

Seal Coats

The topic of seal coats arouses different responses from different municipalities. Many have used them for years and swear by them while others would not use them if they were free. Because seal coats can stretch dwindling municipal funds, this Tech Sheet identifies some benefits as well as the pitfalls of the seal coats.

There are two main reasons why people are dissatisfied with seal coat performance. One, people often expect too much from them. The purpose of a seal coat is simply what the name implies: it seals the surface of your pavement, repelling water. Water is the primary cause of pavement distress.

Seal coats also can add skid resistance to worn pavement. Pavement surface integrity can be restored giving new life to a dried-out, raveling surface. The seal coats are typically applied to roadways under 1,500 average daily traffic (ADT). Roadways with ADT between 1,500 and 12,000 can be seal coated successfully if traffic control (speed of traffic) is maintained during and after construction. Seal coats do not add structural strength to pavement. A badly alligatored surface with depressions indicates water problems or base failure that must be corrected prior to placing a seal coat that must be solved with improved drainage. Sealing an alligatored surface probably will not hold the pavement together. In fact, the cracks will reopen, wasting the money spent on seal coats. In such cases, solve the drainage problems, then consider recycling and seal coating.

The second reason for dissatisfaction is that seal coating was executed or inspected incorrectly. Seal coating success relies on proper materials, equipment, calibration, weather and experienced contractors. If small problems are overlooked, big problems result. For more than 20 years, PennDOT and some municipalities have been applying seal coats prior to an asphalt overlay. This process is known as a reverse seal. Reverse seals provide a waterproofing membrane under the asphalt overlay to reduce water penetration into the base.

First, consider the components of a seal coat. An emulsion is a combination of asphalt, water and an emulsifying agent. The emulsifying agent causes the asphalt to disperse in the water making a mixture stable enough for mixing, pumping and prolonged storage. Polymer modified emulsions (PME) incorporate polymers into the asphalt prior to emulsifying. PME's have been shown to have better stone retention and longer service life than conventional emulsions. Particular problems are the charges on the emulsions and stone. There are anionic (negative charged) and cationic (positively charged) emulsions and stone. This presents the potential user with the problem of matching the charged emulsion with a stone (aggregate) of the opposite charge. Using a cationic emulsion with a cationic stone will result in a natural magnetic repulsion, which means that the stone will push away from the emulsion. This causes an immediate problem with a seal coat. The most commonly used emulsions RS-2 (E-2) and CRS-2 (E-3) and polymer emulsions RS-2P and CRS-2P are anionic and cationic respectively.

Care must be taken to choose the proper combination of aggregate and emulsion. The emulsion supplier can do a simple test to assure material compatibility. The supplier provides a letter stating that the test showed proper material compatibility.

Although most people know that concrete goes through a "setting-up" process, many don't know that emulsions also have a setting-up process called "breaking". The asphalt separates from the water and forms a continuous film on the pavement. Aggregates must be placed and the first roller pass accomplished before the emulsion breaks or the stone will not adhere properly.

A high percentage of fines (finely crushed or powdered material) in the aggregate causes another problem: the fine material will absorb the emulsion. If the aggregate particles are dusty or coated with clay, the emulsified asphalt may not stick. The dust produces a film that prevents the asphalt from adhering to the aggregate. Using a pre-coated aggregate or a washed aggregate can solve this problem. Approved aggregates are ASSHTO #8, #67, and #7 (approved under PennDOT Publication 447). Washed aggregate is required to have less than 1.0% material passing the 200 sieve to meet specification.



PREPARATIONS

Now that we understand the materials and have checked their compatibility, we are ready to start the seal coating process. Clean out the surface cracks between ¼ and 1 inch width and seal them. Clean the grass and weeds from the gutter and curb areas.

The seal coat performance is only as good as the surface to which the seal coat is applied. Care should be taken to assure that the roadway is clean and free of any substances that will prevent the emulsion from bonding to the pavement. Power brooms, vacuum trucks, blowers and high-pressure water are some of the equipment and methods utilized to clean the roadway.

