Montana Department of Transportation
Research Programs
June 2016

CONSTRUCTION REPORT – SITE EVALUATIONS

APPLICATION OF SEAL COAT ASPHALT EMULSION (OR FOG COATING) OVER EXISTING CHIP SEAL FOR IMPROVED CHIP RETENTION

Location: Missoula County, Junction of Beavertail Road and Cook Lane: Approximately 4.5 miles (7.2 Km) east on Beavertail

Project Name: Beavertail Road Chip Seal

Project Number: MT 10-05

Project Type: Chip Seal Enhancement: The use of an SS1 (Asphalt Emulsion) over an existing chip seal for the reduction of chip loss

Principal Investigator: Craig Abernathy, Experimental Program Manager

Date of Documentation: August-September 2011(installation) – 2012-2016 Annual Site Inspections

Objective

Determine the effectiveness and durability of applying a fog seal (SS1 asphalt emulsion) post chip seal with two varying rates of SS1 application in an effort to minimize chip loss.

Experimental Design

In May of 2011 District Maintenance applied and compacted asphalt cement (AC) millings to the 4.5 miles of the Beavertail frontage road.

Prior to the chip seal conducted in mid-August, a tack coat of SS1 at an estimated 0.05 gal/yd. was applied to the millings to tighten up the surface and limit the amount of oil necessary for proper embedment when chipping.

The experimental layout consisted of beginning approximately at mile point 1 and ending at mile point 2 (**Test Section 1/TS1**), with a post-chip fog seal application emulsified SS1 of .1 gallon per sq. yd. Switching at mile point 2 and ending at mile point 3 (**Test Section 2/TS2**), with an application rate of .05 gallon per sq. yd. The remaining eastern portion of the roadbed is considered the control (no treatment – conventional seal & cover).

Evaluation Process

Research will document the project to record a representative practice of activities during and up to the post SS1 application. The application will be documented with an emphasis to report on the practice and to determine if areas of placement conformed to proper application and to record those portions which may have not been placed correctly to delineate on site and as not to be included in the overall analysis. To date there has been no report to Research of any inconsistencies with construction of the project.

Research will inspect/evaluate the project at a minimum semi-annually (late fall/early spring) to document performance of the enhanced chip seal (more if there is an incident with the project that requires formal reporting).

All information pertaining to the performance of the chip seal (including official documentation by district personnel, anecdotal, etc.) will be included in the annual and final reports when made available. The first full project evaluation was conducted in the spring of 2012. All project information generated will be posted at: http://www.mdt.mt.gov/research/projects/seal_coat.shtml

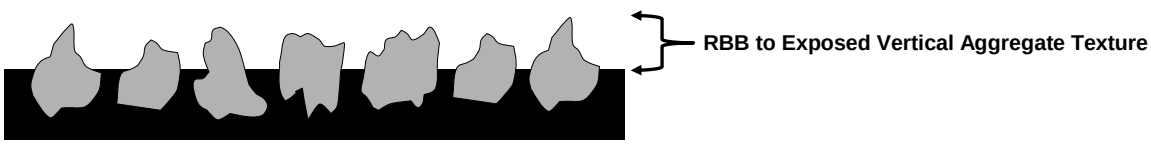
The purpose of an experimental features report is to document the phases and events of any given project to gain the reader an understanding of the general activities required to install or incorporate the research element into an active construction or maintenance project. This report also establishes a baseline for defining performance for any given feature under actual service conditions to determine its relative merits.

The following are representative images and comments of the project to date including pre chip seal condition, chip sealing, SS1 post chip seal application and a site visits in mid-November 2011, March 2012 and April 2013, 2014 & 2015, and June 2016.

Analysis

April 2014: Due to traffic, environment aspects, and plowing all sections of the project (generally) have a uniform appearance. Visually (after three seasons since placement) no visual distress relating to chip seal efficacy on sections TS1, TS2 and the control is apparent to date. Due to the minimum annual daily traffic (ADT) and infrequent winter plowing it may take several more seasons to establish the variance of performance regarding the test sections.

The images on page twenty-two (22) of the report attempts to show the average texture of embedded chip within the residual bitumen binder (RBB) on each of the test sections and control. The level of objective relief (the visual appearance of the ratio of binder to the exposed vertical area of the aggregate - example a seen in diagram below) is lesser in TS1, more apparent in TS2; and greater relief in the control. Basically stating (per visual observation); TS1 may have a tighter bond with the RBB.



April 2015: As stated in April 2014 site visit due to minimum ADT and snow plow activities all sections are in good shape. No visible flushing observed. Raveling or shelling (loss of aggregates), is also minimum. Some areas of pavement show plow scrapes mainly at exposed high spots. Texture depth (through random inspections on all sections) appears denser with TS1, with sections TS2 and control fairly close in comparison. Binder integrity intact with all sections.

