Cleaning Cracks Before Injection: Solution -- or Part of the Problem?
by John Trout

It is axiomatic in the concrete repair industry that if you are going to use an epoxy there has got to be a whole bunch of surface preparation or there will be a failure -- big time! Ergo, if you are going to inject a crack with an epoxy you had better think surface preparation.

Since it is pretty tough to scabble, sandblast, scarify, or otherwise abrasively prepare the internal cheeks of a crack, flowable materials are frequently considered to remove contaminants and prepare the concrete within the fault. Muriatic acid, detergents potable water, and oil free compressed air are among those commonly used.

Many cleaning procedures create more problems than they overcome. For example, if you use muriatic acid to flush a crack that is capped and ported, you may actually weaken the setup while removing little, if any, contamination.

Muriatic acid is aggressive, quickly etching or actually eroding concrete. When injected into a crack its first contact is with the concrete to which the cap and porting adapters are fixed. Continuous contact with the flow of fresh acid can permeate and weaken these bond lines.

In a crack 1/32" (0.79 mm) wide, the acid is probably neutralized (i.e. brine) after traveling little more than 1/4" (0.64 mm)! Although little further erosion of concrete is likely, saturation of the crack with the water is a certainty. The bond and compressive strengths of most injection resins are severely compromised unless adequate drying time is allowed.

Muriatic acid etches; it does not clean. For example, motor oil has been a common masking agent to protect architectural metals from muriatic and other acids during building cleaning. Muriatic acid does not remove oil. Muriatic acid does not remove anything except concrete.

Theoretically, a solvent or detergent would be useful in removing dirt accumulations or oil contamination. In practice however, the results are usually very poor. Though these agents may be successfully moved through the crack, it is not likely that they will effectively clean since there will be no scouring action -- only a slow flow through the widest part of the crack, bypassing the narrower segments.

Loose dry particles can often be removed from a sizable crack with compressed air. However, contaminants of this sort are seldom a problem.

A simple and effective cleaning technique is to simply flush the crack with the injection resin during the course of the repair. Observe the remote drool and continue dispensing until the resin is free of contaminants. When the resin looks good, contain the drain and continue with the repair.

Questions seldom asked are: "Is it necessary to clean this crack to obtain the results needed?" "So what if there is no bond -- is one required?"

Even if a resin does not bond to the walls of oil-contaminated cracks for example, it still cures, making a contribution in compression. Ditto shear, since aggregate interlock is restored. If the aim is to protect the reinforcing or waterproof, this has also been achieved, since the fault is filled and reduced to a seam. True, there will be no contribution in tensile strength, but how often is one needed? Very seldom does a design depend upon the tensile strength of the concrete; steel is added to provide the tensile strength required.

So, bond or no bond, injected resin nevertheless yields a contribution in compression, restores shear, protects critical reinforcement, and waterproofs.

The results available in contaminated cracks are often surprising. For example, in a coal facility where the cracks were loaded with fly ash and dirt, the injected resin penetrated and achieved bond! On a highway project, dirt was impacted full depth into fine pavement cracks, yet, full penetration and bond were achieved!

Both of these projects would have been discouraged if cores had been taken prior to the work -- too much dirt! The combined use of low viscosity resins, high pressure, and long duration produced astonishing results.* The resins literally wicked their way into the faults.

Cleaning of cracks is always costly, is seldom feasible, and is usually unnecessary.

* The coal facility was injected with an epoxy resin with a viscosity of approximately 400 centipoise. Injection pressures were about 150 psi (9 bar) and duration varied from two to five minutes. On the pavement project the resin viscosity was 200 centipoise, pressure 250 - 300 psi (15-18 bar) and duration ten minutes.