

Just for street and road workers

Editor's note: The two articles about asphalt pavement maintenance on pages 8 to 10 are the second part of a series based on information in Iowa's new Local Roads Maintenance Workers' Manual. The manual was developed by CTRE and sponsored by the Iowa Highway Research Board (TR-514).

To borrow a copy of the manual, contact Jim Hogan, Iowa LTAP librarian, 515-294-9481, hoganj@iastate.edu. You can download a printable copy, www.ctre.iastate.edu/pubs/maint_worker.

Asphalt pavement maintenance: Selecting the right treatment

The key to effective asphalt pavement maintenance is to identify pavement distresses, then determine the most effective treatment. See table 1.

Asphalt pavement distresses

Distresses on asphalt pavements may include rutting, cracking (several types), washboards, and potholes.

Rutting. Ruts (figure 1) are surface depressions located in the wheel path.

Causes vary. If the pavement has risen around the edges of the rut, the rut is most likely caused by a poor mix. The uplift is a result of traffic pushing the asphalt to the edges of the wheel paths.

If there are longitudinal cracks in the rut, the rut is most likely caused by structural

failure of the subbase. The pavement is being pushed down onto the base or subbase.

Other ruts are generally the result of poor compaction during construction and subsequent vehicle loading compacting the asphalt.

Progressive rutting (rutting that continues to grow deeper and wider) is a result of poor subbase, very poor mix, or road design that is inadequate for actual loads. If possible, delay treatment until the ruts become dormant or no longer grow.

Cracking. Cracks develop over time due to flexing pavement and temperature changes that cause expansion and contraction. Cracks allow water to move through the pavement and infiltrate the pavement base and subbase. Infiltrated water decreases the load-carrying capacity of the base and subbase. If not repaired or prevented, this cracking effect will grow, leading to deformation of the pavement, potholes, and ultimately degradation of the pavement surface.

Cracking can take several forms.

Fatigue cracks (figure 2) are a series of interconnected cracks in early stages of development. They occur in areas subjected to repeated traffic loadings, like the wheel paths.

Block cracking (figure 3) is a pattern of cracks that divides the pavement into approximately rectangular pieces. Rectangular blocks range in size from approximately 1 to 100 square feet.

Alligator cracks (figure 4) are interconnected cracks that have the appearance of alligator scales. They are typically found in wheel paths and often accompany rutting.

Reflection cracks (figure 5) are cracks in an overlay that have "reflected" upward from cracks or joints in the pavement below.

Table 1. Distresses and maintenance activities for asphalt pavements

Distresses	Asphalt Maintenance Activities				
	Routine Maintenance		Full-Depth Repair	Seal Coat Repair	HMA Overlay
	Crack Sealing	Surface Patching			
Ruts			X		X
Cracks	X			X	X
Washboards			X		X
Potholes		X	X		



Figure 1. Rutting

Washboards. Washboards are a series of ruts in the road running transverse to the road edge.

Potholes. Potholes are bowl-shaped holes of various sizes in the pavement surface, with a minimum width of three inches.

Potholes generally form when water becomes trapped beneath the pavement surface. In the winter, the sub-surface water freezes and expands upward against the pavement. This action creates a void under the pavement, and vehicle loads are not transferred to the base and subbase. Vehicles add more stress until the pavement surface collapses into a hole. The hole grows as traffic breaks the edges of it.



Figure 2. Fatigue cracking. Photo courtesy of CCEE Department, ISU.

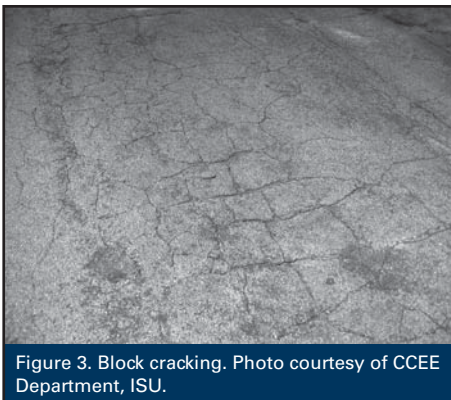


Figure 3. Block cracking. Photo courtesy of CCEE Department, ISU.

Maintenance activities

Maintenance options for asphalt pavements generally include routine maintenance (street sweeping and crack sealing), surface patching, full-depth repair, seal coats, and hot-mix overlays.

Crack sealing. Crack sealing prevents water from infiltrating through the pavement into the base and subbase. Typically the public works or secondary road department rents equipment for crack sealing every other year or as needed. Seal cracks in the spring or fall when temperatures are moderately cool and the pavement cracks are open. The work can usually be accomplished within a month's time.

