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CRACK RESTORATION 9. CRACK REPAIR BY GRAVITY POUR WITH BOND BREAKER TAPE Slight Movement Expected at Crack - Crack is "Veed" Out, Filled and Bond Breaker Tape

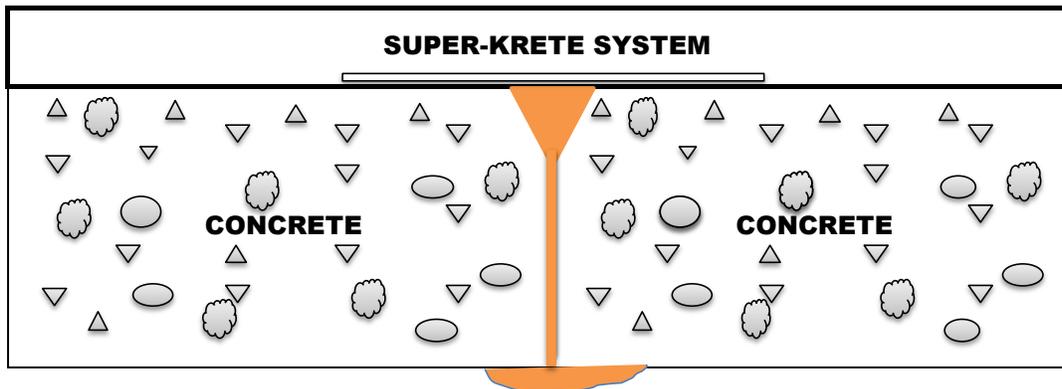
1. "Veed" OUT CRACK
2. GRAVITY FEED EPOXY - SK-E400 Clear (Regular or Fast Cure)
3. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP
4. BOND BROKEN TAPE SPREADS DIMENTIONAL STRESS



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CRACK RESTORATION 10. DIMENSIONAL STABILITY REINFORCED With SCRIM CLOTH Slight Movement Expected at Crack - Crack is "Veed" Out, Filled and Scrim Cloth

1. "Veed" OUT CRACK
2. GRAVITY FEED EPOXY - SK-E400 Clear (Regular or Fast Cure)
3. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP
4. SCRIM CLOTH - S-3500 Elastique Matting

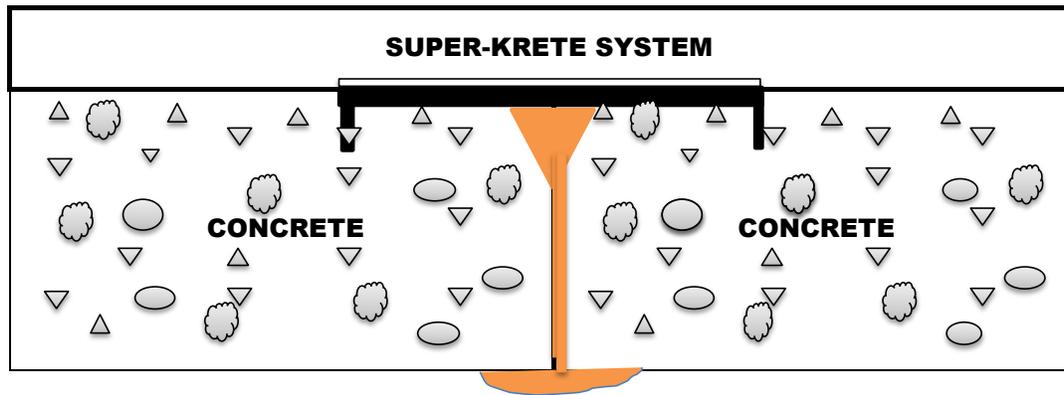


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CRACK RESTORATION 11. DIMENSIONAL STABILITY With STEEL STAPLES and SCRIM CLOTH

Rigid Crack Repair With Gravity Pour Epoxy, Steel Staples and Scrim Cloth

1. "Veed" OUT CRACK
2. GRAVITY FEED EPOXY - SK-E400 Clear (Regular or Fast Cure)
3. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP
4. LOAD TRANSFER DEVICE - STEEL STAPLES
5. SCRIM CLOTH - S-3500 Elastique Matting

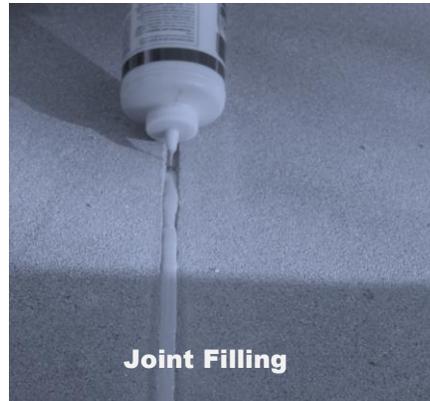
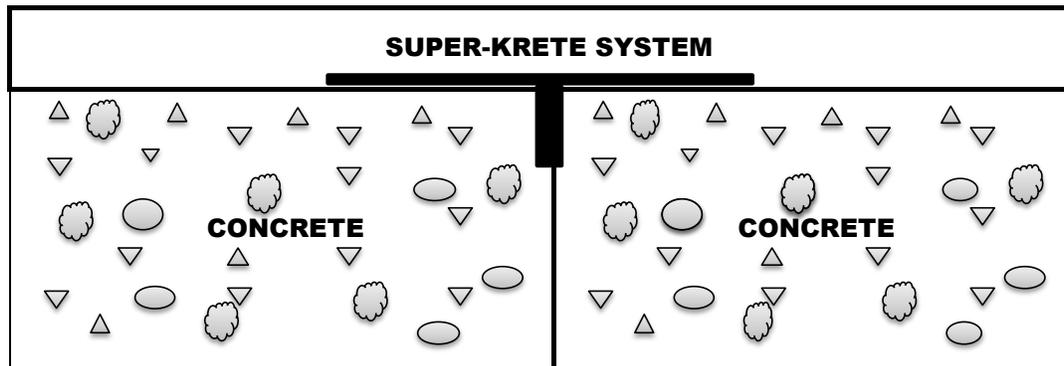


