How to reseal pavement joints

Proper joint preparation and sealant installation help extend pavement life by keeping out water and incompressible materials

Over time, all pavement joint sealants suffer accumulated distress. Sealants can lose bond with joint reservoir sidewalls or lose internal bond and split open. They can also lose their flexibility through natural aging and long-term exposure to oxygen, ozone, and sunlight.

Distressed sealants allow water to seep through joints, which can soften and erode the subbase or subgrade. This degradation can result in loss of structural support and pavement settlement and faulting. Incompressible materials can also enter joints and obstruct pavement expansion, which can cause spalling of the joint faces.

To extend pavement life, joint sealants must be replaced periodically. Correct sealant application and maintenance minimize infiltration of surface water and incompressible materials.

In concrete pavement restoration (CPR), which often includes full- and partial-depth repair and diamond grinding, resealing joints is the last technique in the sequence. Successful resealing consists of five steps:

1. Removing old sealant
2. Shaping the reservoir
3. Cleaning the reservoir
4. Installing the backer rod
5. Installing the sealant

Removing old sealant

Simply pouring new sealant over an existing sealant will not restore pavement joints. Removing the old sealant and cleaning the joint faces are essential steps. These processes provide a surface to which the new sealant can bond. It is imperative that methods for removing old sealant do not damage the joint reservoir. The following methods provide acceptable results:

Manual removal. Typically, compression seals can be easily removed by hand. This simple method provides a quick result whenever feasible and does not leave much material on the reservoir sidewalls.

Sawing. The most common and efficient removal method is sawing with diamond blades (Figure 1). This method is efficient because sawing also shapes the reservoir for the new material. However, it may not be effective on sticky sealing materials such as PVC coal tar. Sticky materials can clog diamond blades.

Plowing. Plowing can be very effective for removing most of the old sealant. A small plow pulled through the reservoir dislodges the material. Be careful, however, when selecting the plow design. Avoid V-shaped plows because they tend to scour the reservoir corners and can easily spall the surrounding concrete. Very little damage occurs with a rectangular plow.

Cutting. Cutting requires a worker to run a knife blade along the faces of the joint. Afterward, the sealant easily pulls free by hand.

All photos by American Concrete Pavement Association

Reservoir preparation is the most important step of a joint resealing project. Above, a worker sandblasts the top of a joint face to provide a clean bonding surface for the sealant.

Shaping the reservoir

Saws can be used to widen the sealant reservoir after the sealant is removed. Saws with dry or wet diamond blades are acceptable. The blades remove any remaining old sealant and provide the proper dimensions for the new sealant.

In certain instances, this step may not be required. Shaping is unnecessary if the sealant was removed by hand and the existing reservoir provides adequate dimensions. Sawing out the old sealant typically provides an adequate reservoir and should not require this step either.

Some minor spalling along the joint face will not inhibit performance of most sealants. However, some patching may be needed for larger spalls. The specifications should detail areas requiring patching so that these areas can be repaired before cleaning the reservoir and installing the sealant.

Resealing pavements containing plastic or metal joint inserts requires first removing the insert. Afterward, sawing provides smooth vertical faces for the new sealant.

Cleaning the reservoir

Cleaning is the most important aspect of joint sealing. For every liquid sealant, manufacturers require essentially the same cleaning procedures. Likewise, the performance claims of any liquid sealant product are predicated on those cleaning procedures.

Reservoir faces require a thorough cleaning to ensure good sealant adhesion and long-term performance. No dust, dirt, or visible traces of old sealant should remain on the joint faces after cleaning. The ability to attain this condition may depend on the reservoir width. Most contractors report that it is easier to consistently clean joints if they are at least ⅜ inch wide. Cleaning ⅛-inch or even ¼-inch joints is very difficult.

Do not use chemical solvents to wash the joint reservoir. Solvents can carry contaminants into pores and surface voids on the reservoir faces. These contaminants will inhibit bonding of the new sealant.