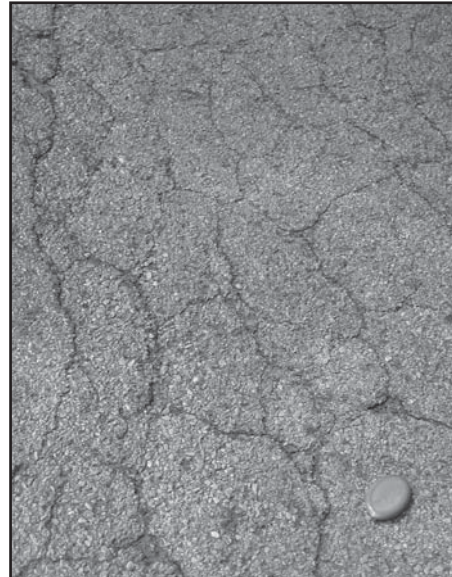


Figure 4. Alligator cracking. Photo courtesy of CCEE Department, ISU.



Figure 5. Reflection cracking. Photo courtesy of CCEE Department, ISU.

Surface patching. Surface patching is an interim repair using all-weather asphalt materials.

Full-depth repair. This is a permanent repair for distresses larger and/or deeper than surface degradation. It involves removing and replacing the distressed section of the slab, from top to bottom.

Surface patch or full-depth repair?

If deterioration is 25 percent or less of the total pavement thickness, apply a surface patch.

If deterioration is more than 25 percent of the total pavement thickness, apply a full-depth repair.

Seal coat. A seal coat is an application of an asphalt binder followed by an application of aggregate. A seal coat fills cracks and low spots, waterproofs the surface, and provides a wearing course for traffic. Seal coats are also known as chip seals, tar and rock (informal description), oil and rock, and surface seal.

Hot-mix asphalt overlay. A hot-mix asphalt overlay is a new layer of asphalt over an existing asphalt pavement or prepared stone base. Overlays can protect and add some strength to the existing pavement structure, reduce the rate of deterioration, and reduce deficiencies like ride quality. Overlays should not be applied to seriously distressed pavement systems.

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Selecting a maintenance activity

Selecting the most effective maintenance activity involves several factors:

1. Type and extent of distress
2. Roadway classification and traffic volumes
3. Cost of treatment
4. Availability of qualified staff and/or contractors
5. Availability of quality materials
6. Time of year

Reviewing the records of the road will also aid in selecting the most effective maintenance activity. Records should include the following:

1. Dates of routine maintenance activities
2. Pavement base and subbase design
3. Pavement section boundaries
4. Pavement age
5. Types, dates, and extent of previous maintenance treatments
6. Traffic volumes
7. Environmental impacts ■



In addition to wearing appropriate safety gear, workers doing asphalt repair should know emergency treatment for burns from hot asphalt.

Routine asphalt pavement maintenance

The goal of routine maintenance is to prevent or delay pavement distresses. Routine maintenance includes regular street sweeping and crack sealing.

Street sweeping

Sweeping removes dried, caked mud, abrasives, and other debris from the road surface. Clean road surfaces help keep drains clean, make travel safer for bicyclists, and ensure good surface drainage.

Crack sealing

The following instructions are general guidelines. Check with your supervisor, and follow your local policy.

Preparing for sealing. Follow these preparation guidelines:

1. Rout or saw-cut cracks to provide clean, uniform surfaces for sealant to adhere to and a reservoir for sealant.
2. Use an air compressor and an air wand to clean cracks of dirt, dust, and remnants from sawing or routing. Contamination in a pavement crack will cause poor sealant bonding.

Applying the sealant. After all cracks are blown clean, seal the cracks:

1. Apply sealant at a temperature of 350°F–410°F with the delivery hose and wand of the melter applicator. Take appropriate safety precautions when handling this hot material.
2. Pour an even bead of sealant into the crack no higher than ½ inch above the pavement surface. If it's higher, it could be damaged by snow plows or street cleaning equipment,

and it may flow over the pavement surface.

3. To remove excess sealant, run a U-shaped squeegee or sealing shoe over the bead to flatten the sealant over the crack, move the sealant to the bottom of the crack, and remove excess sealant. The squeegee creates a U-shaped seal (figure 6), allowing for contraction and expansion of the pavement during pavement temperature changes.
4. Keep traffic off the newly crack sealed surface. This will minimize tracking of material and allow for maximum adhesion to the surface. On occasions where this is not feasible, a light coating of sand spread over the sealant will act as a blotter and allow opening the street to traffic sooner. ■



Figure 6. Crack sealing squeegee. Photo courtesy of CCEE Department, ISU.