The April 2015 documentation begins on page twenty-five (25).

June 2016: Since installation in fall of 2011 semi-annual inspection have taken place with accumulative reporting on an annual basis. At this point it is inclusive to state which section is performing better than others.

Chip retention is tight on all areas of the project. Due to minimum daily traffic and equally low frequency of snow plow activities it may take several more seasons to determine a level of comparison. It is suggested that Research staff inspect the site in 2018 to determine documentation of the chip integrity is warranted or to wait another several more seasons.

August 2011: Pre-Chip Seal

⬆ Above image shows roadway with the compacted millings laid down in May of 2011.

This shot taken at the junction of Beavertail Rd. and Cook Ln., looking east at approximately mile point one.

⬅ Close-up of pavement surface.

August 2011: Chip Seal

🡅 Above image shows roadway with applied tack coat prior to chip seal looking east. The tack was allowed to set for several days prior to chipping.

🡄 Tack coat close-up.

⬆ Application of AC emulsion at approximately 150°F (66°C).

⬇ Application of chips.

Completed chip seal.

Close-up of pavement surface.

🡅 Beginning of the Test Section 1 run of the SS1 at .1 gallon per sq. yd. concentration.

🡇 Completed Section1.

↑↓ Several close-up images of the Section 1, SS1 application directly after placement.

⬆⬇ Images of the Test Section 2 application, (SS1 .05 gallon per sq. yd.). Both views looking west.

Several close-up images of the Section 2, SS1 application.

View of the Test Sections 1 & 2 transition at mile marker 2, view west.

November 2011 Site Inspection

⬆ View east of Test Section 1 at beginning of application, mile point 1.

⬇ View west of Test Section 2 at end of application, mile point 3.

⬆ Closer view of pavement texture of Test Section 1.

⬇ Closer view of pavement texture of Test Section 2.

⬆ Close-up of chipped surface of Test Section 1.

During the initial placement in August, and compared with the site visit conducted in November, the residual AC (locally specific to the top exposed aggregate), is beginning to display minor stripping due to either environmental elements, traffic to date, or a combination of both. This is considered normal and visually the road surface will lighten or become grayer over time.

Upon close examination of chip embedment with the AC as compared to the project control (section of the east end of the road which did not receive the post seal) the amount of AC that encompassed the test section aggregate was more prevalent than the control, and homogeneous penetration with the initial SS1 application (prior to chipping) and the post SS1 application. This was determined by using a small hand chisel to remove a small area of the seal to expose the relief.

To date the topical application of the SS1 (or fog seal) appears to have efficiently locked in the chips than compared to the control which may promote a more durable seal. Future evaluations will determine if this supposition is valid.