Proper cleaning requires mechanical action and pure water flushing to remove any contaminants. Use the following procedures:

1. Immediately after sawing, wash away the slurry from the sawing operation. Perform this operation in one direction to minimize contamination of surrounding areas.
2. After the joint has dried sufficiently, sandblast the joint to remove any remaining residue. Do not sandblast straight into the joint. Hold the sandblast nozzle close to the surface at an angle to clean the top inch of the joint face. One pass along each reservoir face provides excellent results. This not only cleans the joint faces, it provides texture to improve sealant adhesion.
3. To ensure that the sealant enters a clean reservoir, airblast the joint and pavement surface to remove sand, dirt, and dust just before pumping the sealant. Make sure the air compressor does not introduce oil into the lines because this will contaminate the joint faces. The compressor should deliver air at a minimum of 120 cubic feet per minute and develop at least 90 psi nozzle pressure. Consider using a vacuum sweeper and hand brooms to keep the surrounding pavement clean.

Compression seals do not require steps two or three.

Installing backer rods

Install backer rods after cleaning the joint but before installing the liquid sealant. The backer rod must be compatible with the liquid sealant and have a diameter about 25% greater than the reservoir width. Backer rods can be placed easily with a double-wheeled, steel roller or any smooth, blunt tool that will force it into the joint uniformly to the desired depth (Figure 2). A steel roller allows exchange of the center insertion wheel to create different depths and provides the most consistent results. Slightly faulted joints may require a single-wheel roller. Ensuring that the backer rod is at the proper depth cannot be overemphasized. Good practice is to roll the insertion wheel over the backer rod twice.

Installing the sealant

Before installing the sealant, wipe the reservoir sidewalls with your finger to check for dirt and dust (Figure 3). If you find any traces of contamination, reclean the joint.

Installation requirements are slightly different for each sealant type. For most liquid sealants, manufacturers recommend some curing time before opening the pavement to traffic. Some liquid sealant manufacturers also place limits on the ambient and pavement temperatures required for installation. Compression seal manufactur-

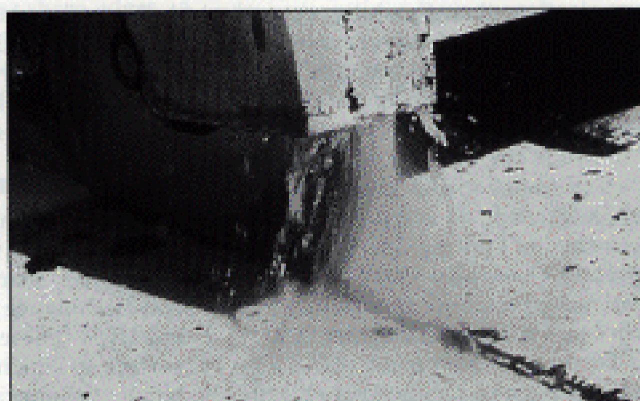

Figure 1. **Diamond sawing is an effective way to remove old sealant and to widen joints to provide the proper shape factor.**