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CRACK RESTORATION 12. CONTROL JOINT "WISE CRACK" FILLER

Bond Breaker Tape Allows Minor Movement To Be Transferred Over Greater Surface Area
With Less Stress At The Joint Location

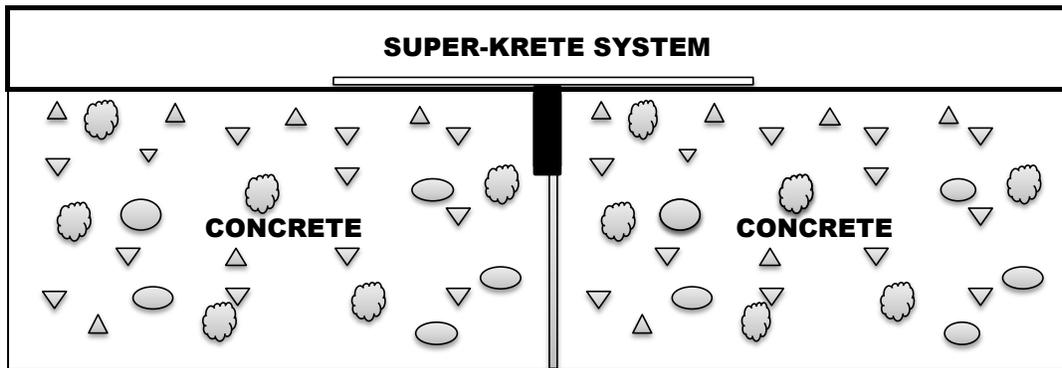
1. SAW CUT CONTROL JOINT
2. GRAVITY FEED EPOXY - SK-E300 Clear or Paste (Regular or Fast Cure)
3. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP
4. BOND BREAKER TAPE



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CRACK RESTORATION 13. CONTROL JOINT "WISE CRACK" FILLER Deminsional Reinforced With Scrim Cloth To Restrict Movement

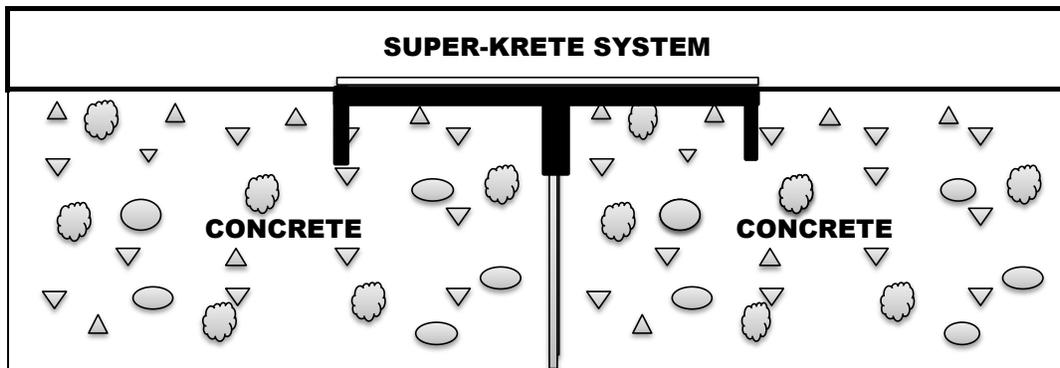
1. SAW CUT CONTROL JOINT
2. FILL BOTTOM OF CONTROL JOINT WITH FINE AGGREGATE or BOND BREAKER TAPE
3. GRAVITY FEED EPOXY - SK-E300 Clear or Paste (Reg. or Fast Cure)
4. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP
5. SCRIM CLOTH S-3500 Elastique Matting



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CRACK RESTORATION 14. CONTROL JOINT "WISE CRACK" FILLER Deminsional Reinforced With Steel Staples and Scrim Cloth To Restrict Movement

1. SAW CUT CONTROL JOINT
2. FILL BOTTOM OF CONTROL JOINT WITH FINE AGGREGATE or BOND BREAKER TAPE
3. GRAVITY FEED EPOXY - SK-E300 Clear or Paste (Reg. or Fast Cure)
4. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP
5. LOAD TRANSFER DEVICE - STEEL STAPLES
6. SCRIM CLOTH S-3500 Elastique Matting



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CRACK RESTORATION 15. CONTROL JOINT "WISE CRACK" FILLER

Honoring The Control Joint Subject To Movement

1. MARK SAW CUT LOCATION and PLACE SUPER-KRETE MATERIAL
2. RE-CUT SAW CUT THROUGH SUPER-KRETE MATERIAL
3. FILL BOTTOM OF CONTROL JOINT WITH FINE AGGREGATE or BOND BREAKER TAPE
4. PROTECT SUPER-KRETE SYSTEM WITH TAPE FROM JOINT FILLER MATERIAL
5. GRAVITY FEED EPOXY - SK-E300 Clear or Paste (Reg. or Fast Cure) or PLACE POLYASPARTIC JOINT FILLER IF EXCESSIVE MOVEMENT IS EXPECTED
6. MIGHT REQUIRE SEVERAL POURS SINCE MATERIAL WILL SLUMP

