

## **CONCRETE INJECTION PROCEDURES**

### **I. Crack Analysis**

As with all the E-Chem products used in the repair and rehabilitation of concrete, the initial job analysis is by far the most important step. E-Chem injection resin will weld concrete cracks, but it will not repair the cause of the cracking. Each potential injection job should be thoroughly analyzed to determine the exact cause of the cracking. Correction of the cracking problem may be fairly simple or may be difficult, involving design change. Where a design is necessary, a structural engineer should be retained. Once the problem has been solved, the crack can be repaired by injection. The injection technique cannot be expected to do any more than repair existing cracks. Prevention of future cracking must be addressed separately. Parking garages are a good example of cracking problems that must be thoroughly analyzed. Often inadequate design for expansion and contraction is the cause for parking garage structural cracking. Unless this expansion problem is first solved, the injection will be of little use.

### **II. Surface Preparation**

Lightly sandblast areas to be injected, if this cannot be done use water blasting and surface saturation. This helps highlight the cracks and gives a clearer picture of what cracks can be injected.

### **III. Drilling For Ports**

- A. When using drill ports it is important to use hollow core bits (Hiller pneumatic bit) with vacuum attached. This helps clear away dust created by drilling into the concrete. Concrete dust can cause lots of problems. For example, any dust remaining in the drilled hole near a crack can combine with the very low viscosity injection resin and form a semi-paste which can slow or even stop the resin flow. The swivel drill chuck will more than pay for itself by eliminating wasted time in correcting blockages caused by dust. Also remember when drilling that cracks do not always run perpendicular to the outer surface. Be careful not to drill beyond a crack which may be running at an angle to the surface.
- B. The spacing of ports is determined by the tightness of the crack and the depth of the concrete substrate. Spacing is generally between 4 to 8 inches with the port to be recessed a minimum of 1/2 in.

### **IV. Setting Surface Ports**

Prior to sealing the cracks when surface ports are being used, it is important to align the surface ports directly over the cracks so that the injection resin can flow into the crack. One method of assuring this is to place a nail through the top of the surface port, center the port over the crack, and gently tap the nail into the crack to temporarily hold the port in place. You may also spot the ports with really fast-setting glue.

### **V. Sealing Cracks and Setting Ports**

When surface ports are installed precautions must be taken to keep the ports centered over the crack. To set the ports and complete sealing of the cracks, use EP-GEL FAST. Using cartridge and gun system, draw a bead along the crack and around the port, finish with a putty knife.

## **VI. Resin Injection**

- A. Resin injection can best be accomplished with an injection machine or properly designed injection gun / cartridge. The pressure can be high or low depending on the type of machine. An excessive high pressure system can create additional stresses in the crack, hydraulic lifting, rupturing of cracked substrate or further elongation of the crack. Low pressure will allow the resin to gradually flow into the crack for total penetration. For delaminations, use less than 10 psi. Also, use low pressure for wood beam injection. On vertical cracks, injection should start at the lowest port and continue upward on the cracked area. For deep penetration it is a good policy to stay on one port and cap the higher ports as clear resin flows through, continue capping ports until the resin flow abates, then move to the last port that resin came through. E-Chem EP-SLV is a very low viscosity resin and will flow in small hairline cracks. Travel of injection can be several feet from point of injection and may take some time before reaching the next port or penetrating through pin holes in the surface. Taking core samples is a good method of quality control.
- B. Temperature plays a big part in concrete injection. During extremely hot weather an open bridge deck may get up to 140° F. (60°C.). Special precautions are necessary before injection work can be done in such heat. These precautions may include shading the area and providing air conditioning. E-Chem can also help by changing to a different catalyst.
- C. A cold substrate or temperature will cause an increase in the viscosity of the injection resin, thereby slowing down the rate of injection and subsequent loss of penetration. Epoxy injection undertaken during cold weather requires special precautions. Injection machines must be kept warm, especially the material tanks. Their temperature should be kept at 80°F (26.7°C) and the hoses from the machine should be insulated.

## **VII. Injecting Delaminations**

- A. Delamination of concrete structures is an area where injection can also offer selective repair. Delaminations are often associated with bridge decks or other self-supporting structures. The most common delamination is shearing of the concrete, generally at the upper rebar mat. This delamination area is subject to chemical and moisture penetration from the surface which may attack the reinforcing bar. If the delamination is not repaired, traffic may cause the area to pop out through pounding on the delaminated upper concrete layer.
- B. Once the delamination has been mapped by drag chain or sounding device, it can then be drilled for injection. The damaged area should have no less than four (4) ports drilled for resin flow, depending on the size and shape of the delamination. This prevents the trapping of water. The delamination is likely to be associated with hollow planes that run along the reinforcing bar. When injecting the delamination, the resin will follow these hollow plane areas and can travel several feet in filling the voids. Use less than 10 psi of pressure when injecting delaminations.

## **VIII. Removing Ports and Capping Compound**

The crack sealing material and ports set with EP-GEL FAST may be removed by grinding or by heating the epoxy and scraping off. This can be done with weed burner or heat gun, after injection resin has completely cured, usually 24-48 hours after injection. Be sure not to get the epoxy too hot, if it starts discoloring the surface it is too much heat.