

Chip Seal Best Practices: Design-Construction-Inspection

Transportation agencies are using pavement preservation programs to more cost- effectively manage their pavement assets. Pavement preservation procedures have been in use for many years, but often agencies use the same pavement preservation terminology in different manners. The implementation of a pavement preservation program is good practice, as it focuses on maximizing the condition and life of a network of pavements while minimizing the network's life-cycle cost. The noted benefits of the use of a pavement preservation program vary from agency to agency, but have been documented as including:

- **Improved pavement performance**—preservation activities extend the performance of the pavement and help to improve the overall condition of the network, as illustrated in Figure 1.

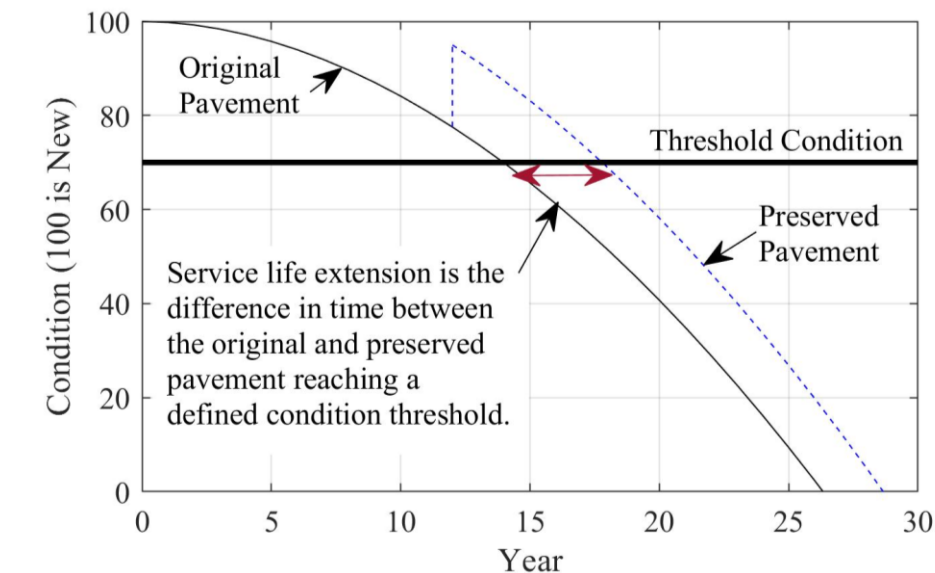


Figure 1. Illustration of Life Extension due to Preservation.

- **Higher customer satisfaction**—use of preservation activities can lead to smoother roads and fewer construction delays.
- **Cost savings**—less expensive treatments and the extension of service lives of pavements help to lower or stabilize operating costs.
- **Increased safety**—preventive maintenance treatments are designed to provide safer surfaces through improved pavement texture and surface drainage, and correction of safety related defects (e.g., ruts).

As a preventive maintenance treatment, chip seals offer superior pavement distress mitigation; retard the infiltration of water, snow and ice; and provide improved skid resistance when applied to the right pavement. Because the primary causes of chip seal failure are poor construction practices, good construction practices are essential to ensure success of a chip seal. A properly placed chip seal will extend a pavements life and the added benefits of a chip seal are:

- ♦ Service life of pavements in good condition will be extended

- ♦ Weathering and aging of the surface will be retarded
- ♦ Minor surface cracking will be sealed slowing the infiltration of moisture
- ♦ Skid resistance to the surface will be restored

The first step in the design of a chip seal is the selection of a pavement that is in a good condition and is structurally sound. The types of distresses that are present should be looked at very closely when deciding to schedule a chip seal a roadway. The overall design approach should look at the surface condition and texture when evaluating the roadway. The type of cracking should be minor transverse, block and fatigue cracking. If open cracks, potholes and areas of extensive fatigue cracking is present then crack sealing and repair of the pavement must be completed prior to placing the chip seal.



Not a Chip Seal Candidate



Not a Chip Seal Candidate



Good Chip Seal Candidate

The second step in the design is to decide on the make-up of the material in the project. Aggregate and Binder selection will be combination of the following:

- ♦ **Natural Aggregate / Pea Rock**
 - Easily Applied
 - Rounded Shape - Easily Dislodged
 - Stripped off During Snow Removal

