Epoxy Crack Injection Inspection Guidance

Epoxy crack injection uses epoxy material to seal cracks in concrete structures (bridges, walls, etc.) and is designed to be a crack sealer and structural repair for concrete elements. The repair methodology outlined below is a step-by-step process similar to the work the contractor will perform in conjunction with the project contract plans to complete the structural repairs.

Locating Cracks and Cleaning Cracks in Preparation for Epoxy Injection

Review the contract plans and locate the cracks in the structural element that require repair. If necessary, remove any obstructions that impair the field engineer's ability to locate the limits of the cracks. For example, if the cracks extend below grade, then the contractor would need to excavate around the abutment, footing or other structure element to be repaired by epoxy injection. The contractor should use compressed air to blow off cracks to expose the visible limits of the cracks. Sand blasting may also be necessary in some cases to open up or expose more of the crack (or cracks) in the damaged area. Follow the specifications for cleaning of the cracks prior to the contractor moving on the epoxy injection work. Removing all dirt, dust, and other unsound concrete material from the cracks is an important step in preparation for the epoxy injection procedure. The specification calls for flushing the crack with water under pressure and drying the crack with oil-free compressed air to complete the preparation of the cracks. Thorough surface and crack preparation will allow for the proper bonding and flow of the epoxy material into the cracks in the concrete.

Preparation for Epoxy Injection – Installation of Injection Ports

The next step the contractor must perform is to set the spacing and attach the injection ports into the cracks to receive the epoxy injection (See Figure 1). The spacing and number of injection ports installed will depend upon the thickness of the element being repaired and the size of the crack. The specification calls for a maximum injection port spacing along the crack of not more than the thickness of the element being repaired. At the ends of the crack the specifications call for a maximum injection port spacing of half of the thickness of the element being repaired. The specifications also allow for a closer port spacing if needed to ensure the epoxy fills the cracks. The contractor can install and secure the injection ports over the crack in a variety of different ways. For instance,

the contractor can use hot glue, from a hot glue gun, or a rapid setting epoxy to stick the injection ports directly into the crack. The contractor should be cautious when applying rapid setting epoxy or hot glue to the injection ports so as not to get any in the injection port or cover the opening at the end of the injection port. Once the ports are properly spaced and set the remaining length of the crack will need to be sealed.

Figure 1. Installing Injection Ports

Preparation for Epoxy Injection – Sealing Cracks Between Injection Ports

The next preparatory step for the epoxy injection process involves sealing the remaining length of the crack. The specification calls for the use of tape or other temporary sealant "capable of retaining epoxy in cracks during pressure injection" to seal the crack. The contractor can use a quick setting epoxy (or even Bondo), or tape to cover the cracks (See Figure 2). Any deficiencies in sealing the cracks may only become evident when pumping epoxy under pressure into an adjacent port. The pressurized epoxy injection may cause a leak to appear along the length of the crack (See Figure 3). If this happens stop the pressurized injection work and have the contractor repair the leak. As a matter

of tribal knowledge in some cases, rubbing bees wax or paraffin over a leak may be sufficient to seal the leak. If this method does not work, place more rapid setting epoxy over the leak before continuing.

