

Chip Seals



A chip seal or seal coat is a single layer of asphalt binder covered by embedded aggregate (one-stone thick). Chip seals are the most often used preventative maintenance (PM) treatment. Effective on structurally sound pavements, they are popular because of low initial cost compared to thin asphalt overlays.

Chip seals seal the fine cracks in the pavement's surface and prevent water from getting into the subgrade and base. They prevent distresses resulting from oxidation as well as enhance skid resistance for vehicles.

Chip seals do not provide structural capacity to pavement. For badly cracked or weathered pavement surfaces, road managers should reconstruct, rehabilitate, or apply a conventional overlay.

PM is a proactive approach to preserve and extend a pavement's life. Its purpose is to maintain pavement before it develops major distresses. Therefore, to achieve the most benefit, cities and towns should apply a chip seal early in the pavement's life. It can be beneficial to apply three or four chip seals to a pavement before it reaches the end of its design life. This article will discuss the elements of a successful chip seal: weather, pavement preparation, application, rolling, and sweeping.

Elements of a Successful Chip Seal

Poor weather may cause newly constructed chip seals to fail. Ideally, weather will have low humidity, no wind, and sustained high temperatures. High humidity results in poor adhesion between the binder and the aggregate.

Warmer air temperatures create a better bond between the binder and aggregate, and the pavement surface. Pavement temperature affects the viscosity

of the binder and the speed at which it will set. It should be more than 70°F and less than 130°F.

Rain will cause chip seal failure. If unexpected rain occurs crews must immediately spread sufficient aggregate to cover the binder. If possible, they should close the road to traffic, or keep traffic speed low because adhesion between the binder and aggregate is at risk. They should reduce or stop the rolling while the aggregate is wet as the binder may be picked up on the wheels of the roller.

Pavement preparation is crucial for a good chip seal. A well-prepared pavement is uniformly textured and smooth, with only minor defects. To prepare the pavement surface for a chip seal

- Patch all holes and depressions,
- Fill and seal all cracks 6 to 12 months before the chip seal to allow sealant curing,
- Level all bumps, waves, and corrugations,
- Remove excess asphalt on patches and joints, and
- Broom the full surface width to be treated.

The distributor is an asphalt tank equipped with spraying equipment mounted on a truck chassis. Crews must calibrate the distributor for the specified transverse application rate. Many distributors have parallel spray bars (also called wheel-path bars) that enable variable spray rates across the lane. When temperature and humidity are ideal, the time between binder and aggregate applications should not exceed 3 minutes or 300 feet.

The aggregate spreader applies an even layer of aggregate across the full width of the binder. Self-propelled chip spreaders are necessary for larger-scale projects. Tailgate box spreaders are usually sufficient for spot (strip) sealing. Self-propelled spreaders give the operator more control to create a uniform spread of aggregate. The Tailgate box spreaders do not lay aggregate as smoothly and continuously.

Many spreaders are equipped with computerized controls that allow the gates to open and close hydraulically, which will compensate for varying spreader speeds. Some models have a vibratory hopper that further improves the uniformity of the discharge.

Dump trucks hitches must match the spreader so the dump truck bed will not damage the spreader's receiving hopper. This will also reduce spillage on the roadway. Sometimes, dump trucks or spreaders have aprons to control the dumping of aggregate into the spreader hopper.

In areas where extensive stopping and turning of traffic occurs, crews should apply some excess aggregate to reduce scuffing and rolling.

Rollers embed the aggregate into the binder and orient the chips so that maximum bonding occurs. Pneumatic (rubber-tired) roller weight provides the force needed to embed the aggregate firmly in the binder. To ensure good embedment and orientation, rolling should occur right after aggregate application.

Operators should roll at a speed that will not displace stone. They should make at least three passes to embed the aggregate into the binder.

Static steel-wheeled rollers have a smooth-surface steel drum. Agencies should use with caution because they can crush the aggregate. If used when the underlying pavement has ruts, the roller bridges over ruts and will not properly seat the aggregate in the wheelpaths.

Sweeping cleans the existing road surface and removes excess aggregate from constructed chip seals. Two types of sweepers are used in chip seal construction: rotary brooms and pickup or vacuum sweepers.

Rotary brooms remove excess aggregate from the chip seal surface without dislodging the embed-

ded particles. Too much downward pressure will cause the broom's bristles to remove the aggregate with a flicking action. Crews should use steel bristles prior to chip seal construction. After, plastic bristles are less likely to damage the new chip seal.

Rotary brooms move the excess aggregate to the roadside. They generate dust and may affect visibility for traffic. Usually the aggregate ends up back in the traveled way by either rain or vehicles using the shoulder for parking.

Pickup sweepers minimize dust and remove all excess aggregate from the project. A pickup sweeper features a broom that sweeps the aggregate to a suction head into a storage tank. Pickup sweepers are useful in urban areas to remove aggregate accumulating in gutters or along the roadway edge.

The recommendations in this article will provide a long lasting chip seal. Chip seals typically provide good performance on roads for 4 to 7 years. Chip seals done correctly reduce wind shield damage from kicked up stones, tire noise, prolonged traffic during construction, flushing, streaking due to non-uniform binder application, and premature failure.

Source:
http://trb.org/publications/nchrp/nchrp_syn_342.pdf, May 6, 2005
Participants Manual for Preventive Maintenance Treatments Workshop, UNH T² Center, November 1996



Photo:
Far left: Spray bar applying binder
Left: Aggregate spreader proximity of distributor