



## Utah Department of Transportation Maintenance Division

### What Causes Potholes?



**Figure 1.** Typical pothole showing saturated area around unsealed cracks

Pavement deteriorates from the bottom up. This means that the thin new crack seen on the surface is actually the end of a wider crack deep in the road's foundation.

Potholes often result from unrepaired cracks. As water seeps through the pavement it saturates the soil below. Low temperatures cause the saturated soil to freeze and as it freezes the pavement heaves. Vehicle wheels further crack the pavement at the weakened spot. As freeze-thaw cycles continue and traffic runs over the pothole, it continues to grow.

### How Do Potholes form?

Figure 2 shows a typical pavement cross-section with three layers: soil, subbase, and pavement. Water from snowmelt and rainfall seeps through the pavement causing damage. As temperature falls and the soil freezes, it heaves, creating a crack in the subbase. As the temperature rise the frozen soil thaws and retreats. Another freeze heave extends the crack up through the pavement overlay. As this cycle repeats, the soil retreats, creating a cavity under the subbase. As a car passes over the crack the wheel load crushes the heaved portion down into the void, enlarging the crack into a pothole.

Potholes are a form of pavement disintegration that may be associated with poorly compacted material, raveling, cracking, base failure, or aging of the pavement. Potholes often appear after rain or during thaws when pavements are weaker. Generally accepted mechanisms for pothole formation are as follows:

Raveling, stripping, or cracking in the pavement surface.

Water penetrates the surface layers of the pavement, softening the underlying pavement layers, which increases deflections. Ice formation and heaving in the pavement occurs in some climatic areas.

Fine material from the underlying pavement layers are lost, reducing overall structural strength and support for the pavement surface.

- After CalTrans "Pavement Preservation Treatment Construction Guide, [Chapter 4: Patching and Edge Repair](#)"

Once a hole forms, it will continue to grow until repaired. Figure 2 illustrates the role traffic plays in enlarging a pothole.



**Figure 2. Pothole Formation**

(From CalTrans "Pavement Preservation Treatment Construction Guide, [Ch. 4: Patching and Edge Repair](#)")

## UDOT Pothole Repairs

We use a number of different products and methods to repair roads, based on how deteriorated the road is and when we intend to reconstruct the road. Potholes often occur in the winter and

early spring when hot asphalt plants are not working. Hot asphalt is the very best pothole patch material. We consider a pothole patch to be a temporary repair which should last until road is reconstruction or resurfacing.

If a pothole occurs on the freeway or other high volume road, shutting down a lane may disrupt traffic for hours, so we limit excessive traveler delay by repairing potholes at night or before the morning rush hour.

## **What product do you use to repair roads?**

Our standard pothole patch material for asphalt roads is a mixture of about 94% gravel and about 6% liquid asphalt. We buy this material, called "winter patch", by the truckload and store it at maintenance stations throughout the state until we need it. All the gravel passes through a 3/8" sieve.

Asphalt roads are usually resurfaced every eight to ten years. Some roads are rebuilt at about twenty years, but most Utah roads receive periodic minor rehabilitation that renews wearing surface and improves ride.

Major rehabilitation projects are sometimes deferred, as funding may not be available.

If we can buy hot asphalt, we will use it first, since it is a much better patching material.

Fast repairs on roads with more than 20,000 vehicles per day require a special product that sets up fast even when water is present and does not require extra mechanical compaction. It comes in a sealed bucket and one five gallon bucket usually fills a typical pothole.

For concrete roads we use the containerized patch because it lasts much longer. Containerized pothole patch has a five year shelf-life. Our concrete roads are repaired about every twenty years and are rebuilt every forty years.

## **How often do you have to use this product before you have to repair again?**

If pothole repairs are properly done, they should last until the road is rebuilt or resurfaced. Sometimes the road base under the pothole is very soft or wet and it flexes when vehicles pass over. This flexing may break the patch requiring repair again. 95% of our potholes are fixed with just one application. About 5% may fail within six months due to saturated road base. Fixing the road base is very expensive.

## **How expensive is it?**

Cold mix "Winter Patch" material costs \$85 per ton.

Hot mix asphalt costs about \$110 per ton.

The containerized patch material costs \$40 per five-gallon bucket.

## Do you use only one type of product or many different types?

We use different products in winter or summer and depending on how much traffic the road gets. If we can get hot asphalt we prefer it, otherwise we use cold mix described above. In heavy traffic areas we may use fast-setting containerized product.

A new process using infrared energy heat material removed from the pothole, thus solving the problem of not having hot asphalt available during the winter. HeatWurx<sup>®</sup>, a Park City, Utah, company developed the process to meet UDOT requirements.



**Figure 3. HeatWurx<sup>®</sup> Infrared Pavement Patching System** Bridge deck pothole repair on I-84 near Echo Junction, Utah. Temperature -5° F.

## How long does it take to repair a pot hole?

Using hot mix or cold mix pothole patch material it takes about ninety minutes to repair a pothole properly. This seems like a long time, but we have to divert traffic around the area. Each step takes time: cleaning and drying the hole, applying liquid asphalt to the edges of the holes, then placing the patch, compacting it, cleaning up, and then retrieving our traffic control signs.

Using containerized patch material takes about 30 to 45 minutes. It takes so much less time because the hole does not have to be dried out and it does not require compaction.

## **Are the products you use different during summer and winter? Why?**

Yes. In summer we use hot mix asphalt if we can get it. We don't have many summer potholes. In winter we use cold mix asphalt that takes more time to set up. We use cold mix because we usually cannot buy hot mix asphalt in the winter.

## **Why do they call it a Pothole?**

In the 1700's pottery making was a major industry in central England. Finding and mining good quality clay was a constant activity. Just as today, some property owners did not want their land disturbed by clay mining. Small pottery makers found it difficult to obtain sufficient clay to make their pottery since larger companies had the money to buy the best clay pits. Some enterprising persons found a way to supply clay to the small pottery makers by digging clay at night from roads that were located next to quality clay deposits. Overnight, a road would fill with holes left by these diggers. When local residents found out why the holes appeared, they began calling them "potter's holes" or "potholes". Today we don't have nocturnal clay diggers damaging roads, but holes still seemly appear overnight, so the term "pothole" applies.

### **For further information contact:**

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