Figure 2. Sealing a Crack Between Injection Ports

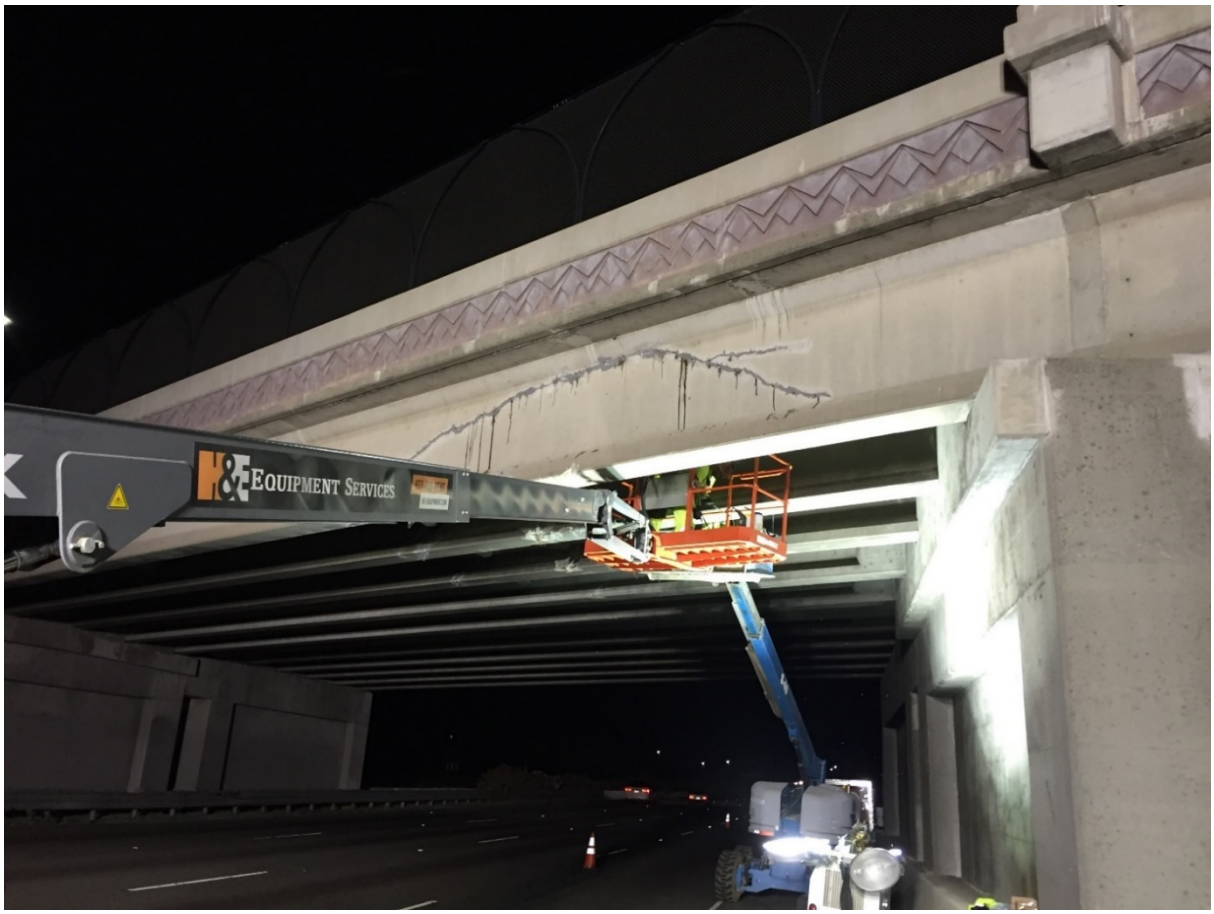

Figure 3. Epoxy Leaks on a Structural Element from Pressurized Epoxy Injection Work

Pressurized Epoxy Injection

With the completion of the preparatory work the contractor can commence the pressurized epoxy injection work. Verify that the concrete temperature is within the allowable temperature range per the contract specifications (50-90 degrees F) and the manufacturer's recommendations. The idea of epoxy injection is to start injecting epoxy at the low end of the crack and keep the epoxy moving from port to port. The contractor will insert the injection gun (See Figure 4 and Figure 5) on to the first port and will keep pressure injecting the epoxy until the epoxy runs out of the next port in line (i.e. return). When the epoxy returns from the adjacent port the crack between the ports is now filled with epoxy. The contractor's field crews will then disconnect the injection gun from the first injection port, cap it off and reconnect to the next port. The epoxy injection work will continue in this fashion, moving from port to port to keep the epoxy flowing, until the entire crack is filled with epoxy. Sometimes the epoxy will follow a subsurface crack that was previously unseen and will come out (return) somewhere else. For example, the epoxy return could occur at another port on another crack, or even start oozing out of an unseen crack. When this happens, the contractor will need to either cap off the port with

the epoxy return, or if it is a new crack, stop and seal the crack. The idea is to fill all the cracks with epoxy. The operation will continue by pumping and capping off the ports. Eventually the epoxy will eventually fill all the cracks and return from all the ports. If there is a problem with a crack that keeps leaking, stop pumping on that crack and go on to another crack. This will give the epoxy time to gel in the crack and the contractor can come back to it later. The epoxy will have to set overnight to cure, or for a duration recommended by the manufacturer. After the epoxy has hardened the contractor will seal the ports by removing the port fittings and filling the voids with epoxy and covering the voids with tape or sealant. Leave the tape or sealant in place until the epoxy has hardened. The contractor may use a chipping hammer to chip off the ports and most of the epoxy. The contractor can use a grinder or an air powered sanding disk tool to grind down the remaining epoxy smooth. If questions from the contractor or the field Engineer's arise on the type of epoxy to use, coordinate with Structure Design or Structure Maintenance Design on which low viscosity epoxy to select. Selection of an epoxy that meets the standard specifications and the project objectives will ensure the epoxy will flow through even the smallest cracks allowing for a quality repair of the damaged member.