- ♦ **Ledge Rock -Limestone**
 - May be soft and dusty
 - Fractured faces interlock
 - Provides great skid resistance
 - Improper Crushing creates Flat and Elongated Pieces
- ♦ **Ledge Rock - Quartzite Chips**
 - Moderately priced
 - Single sized stone
 - Fractured faces interlock
 - Provides great skid resistance
 - Loose stones can and will cause windshield damage operations
 - Improper Crushing creates Flat and Elongated Pieces
- ♦ **Cutbacks – Asphalt Binder and Petroleum Distillate**
 - MC-3000 – SD County work horse
 - More forgiving with dirty aggregate
 - Problems during damp conditions
 - Good storage life
- ♦ **Emulsion – Asphalt Binder, Water, and Emulsifier**
 - CRS-2P – Primarily Used in Eastern SD
 - AE-150S – Primarily Used in Western SD
 - Make sure its compatible with aggregate
 - Strength in hours instead of day
 - Clean aggregate a necessity with CRS-2P
 - Place aggregate within 1 minute
 - Safer to use –Low application temps
 - More environmentally friendly
 - Not as forgiving during application
- ♦ **What type of Rock and Binder Should I Use?**
 - Most of the time location will dictate what material is used
 - Don't just settle for cheapest material, look at life cycle cost - The lowest initial cost may not always be the lowest cost over the life of the pavement

Asphalt Surface
Treatment –
Quartzite Chips
With CRS-2P
Emulsion



Asphalt Surface
Treatment –
Natural
Aggregate With
CRS-2P
Emulsion



The third step is to put your bidding documents and specifications together either by you or with the assistance of a Consultant. This step is very important to getting a quality project built and consists of assembling the proper estimate of quantities, specifications, and rates of materials for your Contractor to follow. Setting up a good estimated rate of materials and specifications will provide you and the Contractor guidance to ensure that a quality project will be built. The rates of materials can be established from rates that was successfully placed on previous chip seal work. The specifications are very important and should include a requirement for the Contractor to do a preliminary chip seal design using **South Dakota DOT's Special Provision for Asphalt Surface Treatment Design** in the bidding documents. A County and Municipal version of this Special Provision is available from South Dakota LTAP for use in your plans. The design will ensure that the Contractor will be using an aggregate and binder that are compatible with each other or that the binder will adhere to the aggregate ensuring a successful chip seal. Here are pictures of materials that are compatible and not compatible with each other.



Not Compatible



Compatible

The fourth step after the successful bidder is selected is to do the verification of chip seal design work that the Contractor will submit to you prior to starting construction. When the Contractor submits the documentation of the chip seal design for verification then you should do a couple of things. First, use the chip gradation and quality elements of the chips provided by the Contractor and perform a design to see how they compare to those provided. An excel spreadsheet is available from South Dakota LTAP to perform this verification. Second, you should perform a Compatibility test on the two materials supplied to verify that they are compatible. South Dakota DOT Test Procedure **SD 322 Method of Test for Determining Compatibility of Cover Aggregates** should be used to determine the compatibility of the two materials.

The fifth step is the Construction of the chip seal. It is very important during this phase of the project to either hire a Consultant to do the construction inspection or it can be someone from your staff. The inspector should be responsible for ensuring that the requirements and specifications in the bidding documents are followed and thus ensuring a successful project. There is a Federal Highway Administration (FHWA) Checklist available for Chip Seals that may be obtained by contacting South Dakota LTAP or accessing the checklist at the FHWA following link: <https://www.fhwa.dot.gov/pavement/preservation/ppcl00.cfm>.

The following excerpts from the checklist detail some of the duties the inspector should be performing during construction:

- ♦ **Pre-Application Inspection Responsibilities**

- **Pavement Surface Preparation**

- ✓ The surface has been swept clean and is dry.
- ✓ All pavement distresses have been repaired.
- ✓ Cracks wider than ¼ in. have been filled or sealed.
- ✓ Raised pavement markers and thermoplastic markings have been removed.
- ✓ Temporary road markers have been placed on lane lines for delineation after chip sealing.
- ✓ Grass and weeds have been removed or destroyed by chemical herbicide. If an herbicide was used, approximately one to two weeks has been given to kill the vegetation before applying the chip seal.
- ✓ Utility castings have been protected with kraft paper or roofing felt to prevent coating the casting with asphalt. A temporary road marker has been placed on the protected cover to locate casting after chip sealing.
- ✓ Asphalt patches placed within six months have been fog sealed prior to chip sealing. The fog seal must be completely cured prior to chip seal construction.
- ✓ Review the existing surface for possible overspray by working irrigation systems during construction. Inspect the pavement for existing drainage issues from stormwater

- **Equipment Inspections**

- **All Equipment**

- ✓ All equipment meets manufacturer's standards.
- ✓ All equipment is free of any fluid leaks.
- ✓ All equipment is clean and properly calibrated.