APPLICATION

It is time to consult the PennDOT Manual Uniform Traffic Control Devices (MUTCD), Publication 213, 212 and set up your work zone traffic controls. After you've placed proper signs, cones, barricades, etc., drive through the work zone and make adjustments as needed. Some municipalities place "Roadway to be oiled & chipped next week" to notify motorists that a seal coat will be done on the road. Place the "loose stone" sign prior to the seal coat application. Refer to the PennDOT Publication 408 Section 470, Bituminous Seal Coat for guidance and acceptable materials and proper construction. The contractor must submit a seal coat design as per PennDOT Bulletin 27 at least two weeks prior to the start of the project. It should be noted that even if you are doing the seal coating in house you should have a seal coat design to assure success of the application.

All equipment, distributors, chippers and rollers must be calibrated annually for PennDOT and liquid fuels funded projects. The contractor as well as the municipal equipment if being done in house should have a current copy of the equipment calibration. If the temperatures of the air, road surface and the aggregate are above 60 degrees and rising you're ready to start. If a current calibration is not available, check the equipment as follows. Check the distribution rates of both the asphalt distributor and the chipper on the small test strip to be sure you met the design specifications. Measure the area of the strip and record the level in the distributor before and after spreading. Check the application rate of the spreader by placing a three foot by three foot (one square yard) flat pan under the spreader as it moves through the test area. Weigh the chips on the pan, subtract the pan's weight and you have the pounds of aggregate per square yard you have applied. Match both figures to your design and if they are within acceptable limits, you can start work. Check the color of the emulsion as it is applied. If it is black, the emulsion has "broken", with the water separating from the asphalt too soon. Stop the project and get new emulsion. The emulsion should be creamy dark brown in color before "breaking". The application should be watched carefully because misaligned spray bars can cause streaking. This means some areas are getting too much asphalt (resulting in

bleeding) and some not enough (resulting is loss of aggregate). If this happens, stop the project and have the spray bars recalibrated. If the pads on the roller are worn or missing, the tires will pick up the aggregate. If you see this happening, stop the project and have the pads replaced. Be sure to check the tire pressure on rubber-tired rollers because uneven pressures produce uneven results. The contractor should provide enough rubber-tired rollers for full coverage in one pass. Avoid back rolling, as this will tend to move aggregate exposing asphalt which increases pick up on rollers.

Now that you've seen that seal coating is a complicated process of many small parts, you can appreciate the need for care in placing seal coats. By taking your time and following the procedures set forth in PennDOT Publication 408, sections 470, 471 & 472 Specifications Manual, your efforts should result in a successful seal coat that will stretch your municipal dollars. Just don't expect seal coats to perform miracles. Seal coat is a preventative measure. Choose candidates wisely.

TIPS FOR A SUCCESSFUL SEAL COAT

Rubber-tired rollers should be used meeting the requirements of PennDOT Publication 408, section 108. The tires on the type of equipment will follow the contours of the road. Steel-wheeled rollers tend to crush the aggregate. This can cause the aggregate to pop out of the emulsion and also may create more uneven results.

A properly constructed seal coat should have one-half to two-thirds of a typical stone imbedded in the asphalt after the surface is rolled and cured.

Application of too much stone may also be a problem. If the mix is more stone than the emulsion can hold, the loose stone may push the adhered stone out of the emulsion under compaction.

Sweeping the area is done but only after the emulsion has broken. Check the emulsion by scraping the chips from the small area and inspecting the asphalt. If it is a brown color, wait. If it is black, the emulsion has broken and the sweeping may be started. To prevent loss of adhered aggregate, it is a good practice to wait as long as possible before sweeping. Through the next week, check the surface and remove any remaining loose aggregate.

Try to keep traffic off the new seal coat for as long as possible. If road closure is not an option consider use of leader or pilot vehicles to control speed of traffic during the operations. Restricting traffic for twenty-four hours, will assure a greater chance of success, but may not be realistic. See PennDOT Publication 408, section 420, Maintenance and Protection of Traffic regulations for seal coats. Now, remove the work zone traffic-control devices leaving the loose stone signs in place for an additional week after the project is completed (in reverse order of placement) and allow traffic to follow a leader or pilot car at a slow rate of speed over the newly seal-coated pavement.

Information provided by the Pennsylvania Association of Asphalt Materials Applicators.