

UNH T² Center Technical Note

Pothole Prevention & Repair

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<http://www.guardian.co.uk/uk/2010/mar/24/budget-2010-potholes-winter-repair>.

Potholes are formed when water is trapped beneath the surface of the pavement. Water can enter the road base through surface cracks or from the side of the pavement. During winter, the water freezes and thaws in reaction to temperature changes. This freeze-thaw cycle often produces frost heaves, which allows more water in the pavement, perpetuating the frost heave creation cycle.

New Hampshire roads are most heavily affected by potholes in the spring, during the final thawing of the season. As the ice melts, water is trapped beneath the pavement surface. As vehicles drive over the pavement, the weakened pavement surface layer collapses, resulting in small holes and cracks, which expand as traffic continues to move over them.

In the summer, highway departments can take preventative measures such as crack sealing and

improving drainage. This minimizes the number of potholes formed by keeping water out of the base material. Due to cold temperatures, however, the only option for maintenance in the winter and spring is pothole patching. To ensure a longer-lasting pothole patch, crews must apply the right material using the right procedure.

Materials

There are two options for materials used in pothole repair: hot-mix and cold-mix patches. Hot-mix asphalt patches generally last longer than cold-mixes, but the hot asphalt must be mixed at extremely high temperatures. Also when using hot-mix, repair, compaction, and paving must be completed before the asphalt has cooled. The temperature of the roads' surfaces for the majority of the year is far too cold for hot-mix asphalt to be used effectively. Due to this, cold-mix asphalt patches are generally used on New Hampshire state roads. Not only is cold-mix more practical in terms of weather, it can be stockpiled throughout the year, and is less expensive and easier to use than hot-mix.

Three types of cold mix can be used: local cold mix, agency-specified cold mix, and proprietary cold mix. Local cold mix is a blend of local aggregates and liquid asphalts, either cutbacks or emulsions. Agency-specified cold mixes, requested by state highway departments, are created by asphalt plants, who produce the material according to these

specifications using high-quality aggregates and modified liquid asphalts. Proprietary cold mixes are commercially produced blends of carefully matched aggregates, liquid asphalts, and additives. By applying cold-mix using the following techniques, highway departments can make repairs that will last for many months.

Repair Techniques

Using cold-mix asphalt patches, repairs can be performed during varied weather conditions, ranging from clear spring days to harsh winter storms, with temperatures from 0 degrees to 100 degrees F. Under harsher conditions, pothole repairs are generally only performed in emergency situations. Otherwise, repairs are scheduled as routine maintenance during warmer and drier seasons. Highway departments have successfully used four methods for pothole patching: throw-and-roll, edge-seal, semi-permanent, and spray injection. The method of choice depends on the amount of money an agency can spend, the equipment available, and time available for repairs.

Semi -permanent

Semi-permanent patching is the most widely recommended method of pothole repair. It includes the following steps:

- Remove water and debris from the pothole, using a broom, shovel, compressed air or other comparable equipment.
- Straighten pothole edges, creating a rectangular rather than jagged edge. This can be done using a jackhammer, pavement saw, milling machine, etc.
- Place the mix using a shovel and rake. Placement should be made in no more than 3” lifts, compacting between each lift.
- Compact patch from the center towards the edges of the hole. This will provide better compaction at the edges and corners. Hand devices, such as a vibratory plate compactor or single-drum vibratory rollers, are recommended

for this method of pothole repair.

This repair requires more equipment and workers than the throw-and-roll or spray injection methods. However, the semi-permanent method results in a very tightly compacted patch, which is why it is the most widely recommended of the procedures given here.

Throw-and-Roll

Throw-and-roll is possibly the simplest and quickest method. The throw-and-roll method consists of the following steps:

- Place mixture into the pothole. The hole does not need to be cleared of water or debris before repairs. Any type of hand tool, such as a shovel or pitchfork, may be used to fill the hole. Fill the hole so that there is a crown in the center.
- Compact the material, by rolling over it 6 to 8 times with truck tires. Some crews have found it useful to cover the patch with sand before rolling over the patch, to prevent material from sticking to tires.
- After compacting, check the level of the patch to make sure the center of the patch is 1/4” to 1/2” above the pavement surface.
- If the patch is low add more cold mix and repeat the patching steps again.

This method is similar to the standard “throw-and-go”, “dump-and-run” or the “pitch-and-pat” methods. In this method, however, truck tires compact the patches, which provides a tighter patch.



http://www.pennlive.com/midstate/index.ssf/2010/03/pothole_botline.html

Traffic is able to drive over the patched pothole without creating depressions in the patch, and it also provides for better water runoff. While the throw-and-roll method does require a little more time to complete than the standard “throw-and-go” or “dump-and-run” methods, the extra 1 to 2 minutes to compact the patches will produce a significantly better patch.