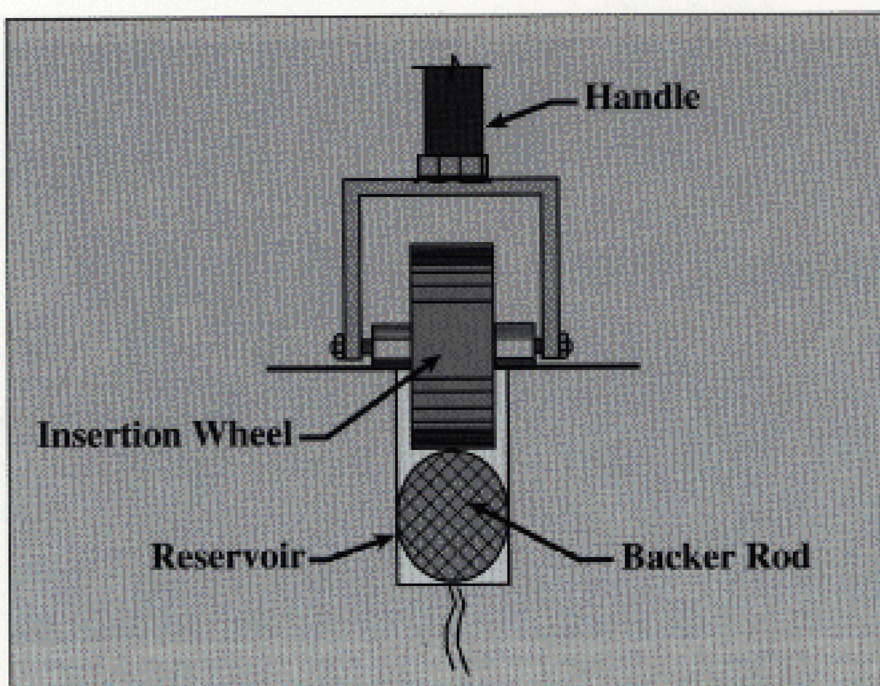

Figure 2. **A double-wheeled, steel roller forces backer rod into joints to the desired depth.**

ers specify desirable limits on sealant stretch and lubrication. Always consult the sealant manufacturer for particular product recommendations.

Liquid sealants. Pay special attention to the temperature of hot-pour liquid sealants before installing them. No sealant should be installed before it reaches proper installation temperature. Approximately one gallon of material is unusable because cooled sealant and flushing oil remains in the pumping unit hoses and nozzle. Discard this material and begin pumping only after fresh sealant is ejected from the nozzle at an acceptable temperature.

All liquid sealants require uniform installation. Pump the sealant through a nozzle sized for the width of the joint reservoir. The nozzle should fit into the reservoir to allow pumping to the bottom. Filling the reservoir from the bottom up reduces the chances of trapping air pockets in the sealant. Drawing the nozzle toward you rather than pushing it results in fewer voids and a more uniform sealant cross section. Do not fill the reservoir all the way to the top. Recess the sealant at least ⅛ to ⅜ inch below the surface of the pavement.

Low-modulus silicone sealants that are not self-leveling require tooling to provide the desired results. After pumping the sealant, draw a tool or backer rod strip over the fresh sealant. This forces the sealant into contact with the sidewalls at the top of the reservoir and produces the desired shape (Figure 4). Tool the sealant within 10 minutes of installation, because, after this time, the sealant will begin to cure and form a "skin."

The reservoir walls *must be dry* before installing a liquid sealant. Water will boil when placed in contact with hot-pour materials, forming steam that will bubble the sealant. Water will also inhibit silicone sealant adherence. Most silicone manufacturers require a surface-dry condition before installation. This includes drying the reservoir walls after water flushing or rainfall. Follow the manufacturer's guidelines for optimum seal adherence. Moisture removal is not as critical for compression sealants.

When transverse joints are sealed with silicone and longitudinal joints are sealed with hot-pour material, seal the transverse reservoirs first. Some contamination of the longitudinal reservoirs will occur while placing the silicone; however, silicone is somewhat more viscous than hot-pour sealants and the longitudinal joint contamination will be tolerable.

It is important to examine all sealants after installation. A knife blade pushed down along the joint face provides an excellent tool for checking sealant adhesion (Figure 5). A loose, effortless penetration indicates adhesion loss, while good adhesion provides resistance.

Testing of silicone sealant curing can only be completed after 14 to 21 days. For a quick check, remove a small 2-inch-long sample of sealant, and stretch the segment about 50% for about 10 seconds before releasing it. A fairly fast and uniform relaxation of the sample indicates adequate curing. Slow rebound and curling of the sample indicates differential curing. The curl results from the upper (cured) seal retracting faster than the lower (less cured) portion. It is important to repair the 2-inch gap in the sealant where the sample was extracted. Use the same brand of sealant to take advantage of the good adherence the material has to itself.

