

## BEST PRACTICES FOR PATCHING POTHoles IN ASPHALT PAVEMENTS

by Pa. Association of Asphalt Material Applicators

If you want to prevent potholes, you must keep water out of your pavements through the maintenance of drainage facilities, pavement surfaces, and shoulders. But even with proper maintenance, water will sometimes undermine the integrity of the roadbed (subgrade) and road base.

Late winter and spring are pothole seasons when more water is in the subgrade than at other times of the year. Throughout the winter, moisture is pulled into the pavement system and subgrade during the snow, rain, and freezing and thawing cycles typical of Pennsylvania weather. Freezing and thawing both progress from the surface to underlying material.

Sometimes, ice lenses that develop in the subgrade can heave a section of subgrade into the base, forcing cracks in the pavement surface above. *(An ice lens is a pocket of ice that has the shape of a convex glass lens. Ice lenses form at the ever-changing boundary between subgrade material near the surface, where moisture already has frozen, and saturated subgrade material below.)* By the spring thaw, water and ice lenses can accumulate, only to be augmented by melting snow and more rain.

With each thaw, and particularly after the spring thaw, ice lenses melt, and accumulated water can soften a subgrade and road base, weakening their capacity to support traffic. Worse, the aggregate of a road base can sink into a soft subgrade, particularly in subsided areas of subgrade previously expanded by ice lenses. Add the load imposed by cars and trucks, and a pavement, relatively brittle in the still cold temperatures of late winter and early spring, can crack and collapse into the soft spots.



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### Types of Potholes

The process in which potholes form is described as fatigue failure, and in thin pavement, it produces the **classic pothole**, a bowl-shaped crater. Pavement in the fatigued area disintegrates rapidly into 1- to 2-inch pieces that are easily dislodged by traffic.

Fatigue failure in a thick pavement is more likely to show as **jigsaw cracking** and makes for a rough ride, yet the pavement usually will remain intact and serviceable because of its thickness. Chances are, you'll be able to wait for the better weather of late spring and summer to repair pavement sections that exhibit this type of fatigue failure.

Another form of failure, called **raveling failure**, can produce potholes in both thin and thick pavements. The holes are not bowl-shaped craters but are irregularly shaped holes that form at seams, edges, joints, unsealed cracks, and other areas where a pavement may lack density. Where no cracks are evident, pavement sections prone to raveling will reveal themselves by staying damp when the rest of the pavement has dried out after rain.

As surface water permeates a pavement ripe for raveling, it weakens the asphalt binder that holds the aggregate (stone) together, and the aggregate breaks away (ravels) at the surface from the wear and tear of traffic. It is best to repair these sections in good weather before raveling progresses to the point where holes form. Of course, pavements susceptible to raveling also let water into the road base, which contributes to the formation of classic potholes by lubricating the aggregate of the base and enabling it to displace under traffic loads.

### Patching Potholes

The success of your patches relates directly to how well you prepare holes and compact the patching mixture.

Although it may be the only option at times, the simple method of filling a hole in one lift

and compacting the mixture with the back of a shovel, without shaping, cleaning, and drying the hole or tacking the exposed surfaces, is not the ideal way to repair pavement distress. The use of polymer-modified or “super-modified” cold-mix patch material will likely perform better than conventional patch material.

In addition, high-performance cold mixes give better exterior adhesion to the existing and surrounding repair of a pothole and cohesion to bond to itself. If you want your repair to last, be sure to maintain the repair to prevent moisture from entering and creating failure surface preparation. Using the tire of a dump truck to compact the patch is a step in the right direction but is still not the recommended practice.

While simple methods of pothole repair require only a dump truck and shovels and enable a crew to fill many holes in a shift, you may end up sending the crew back to refill the holes several times throughout the winter and spring. To ensure the maximum life and performance of your pothole patching efforts, clean and dry holes properly, employ approved tack coat materials on exposed surfaces, use high-performance mix to eliminate the need for tack coats, and compact mixtures with a vibrating-plate compactor or roller.

Before preparing a hole and compacting a mixture, consider four factors that will bear on the success of your efforts during pothole season:

**Weather** – Patch potholes on the warmest, driest days possible, but be ready to work whenever a dangerous hole has formed. That means choosing material appropriate to the weather. Best results occur when pavement and air temperatures are above 40 degrees Fahrenheit and rising.

**Material** – While hot-mix asphalt is often a good option for asphalt repairs, you probably can’t purchase these materials while the plants are shut down in the winter. Cold-mix patch material is designed to be stockpiled, even in cold temperatures, and will remain workable and sticky. This allows suppliers or road maintenance personnel to store cold patch throughout the winter to be used for pothole and pavement repairs as needed.

In cold mixtures, aggregate of a specified gradation (*containing specified percentages of stones of particular sizes*) is mixed with emulsified asphalt (*asphalt cement, water, and an emulsifying agent that helps them mix*) using a portable pugmill. The use of high-quality aggregate and asphalt emulsion is recommended to yield best results. Especially in colder temperatures, there are benefits to using cold-patch materials with additives, such as polymers, rubber, fiber, or other proprietary blends.

Some municipalities use portable patching machines, or “hot boxes” in their patching operations. When used properly and safely, these machines can serve a number of purposes, including helping keep the material soft and workable.

**Training** – It’s easy to blame material for patch failure, but

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even the best material may fail if improperly installed. Crews should be trained to identify problems and use appropriate equipment and technique in their work.

**Safety** – Repairing potholes means concentrating on a multi-step operation while working fast, sometimes in bad weather. Protect your workers and the motoring public by installing appropriate work zone traffic control before beginning work on any potholes in roads still open to traffic. On two-lane roads, you must establish a flagging operation. See PennDOT Publication 203, Work Zone Traffic Control, for traffic control plans for your planned work.

Most of the time, you must establish traffic control for a short-term, stationary operation. Make sure you do it right. See LTAP Technical Information Sheet #133, Work Zone Traffic Control Plans.

### Preparation and Method

The preparation and application method you use with patch material is of utmost importance – even as important as the quality of the material itself. To ensure the maximum life span and performance of your pothole patch, it is essential that the pothole be properly cleaned, dried, and tacked prior to being filled with patch material.

Although it may seem efficient (*or at least easy*) in the short run, the “throw and go” method of simply shoveling patch material into a pothole and moving on will not provide the best long-term solution to a problem. Properly preparing the pothole by cleaning, drying, and tacking will maximize the lifespan of the repair and will help the municipality – and the taxpayer – get the most out of its highway repair dollars.

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For technical assistance on potholes or course information on pothole prevention and repair, please contact LTAP at 1-800-FOR-LTAP (367-5827) or [www.ltap.pa.us](http://www.ltap.pa.us).