Edge Seal

The edge seal method is essentially the throw-and-roll method with an additional step added. Follow all the same procedures for the throw-and-roll method, and then seal the edges of the patch, using asphalt tack and sand on the road surface.

Spray Injection

Spray injection is the most rarely used method, but does provide a long-lasting patch. The spray-injection procedure consists of the following steps:

- Blow the hole clean and dry of water and debris.
- Spray a tack coat of binder on the sides and bottom of the pothole.
- Spray asphalt and aggregate into the pothole. The compaction is provided by the velocity of the aggregate sprayed into the hole, thus no further compaction is required.
- Cover the patch with a layer of aggregate.

The spray-injection method is quick, provides a long-lasting patch, and uses low cost materials. However, a skilled operator is usually required to effectively patch using the spray injection method. Also, spraying machines are required for this method so the cost of equipment is much higher than the other pothole repair methods discussed.

Winter Patching

Best results for pothole repair are obtained by scheduling repair work during dry, warm weather.

Unfortunately, potholes usually form during wet and cold weather, during the winter and early spring months. In such cases, careful selection of materials and procedures is important to obtain a long-lasting patch, particularly because conditions for repairs are not ideal.

Choose high-quality, crushed aggregates for winter patching. The selected binder should be made from emulsified asphalts, with an anti-strip additive. The mixture should be workable at low temperatures, to allow both easier handling and compaction. This also ensures that winter patching can be completed before low air and surface temperatures cool the mixture. The most important issue to consider for winter patching is that the binder-aggregate-additive mixture be compatible. Since winter patching seldom allows the time required for the semi-permanent procedure, use the throw-and-roll method with a high quality or highway department-specified mix to provide a longer-lasting patch.

Spring Patching

Patches placed in the spring have a longer life than those in the winter because of more favorable weather conditions, and the end of the freeze-thaw cycle in particular. Spring patching can be done by any of the procedures discussed above: the throw-and-roll, edge seal, semi-permanent, or spray injection. Cost and the availability of equipment and workers should be considered when choosing which method to use in pothole repair.

Managers should make sure that any material stockpiled over the winter is workable in a range of temperatures. Materials workable at very low temperatures tend to be very sticky and hard to use at higher temperatures, while materials workable at very high temperatures are also difficult to use at low temperatures. Therefore, material that's useable in a range of temperatures is best because of varying weather conditions in the spring. High-quality crushed aggregate and emulsified asphalt should be used for spring patching. Antistripping additives are recommended to keep asphalt from stripping away

from aggregates.

The SHRP Asphalt Pavement Repair Manual of Practice provides illustrations of the methods discussed above. Readers can obtain the book from the UNH T² Center.



<http://www.ezstreetdiy.com/potholes.htm>

Proper Budgeting

Highway department budgets are often drained at the end of winter due to snow removal costs. Unfortunately, the costs of road upkeep do not end when the snows melt. To ensure that money is available for spring pothole repair, agencies should have separate budgets for snow removal and for road maintenance. Money allotted for road maintenance can be used for preventative maintenance such as crack sealing and debris removal, as well as for spring pothole repair.

Using a Management System

Along with a maintenance budget it is important to have a plan of action when potholes do occur, and also ways to prevent potholes. A pothole control program is an essential part of a productive and efficient pavement management system. By sticking to regularly scheduled maintenance tasks relating to drainage, agencies can decrease the accumulation of water in the road base. Make sure to regularly schedule drainage-related maintenance, including clearing debris and foliage from storm

drains, ditches, and culverts. Because potholes are formed when water drainage is poor, the elimination of water reduces pothole formation. Additionally, an active crack sealing program is very cost effective, and extends the life of the pavement. Water can enter the roadway through unsealed cracks, which can cause potholes to develop rapidly. Sealing these cracks can effectively stop potholes before they form.

A pavement management system, such as Road Surface Management System (RSMS), can help detect early signs of roadway failure. Early detection enables agencies to implement maintenance strategies before potholes develop. A comprehensive inventory of all city or town roads by pavement type, thickness, and condition of roadway allows the department to coordinate and prioritize maintenance efforts, which is more effective in terms of time and money. Agencies can train crews or hire an expert to recognize problem areas before potholes develop. Well-trained employees help the problem areas to be repaired and strengthened immediately.

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