Compression seals. A compression sealing operation requires application of a lubricant/adhesive to the sealant edges and/or reservoir sidewalls. The compression seal is then mechanically compressed and inserted into the reservoir. The lubricant/adhesive material eases sealant insertion and forms a weak adhesive to help hold the seal in place.

Inspect the joint walls before sealant installation to find any suspect areas. Raveling, spalling, or other irregularities in the joint walls pose potential problems. These areas could reduce the seal's lateral pressure and allow the seal to extrude or pop from the joint. The engineer and contractor should agree on potential problem areas before the contract is complete and seal damage occurs.

Sealant stretch of 3% or less is desirable. Some neoprene seals are capable of stretching as much as 50%. Stretching reduces the cross section and compression recovery of the sealant. More than 5% stretch is excessive and could be detrimental. Some sealants can later break into pieces if stretched excessively during installation. Pay special attention during installation to avoid twisting, nicking, or stretching the sealant.

To monitor sealant stretch, lay a length of sealant parallel to the joint and cut the seal to the exact length. After installing the seal, measure the length of any protruding seal, and divide this number by the original seal length to determine stretch percentage.

Figure 3. **Dirt and dust on the reservoir sidewalls will inhibit bonding of the sealant. If you find any traces of contamination, reclean the joint.**

Figure 4. **Low-modulus silicone sealants that are not self-leveling require tooling. This forces the sealant into contact with the sidewalls at the top of the reservoir and produces the desired shape factor.**

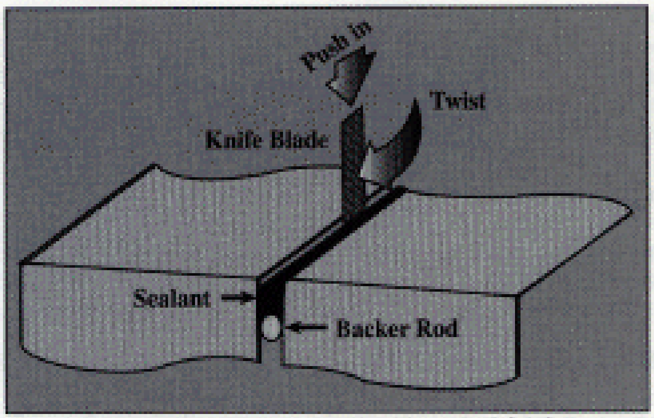

Figure 5. **A knife blade pushed down along the joint face provides an excellent tool for checking sealant adhesion. A loose, effortless penetration indicates adhesion loss, while good adhesion provides resistance.**

Most compression seal manufacturers make equipment for accurate seal installation. The most common are compress-eject machines. The machines compress and insert a seal to a desired depth in a continuous motion.

The most advanced equipment automatically applies lubricant/adhesive along the sealant edges. Compress-eject machines remove most stretching and twisting problems that accompany hand installation. The machines are usually self-propelled with a guide that keeps them on course over the joint.

Burrs along the sawed joints may make seal installation difficult. Dragging a blunt, pointed tool along sawed joints removes sharp edges. A mechanized wire brush will also remove burrs and provide consistent results. While this simple step eases seal installation, it may contaminate clean joints and should be done only when needed and before cleaning the reservoir.

Whenever possible, avoid splicing compression seals. Splices are discontinuities prone to moisture infiltration and dislodging by traffic. Use only one length of compression seal for transverse joints less than 25 feet long. For transverse joints on wider pavements, one splice is acceptable. For longitudinal joints, cut the compression seal at the transverse joint crossings.

Acknowledgment

This article is based on information from *Joint and Crack Sealing and Repair for Concrete Pavements*, American Concrete Pavement Association, 1993. For more information, contact ACPA, 3800 N. Wilke Rd., Suite 490, Arlington Heights, IL 60004 (708-966-2272).

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