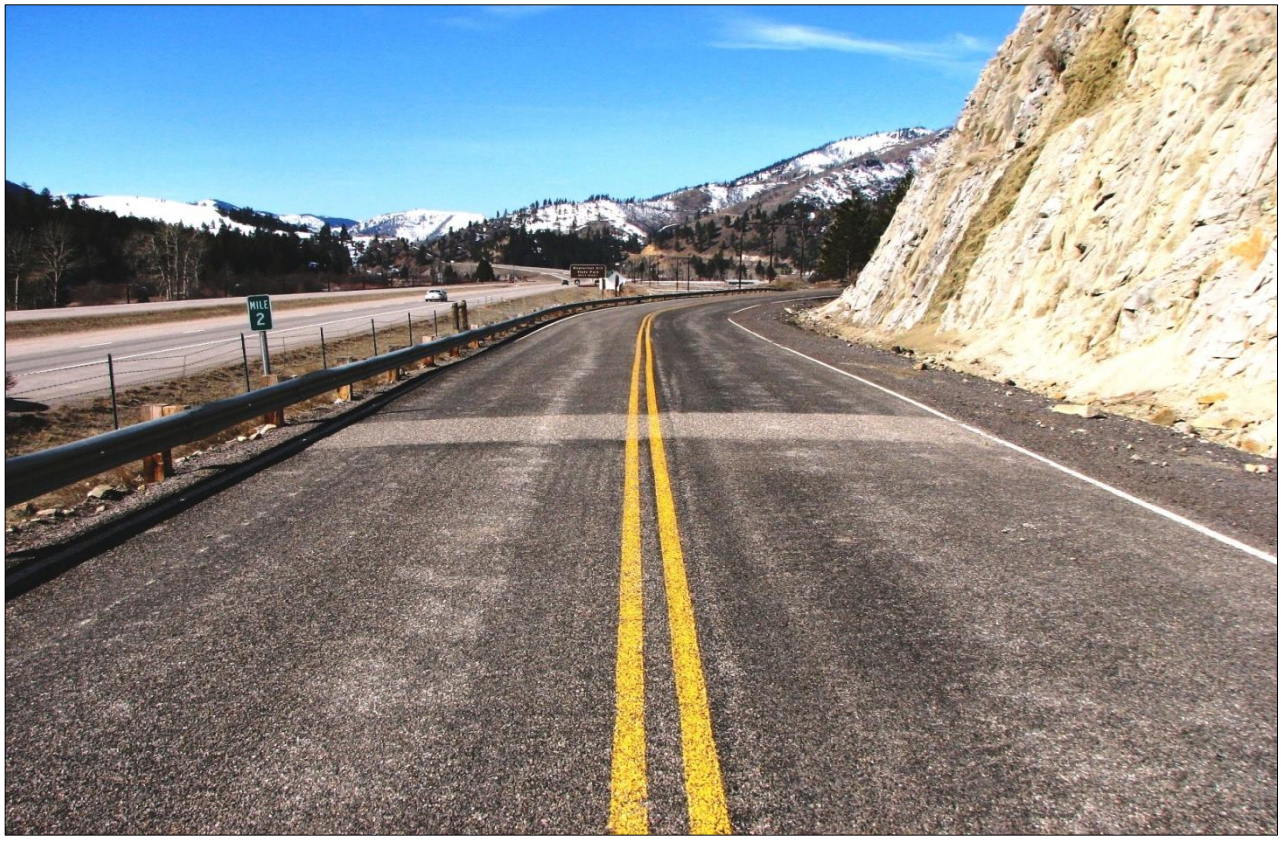
March 2012 Site Inspection

⬆ Test Section 1: SS1 of .1 gallon per sq. yd. – Mile point 1 looking east.

⬇ Test Section 2: SS1 of .05 gallon per sq. yd. – Mile point 3 looking west.

🡅 Control Section: Conventional Chip Seal – Mile point 3 looking east.

🡇 Separation of test sections 1 & 2 – Mile point 2 looking west.



← Control section close-up of surface aggregate.

← Test section 1 close-up of surface aggregate.

← Test section 2 close-up of surface aggregate.

⬆ The spotty appearance (lighter shading) of the road bed is predominant on all sections of the project including the control, but not as visible due to the lack of SS1 application. This condition primarily is located away from the wheel paths. This may indicate minor rutting. The lighter areas indicate possible snow plow chatter and the subsequent scouring of the top of the chip seal layer.

➔ On closer inspection these areas appear to have loss the topical application of SS1 and some minimum removal of higher relief chips.

During the site visit at random spots along all three sections, a broom was used to determine if it could indicate a level of loose chips at any section. Although highly subjective; test sections 1 & 2 had about the same level of detached chips which was minimum as compared with the control section with noticeable (but minor) added chip loss. Also noted that there seemed to be very little perceptible sanding material on the pavement surface in all sections.

Maintenance personnel has reported that due to a mild winter season an estimated 40-45 snow-plow passes were performed through the 2011/2012 season. Drivers have indicated they have not noticed any appreciable difference between sections with chip loss to date.

April 2013 Site Inspection

⬅ Transition of control section and TS2 at mile post 3; view west.

⬅ Transition of TS2 and TS1 at mile post 2; view west.

⬅ Beginning of TS1 at mile post 1; view east.

← Control section close-up of surface aggregate.

← Test section 2 (.05 gallon per sq. yd.), close-up of surface aggregate.

← Test section 1 (.1 gallon per sq. yd.), close-up of surface aggregate.

In comparing all three treatments, TS1 appears to have a tighter mat, rock embedment is firm and the SS1 application is evident.

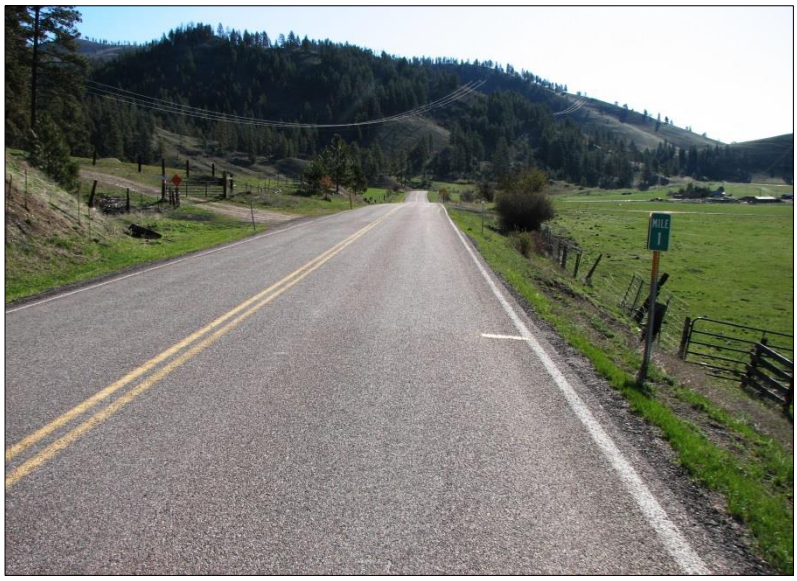
April 2014 Site Inspection- Close-up of Chip Embedment

