

Introduction to Crack Sealing

Water is the most destructive element to our pavement. Water entering our roadway through cracks accelerates the deterioration of the roadway. In time, the water will undermine and weaken the roadway base material creating cracks and potholes. Sealing pavement cracks to prevent water from entering the base and subbase will extend the pavement life from 3 to 5 years.

Before the advent of high performance, polymer modified asphalt sealants, many municipalities filled cracks with AC-20, emulsions, J-1 and cutbacks, known as fillers. Fillers did fill the void in the crack but had little flexibility to move with the crack in cold temperatures and not flow or bleed in high temperatures.

Pavements expand and contract with seasonal temperature changes. Consequently, cracks and joints are expanding and contracting when the pavements move. Sealing the cracks with flexible rubberized asphalt that bonds to the crack walls and moves with the pavement will prevent water intrusion. As part of a Pavement Management System, crack sealing can reduce pavement deterioration by restricting water penetration into underlying base and subbase layers. This restriction helps to maintain pavement structural capacity and limits future degradation. Simply stated, sealing cracks and joints in pavements extends the service life of the surface treatment and the pavement.

It should be noted that crack sealing would not improve the initial pavement rideability. The benefits are realized in 3 to 5 years when it becomes obvious that the pavement has not deteriorated. Roads and bridges that are crack sealed last longer than those that are not. Sealing prior to surface treatments and bituminous paving overlays enhances the treatment and further extends the pavement life.

At a time when highway crew sizes are shrinking (along with funds to support road maintenance), crack sealing stands out as an economical maintenance technique. The overall successes of pavement maintenance systems that include crack sealing (combined with the generally low cost) make crack sealing a desired maintenance program. Crack sealing provides the most cost effective use of the dollars over time when compared to other pavement maintenance treatments.

Estimates Cost Per Mile

Crack Sealing	\$2,500
Chip Seals	\$12,500
Micro-surfacing.....	\$17,500
Overlays.....	\$60,000

SEALANTS

Asphalt rubber was the first generation of flexible sealants to move with the pavement and maintain flexibility at warm and cold temperatures. Unlike fillers, asphalt rubber is flexible below 35° F and does not migrate or run when temperatures reach 85° F.

Regional climates encouraged manufacturers to develop sealants that would out perform standard flexible sealants. Extreme high temperatures in the southwest and severe cold temperatures in the northern midwest prompted the development of sealants that have greater flexibility and better bonding to crack walls. A generation of sealants utilizing polymer technology was introduced. Polymers, when added to a liquid asphalt base, formulate a sealant that has a greater expansion capability than asphalt rubber sealants. Sealants can now be manufactured with a performance range from 200° F to -30° F.

To ensure a minimum standard for sealant performance, ASTM, AASHTO and federal agencies have developed test specifications for polymer modified and asphalt rubber sealants. The most recognized standards in the northeast are ASTM D6690 (polymer modified) and D 5078 (AC & crumb rubber) sealants. Both products require some equipment for application. Although most



of these tests were originally designed as joint sealing standards in concrete pavements, these standards are now widely used in asphalt pavements as well. PennDOT Publication 408, section 469 has a list of the material approved for use on municipal projects. Approved PA sealant manufacturers are listed in PennDOT Bulletin 15, section 705.4 (g) and 705.5 (c).

EQUIPMENT

Using the right equipment is an important part of any crack sealing program. There are two major areas of consideration: crack preparation and sealant application. In the same way that a dentist prepares a tooth before filling a cavity, crews must prepare cracks to receive sealants. The better the preparation, the better the chance that the sealant will last and perform.

Cracks must be free of all dirt, dust and debris. The sealant must have a clean, dry bonding surface. Surface preparation can be accomplished with compressed air (100 PSI minimum) and a simple blowpipe. This technique works well when the dirt is dry and not packed hard. If the cracks are filled with wet dirt, the dirt needs to be removed and the crack must be completely dried. An air compressor or a hot-air lance generating temperatures in excess of 2,000° F is the best tool. In simple terms, a heat lance uses hot compressed air that blows cracks clean while drying them out. Field studies and research are finding that heat lances are valuable tools for successful programs.

Results from the Strategic Highway Research Program (SHRP) study show that there is almost a 40% greater chance of sealant success if cracks are routed prior to sealing. Cutting a reservoir also ensures that the proper amount of sealant penetrates the crack. An operator passes the pavement cutter or router over the crack and, through a series of star-shaped steel teeth, cuts a reservoir into the crack. Modern routers can follow even the most random pavement cracks. Once the rout is complete, simply use compressed air (hot or cold) to remove the dust created by the router. Engine-powered steel wire brushes can also be used to clean routed and nonrouted cracks. (Note: Older-aged asphalt pavements and thin asphalt pavements may not be suitable for routing.)