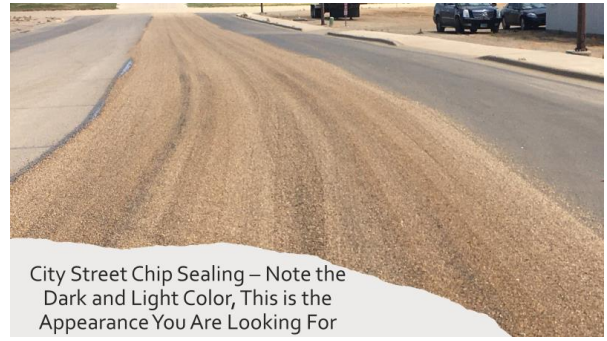
- **Distributor**

- ✓ All nozzles are uniformly angled 15° to 30° from the spray bar, as recommended by the manufacturer.
- ✓ All nozzles are free of clogs.
- ✓ Nozzles deviating more than 10% from the average flow rate should be replaced.
- ✓ The spray bar has been checked for constant pressure along the entire length.
- ✓ The thermometer for measuring temperatures of the asphalt emulsion in the tank has been checked for accuracy.
- ✓ The spray bar is at the proper height and the spray pattern has been checked for uniformity and triple overlap coverage.
- ✓ The distributor's application calibration has been checked.
- ✓ The ground speed computerized application control has been checked for providing a uniform application rate at different speeds.
- ✓ Annual certification of distributor, if required by the specification.

- ✓ Asphalt rubber and hot applied chip seals require distributors and transports to have heating capabilities, an internal mixing device in the tank, and appropriate pumps to handle the viscous asphalt.
- **Chip Spreader**
 - ✓ Gates are adjustable and each gate control and setting has been checked.
 - ✓ The roller is straight and not warped.
 - ✓ The scalping screen is in good condition.
 - ✓ The chip spreader's calibration across the entire chipper head has been checked for uniformity as specified or by ASTM standard.
 - ✓ The truck hookup hitches have been checked.
 - ✓ The truck release latch on the aggregate spreader is in working order.
 - ✓ The receiving hopper has no holes or large gaps that would allow aggregate to fall through.
 - ✓ The rubber shield on the receiving hopper should be in good condition and not torn or missing.
 - ✓ The conveyor belt system has a rubber, neoprene, or fabric cowling around it to prevent aggregate loss.
 - ✓ The conveyor belt is tight.
 - ✓ The aggregate spreader computer rate control has been checked for a uniform application rate at different speeds.
- **Haul Trucks**
 - ✓ The truck box is clean and free of debris and other deleterious materials.
 - ✓ The truck hookup hitch is in working order
 - ✓ If required, a truck box apron or extension for loading the chip spreader is in place to eliminate any spillage.
 - ✓ There are enough haul trucks on the project to keep up with the application rate of the aggregate spreader.
- **Rollers**
 - ✓ The pneumatic-tired roller is recommended for chip seals.
 - ✓ The roller tire size, rating, and pressure comply with the manufacturer's recommendations.
 - ✓ The tire pressure is the same on all tires.
 - ✓ All tires have a smooth surface.
 - ✓ A sufficient number of rollers are available that when placed in echelon can provide full lane coverage in each pass.
- **Sweepers**
 - ✓ Sweepers shall meet applicable U.S. Environmental Protection Agency standards.
 - ✓ The bristles are the proper length.
 - ✓ The broom can be adjusted vertically to avoid excess pressure.
 - ✓ The broom bristles should be made of nylon, fiber, or plastic (no metal).
 - ✓ Pickup sweepers should be used to remove excess aggregate once rolling is complete.



Asphalt Surface Treatment
– Working In A Municipality



City Street Chip Sealing – Note the
Dark and Light Color, This is the
Appearance You Are Looking For

A successful Chip Seal Project can be achieved by following the project specification requirements and the steps laid above. Following these requirements will lead to longer lasting and cost effective pavement preservation treatment for your entity. The following Final Tips will help ensure that you achieve a successful project:

Final Tips for Successful Seal Coats

- ✓ Make sure pavement is clean
- ✓ Place Chip Seals from Mid-May thru August for a Successful Project
 - A Pavement needs **160 Hours** of pavement temperatures exceeding **100 degrees** to effectively cure the chip seal
- ✓ Use Quality Materials
- ✓ Use a Proper Application Rate for the Binder
- ✓ Use a Proper Application Rate for the Aggregate
 - Excess Chips only Causes Failure and Leads to Waste
- ✓ Minimum distance between distributor & chip spreader
 - Aggregate must be placed before emulsion starts to break or cutbacks begin to cool and stiffen.
- ✓ Minimum of three rollers; Speed under 5 mph
 - Compaction must be completed before emulsion is broken or cutbacks cool and stiffen.
 - Rolling will drop the voids in the seal to @ 30% and achieve the 70% embedment needed for a successful project.
- ✓ Final sweeping of roadway as soon as possible.
 - No later than the cool of the next morning following placement.

⇒ **Remember That Details Count and Quality does not COST it**
PAYS

&

⇒ **Remember You Don't Get What You Spec, You Get
what You Inspect**