

Surface Treatments

When to Use Them and How to Ensure Quality

Surface treatments include thin overlays, chip seals, and sand seals. Applied to the right roads at the right time, they slow the rate that roads deteriorate, and make best use of limited budgets. This article describes when municipalities should use all three, and describes how to ensure high quality chip seals and sand seals. (Spring workshops will cover overlay inspection and testing.)

What Are Surface Treatments?

Thin overlays are 1 to 1½ inch hot mix asphalt (HMA) placed with a paver on an emulsified asphalt tack coat. A 1 inch overlay costs about \$2.25/sy, and a 1½-inch about \$3.35/sy. Chip seals are crushed aggregate spread over and then rolled into a layer of medium-set emulsified asphalt. They will seal pavements for 4 to 5 years, and cost about \$1.35/sy. Sand seals are 3/8 inch minus aggregate rolled into a layer of slow-set asphalt emulsion. When applied to low traffic, low speed roads, they should seal the surface for 2 to 3 years. Sand seals cost about \$1.00/sy.

Surface treatments provide a wearing surface over existing pavement to seal cracks, waterproof the surface, improve friction, and smooth rough roads, and rejuvenate hardened or oxidized asphalt.

When to Use Surface Treatments

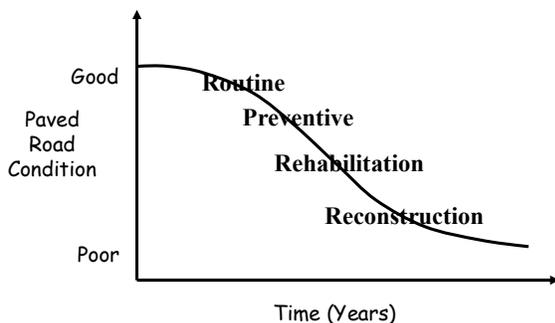


Figure 1. Classic Road Deterioration Curve

Roads deteriorate as shown in the Figure 1 curve. Surface treatments are a “Preventive” maintenance strategy applied when pavements are in the second stage of failure. In this state, pavements have

the following distresses:

- Alligator Cracking
 - Severity -- Just visible
 - Extent -- less than 10% of the area
- Longitudinal and/or Transverse Cracks
 - Severity -- less than or equal to ¼ inch wide
 - Extent -- greater than 30% of the area

In addition, each road should have a stable base and a proper crown. If rutting exists, the city/town must shim before applying a surface treatment. Crews should also fill large cracks (greater than ½ inch wide).

Ensuring Quality

Quality begins with applying the treatments to the right road as described above. The next step is to have adequate specifications. One-inch HMA overlays should be NHDOT Specification 401 Type E. A 1½-inch thick overlay should be Type D. Section 410 describes proper HMA placement. The tack coat should conform to NHDOT Specification 410. The UNH T² Center can provide specifications for chip seals and sand seals.

Other factors contribute to the quality of chip seals and sand seals:

- Environmental
- Surface conditions
- Equipment
- Construction procedures
- Traffic control

Environmental. Emulsified asphalt is a mixture of asphalt, water, and additives. It “cures” as water evaporates from the mixture. If curing is too slow, it delays formation of the asphalt-aggregate bond. If too fast, the asphalt can stiffen before this bond occurs.

Air and pavement temperatures and relative humidity affect curing times. Contractors should not apply seals during or after rain, or even when misty or foggy. Because weather is not controllable, managers should consider the weather when deciding

whether to seal on a specific day.

Air and pavement temperatures of 70°F are ideal, and 50°F is too low. The best relative humidity is in the 40 to 80 percent range. Cooler temperatures or high humidity slow emulsion curing. Very hot weather and low humidity can cause it to be too fast.

Surface Conditions. The usual practice is for city/town crews to prepare the road surface. As noted, the road must have a proper crown and no ruts. Crews must protect all structures -- manhole covers, valve covers, catch basins, etc. The surface must be clean and dry. Crews should remove debris the day before application, and swept immediately prior to emulsion application.

Equipment. Contractors apply chip and sand seals with an emulsion distributor and an aggregate spreader. They imbed the aggregate into the emulsion with rubber tired and steel rollers.

The distributor must spread a uniform coat of asphalt at the specified rate. Its heating and circulation system maintains a proper emulsion temperature. Proper spray bar pressures, height, and configuration ensure a uniform, fan-shaped coverage along the entire bar length. Electronic controls vary application for various truck speeds.

The spreader must apply a uniform aggregate layer at the specified rate. Too little aggregate can cause bare spots and eventual “bleeding” of the emulsion. Too much can result in window damage and wasted material.

Rubber tired and steel rollers align aggregates and seat them into the asphalt. Each should be 8-ton or more. Municipalities should never use haul trucks or traffic in place of rollers.

Construction Procedures. Inspectors should ensure that contractors conform to the specifications. The following are of particular importance.

As noted, applications outside certain temperature and humidity ranges will affect seal quality. A clean, dry surface is essential. The emulsion coating should be uniform across the road and along its length.

Aggregates should be crushed, clean, single-sized, durable, and as angular as possible. The stones

can be slightly damp, but not wet. Too much or too little moisture can inhibit the binder-aggregate bond. Too much can create a film around the aggregate. Dry stones absorb water from the emulsion, and can cause it to break too soon.

The contractor should check distributor and spreader calibration before starting work and during the day. Inspectors should ensure frequent calibration and cleaning. They should confirm application rates from weigh tickets and the covered area. They should also look for emulsion or aggregate bare spots or over application. Either indicates the need to check calibration.

Initial rolling must immediately follow stone application. The first roller should be rubber tired because it will not crush the stones. Wheels must be equally inflated to prevent streaking. The contractor should complete all rolling within 30 minutes after stone application.

Traffic Control. Allowing traffic too soon, or at too fast a speed, can affect quality. Usually one road lane is left open during chip or sand seal application on the other. After the contractor completes rolling, the city/town can reopen the lane to traffic at a maximum speed of 20 mph for at least 2 hours. Municipal crews can then sweep excess stones, and reopen the road lane to normal speeds.

Sources:

Martin, Tom. 2003. “Quality Assurance of Surface Treatments.” *Pothole Gazette*. Summer. IN LTAP.
NHDOT. 2002. *Standard Specifications for Road and Bridge Construction*.
<http://www.state.nh.us/dot/specifications/index.htm>