The most visible piece of equipment is the melter. In years past the “tar pot” was simply a steel pot with a direct flame burner used to heat the material. Tar pots are still used today for applying AC materials. Also in use today are indirect fire melters, which require a high temperature heat transfer medium such as oil. These kinds of melters are known as “oil jacketed” melters or “double boilers”. Special care must be taken to assure that the sealant temperature does not exceed the manufacturer’s recommendations; otherwise the polymers may be destroyed therefore reducing the sealant performance.

Hot pour sealants are effectively applied through a delivery hose and wand. These materials are commonly applied at 375° F however the manufacturer’s recommended application temperature must be adhered to. This temperature normally is printed on the cardboard box the sealant comes in. To prevent sealant cooling, setup and clog, the hose is placed under constant pressure and the sealant circulates constantly back into the main tank. Crewmembers must therefore be trained not only in proper safety procedures but also proper operation of the melter. Melters with “on demand” pumping and thermostatically controlled delivery hoses reduce the chances of mistakes and improve productivity.

APPLICATION

Sealant application can be accomplished in a variety of ways. No less than 12 methods are outlined in the SHRP publication: Materials and Procedures for Sealing and Filling Cracks in Asphalt-Surfaced Pavements (SHRP-H-348). This manual was printed as part of the overall study that researched crack sealing methods and programs. Admittedly, the 12 methods did not all perform the same.

The three most widely used material placement configurations are:

- Simple band-aid (2” to 3” wide band)
- Recessed band-aid
- Shallow, recessed band-aid

The success of each method was not only determined by configuration, but also by cleaning technique and sealant selection. Sealant applied in routed cracks performed longer: each of the recessed band-aids had good results. A recessed configuration dispenses material into the confines of a routed crack. The sealant can be placed flushed with the pavement, or slightly below the surface of the pavement, or slightly overfilled on the surface. In an over-band configuration, the sealant is placed onto and over an unrouted crack. The sealant can be shaped into a band over the crack using a rubber blade squeegee or a sealing shoe that flattens the sealant over the crack.

Seal cracks between ¼” to 1” wide. Cracks smaller than ¼” will not retain sufficient sealer to flex in the cold. Cracks greater than 1” will sag and possibly prematurely fail without the installation of HMA or backer rod.

Contracted crack sealing is typically bid by three methods: lineal feet of crack, gallons of sealant applied, or pounds of sealant applied. Each method has drawbacks.

- Lineal feet- municipal personnel need to measure cracks during application (preferred) or after the project is completed. Time consuming to the municipality but no incentive to overapply sealant.

- Gallons- need to verify melter level and available material (boxes) at the start of the project. Take the total weight of the boxes and divide by the weight/gallon of the material to determine gallons used in each box.
- Take melter measurement at the end of the project, adjusted for temperature. Subtract the ending kettle level from the start level and add the gallons from the additional boxes to determine the total gallons applied.
- Some manufacturers only provide weight per pallet of material. In this instance, use an average weight based on the pallet weight divided by the number of boxes on a full pallet.
- Pounds of sealant- calculate material volume in the melter and convert volume to pounds as above. Count total boxes and add the two figures.

Use the method that best suits your requirements.

CONCLUSION

Pavement selection is often a forgotten element in determining the success or failure of a crack sealing program. If the road has alligator cracking, high density, multiple cracking, or poor subbase drainage, or structural damage, crack sealing will not solve the problem. In these cases the damage is too far-gone. If you try to save a pavement that has too much cracking, you will be disappointed with your efforts. The best candidates for crack sealing are newer pavements that are beginning to form cracks. Always begin your crack sealing program by sealing your best or newest roads first. We can certainly extend the life of these roads. A good rule of thumb is to monitor roadways that have been resurfaced and consider crack sealing within three to five years following the resurfacing.

Keep in mind that more sealant is not always better. Over applying sealant material can lead to problems when paving over with HMA or bleeding up through the seal or paving application. These new sealants are not designed to be “road glue”. Yes, they are very sticky and have tremendous bonding power. However, they were not made to “hold the road together”. Crack sealing has one objective: to prevent water from further damaging our roads. Sealing “buys time” and saves money by delaying the expense of major reconstructive pavement work.