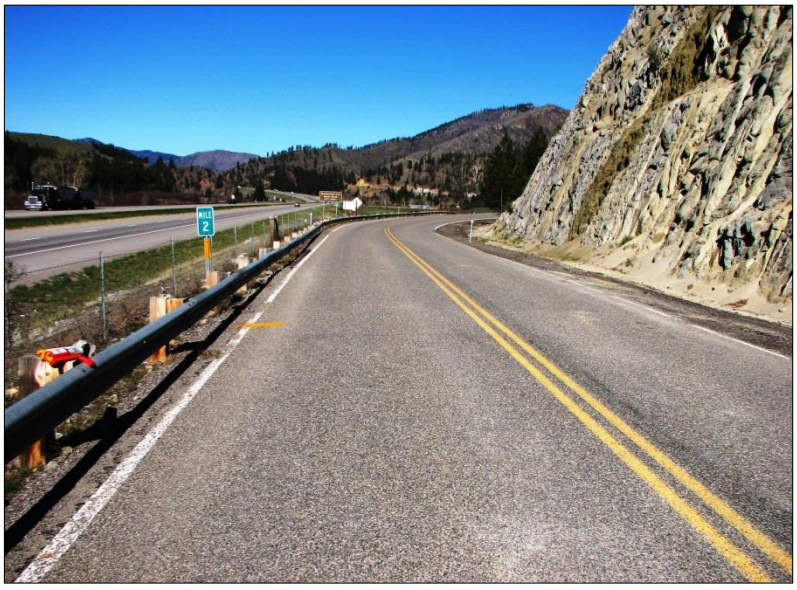
🡅 Section TS1 (.1 gallon per sq. yd.) close-up of surface aggregate.

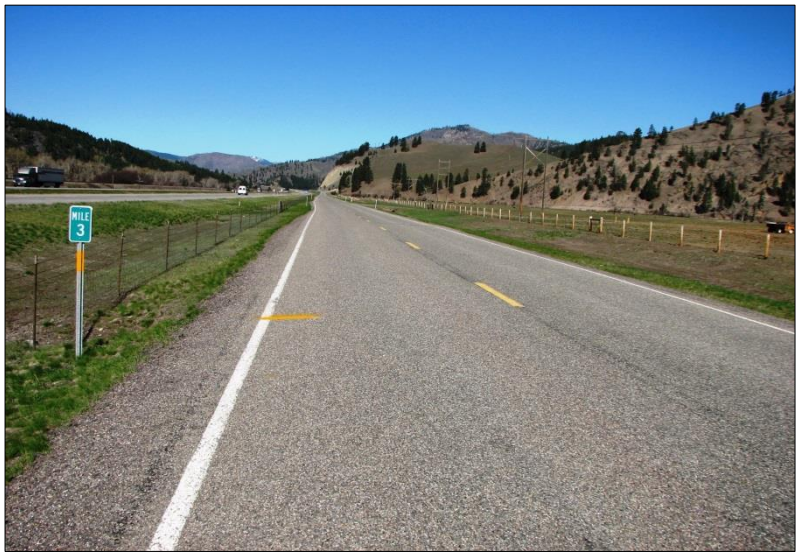
🡇 Section TS2 (.05 gallon per sq. yd.) close-up of surface aggregate.

Control Section: close-up of surface aggregate.

April 2015 Site Inspection







⬅ ⬇ Project sections at transition sites.

-Milepost 1: Beginning of TS1, view east.

-Middle image: Milepost 2, transition of TS2 & TS1; view west.

-Lower image: Milepost 3, transition of control and TS2; view west.

At this date all sections have uniform appearance in visual consistency.

← Test section 1 (.1 gallon per sq. yd.), general appearance.

← Test section 2 (.05 gallon per sq. yd.), general appearance.

← Control section, general appearance

← Test section 1 (.1 gallon per sq. yd.), close-up of surface aggregate.

← Test section 2 (.05 gallon per sq. yd.), close-up of surface aggregate.

← Control section close-up of surface aggregate.

In comparing all three treatments, although subjective; **TS1** appears to have a tighter texture, rock embedment is firm. **TS2** also exhibits a tight mat however displays a slightly higher relief of exposed aggregate to binder as does the control.

June 2016 Site Inspection

← Test section 1 (.1 gallon per sq. yd.), close-up of surface aggregate.

← Test section 2 (.05 gallon per sq. yd.), close-up of surface aggregate.

← Control section close-up of surface aggregate.

In comparing all three treatments, although subjective; all treatments are in good visual shape with minimum aggregate loss to report to date.