Note: Epoxy injection can be a very slow process. The key to the success of the process is to go at slow rate when injecting the epoxy into the ports. The pump and mixing machine will continue to inject epoxy if the button is held down. The pressure will build up in the crack and may lead to blowing holes in the epoxy cover over the cracks. To avoid this, the contractor should inject a little at a time and allow the pressure to dissipate in the crack. Most machines have a pressure gauge on the injection line that the field Engineer and the contractor's personnel can watch. When the pressure goes up, the contractor should exercise caution and even stop until the pressure goes back down. Once the pressure spike subsides, to low or zero pressure, the contractor can continue to inject epoxy. The contractor may elect to have a tripod that will hold the epoxy gun during the injection process. On some large cracks, epoxy injection can take place for several minutes non-stop before there is any return. Very small cracks may take a long time to fill, so the contractor should go slowly.

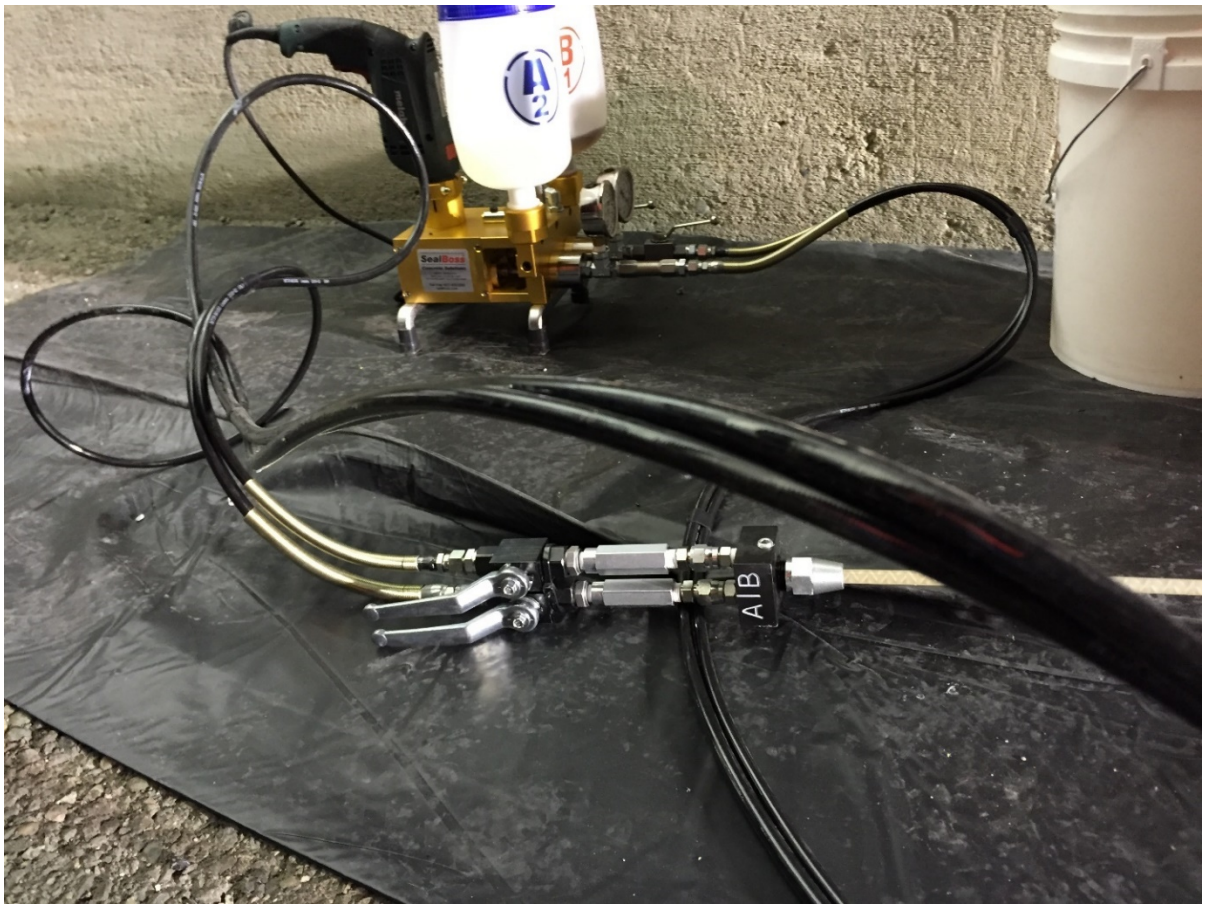

Figure 4. Epoxy Injection Pump and Injection Gun

Figure 5. Epoxy Injection Pump, Injection Gun, and Two-Part Epoxy