Geosynthetic-Reinforced Double Chip Seal Tames Troubled Streets

By Norman "Skip" Brown

Delta places a 4.1 oz. pavement fabric into a hot oil binder, followed by pneumatic rolling

In 2008, the City of Williams, Calif., a had a problem: How to prudently spend money (from State Proposition 1B) that was earmarked for streets and roads.

A considerable portion of city streets was in poor condition due to a lack of funding for maintenance on decades-old pavement situated over clay, with free water no more than 24-36 in. below surface. This lack of adequate structure on the saturated clay had resulted in heavily cracked and deteriorated asphalt streets.

The City of Williams responded by issuing a contract for chip sealing and hot mix asphalt (HMA) overlays on fabric. Gutters were to be matched by key-cut, cold plane grinding on the HMA portion.

Delta Construction Company, Inc. was the low bidder for the project, which involved repair of 33,000 sq. yd. of pavement. As president and owner of this over-65-year-old family business, I was concerned that this grind/overlay would fail the existing pavement, and the project as designed could not successfully be constructed due to an obvious lack of competency of the existing subsurface structure.

Removing portions of the existing asphalt surface by grinding on failed pavement where there is "no bottom" could result in huge

After five years, pavement is intact (compare to same location in photo Page 19)

expenses to attempt to stabilize the subgrade if equipment fell through. This proved to be correct as one truck subsequently fell through the existing surface while implementing a different process.

Subgrade failure then could also result in serious issues with underground utilities. It became obvious that we needed to leave whatever was there alone and build on top with a flexible surface that would take movement under traffic loading without cracking. The contractor, Delta, proposed a double-chip seal process it had been developing over the past 25 years that clearly represented "out of the box" thinking.

Subgrade in Williams so saturated that trucks could not negotiate streets

BREAKING THE SPEC

This double-chip seal process is called a *Geosynthetic Reinforced Chip Seal* (GRCS), a surface treatment using the standard pavement fabric under a double chip seal. This highly flexible surface wears well under traffic and has proven to preclude over 90 percent of reflective cracking for over 20 years. The method used at Williams was the same used by Delta for over 25 years in northern California and Nevada.

GRCS will not "improve the ride" of existing pavement. It applies an even thickness throughout. If there are potholes or depressions, they should be filled with HMA prior to the installation of the GRCS.

If the failed asphalt was not vertically deflecting under loads both down and up, Delta did not remove it. Where the traveling surface was too irregular to leave as is, a thin blanket overlay was placed with HMA to build a better ride and provide a smoother surface on which to place the surface treatment.

Following this HMA "skin patching," Delta filled all existing cracks wider and deeper than 1/4-in. The preferred material is a hot-pour, polymer modified asphalt sealant. Any cracks already filled were not addressed unless the "fill" consisted of weeds. The main reason to fill the cracks is to ensure the fabric binder is available to saturate the fabric and not disappear down the crack.

Next, Delta placed a 4.1 oz. pavement fabric into a hot oil binder followed by pneumatic rolling.

Delta prefers to use PG 70-10 binder below 4,000 ft. in elevation, and PG 64-10 or PG 64-16 above that elevation, unless in desert areas, where it's best to stay with PG 70-10. Although typical fabric applications under HMA overlays usually specify 0.22-0.26 gal. per sq. yd. (G/SY) of binder, this process demands much more. I typically recommend 0.30-0.40 G/SY, depending on a number different conditions, including type of fabric applicator used, pavement texture, amount of cracking, ambient temperatures, future traffic loading and contractor ability to provide full saturation of the fabric by the binder. The Williams project was shot at a range of 0.30-0.33 G/SY.

FULL SATURATION OF FABRIC

Fabric placed under HMA should always be "fully saturated." This has not been an issue under HMA overlays, as the hot asphalt placed on top of newly installed fabric will draw the binder up through the fabric and "saturation" will not be an issue when proper amounts of binder are present.

That may change under the new warm mix asphalt (WMA) processes now becoming popular, as the fabric manufacturers are now recommending rolling the fabric with pneumatic tired rollers prior to WMA overlays.

This complete saturation is mandatory under chip seals. If the fabric is not completely saturated with the hot asphalt binder, some of the following application of PMCRS-2h emulsion binder for the chips will be absorbed into the fabric, resulting in the loss of the necessary film thickness to properly hold the chips. The addition of extra binder along with the use of pneumatic rollers working closely behind the fabric laydown machinery will achieve this best. Several passes of these rollers are necessary while periodically using a "parting agent" (sparingly) on the roller tires to prevent adherence to the surfacing binder.

Longitudinal joints were lapped 1 to 3 in., and transverse joints were butt joints. On streets with a painted center line, temporary raised markers were installed on top of the fabric. To assist them in holding their position under traffic, they were nailed down through large washers.

The fabric was then evenly sanded at a rate of 2 to 3 lbs. per sq. yd., and re-rolled for a minimum of one complete coverage.

SANDING MANDATORY

Sanding is mandatory prior to allowing any public traffic on the fabric. This sand remained in place until immediately prior to the application of binder for the chips. All loose sand was then swept clean prior this application. Only brooms with nylon bristles were used. Excess pieces of fabric not attached to the binder were trimmed off.

The first of two chip seal applications was performed within 72 hours of the placement of the fabric. The bituminous binder used for the chip seal was polymer modified PM CRS-2h. The application rate used was 0.32 G/SY over the installed fabric. The determination of application rate depends on the relative success of complete saturation of the fabric into the paving asphalt (fabric inadequately saturated will need more binder) and the nominal height of the chips used. 3/8 x No. 6 chips were placed at the rate of 22 to 24 lbs. per sq. yd. using a self-propelled spreader.

Three pneumatic tired rollers were used to set the chips. Five coverages were maintained at a maximum roller speed of 5 mph. Cul-de-sacs, dead end streets, bicycle lanes or parking areas along roads wider than 26 ft. received an additional five coverages. The reason for this is to help compensate for the lack of traffic on these surfaces prior to sweeping.

The second chip seal was placed within 48 hours of the first chip seal on most of the streets. Loose chips were swept off with brooms using only nylon bristles prior to the application of the emulsion. The same emulsion used on the first application above was applied at a rate of .38 G/SY. 5/16 x No. 8 chips were then placed at a rate of 22 lbs. per sq. yd. Rolling then proceeded as described above.

Initial sweeping was delayed for three days to allow traffic to continue to "set" the chips. Final sweeping

Where the traveling surface was too irregular to leave as is, a thin blanket overlay was placed with HMA ahead of surface treatment

was performed three weeks after the initial sweeping.

FIVE-YEAR RESULTS

The five-year results speak for themselves. Due to the savings of placing a GRCS in lieu of a HMA overlay on fabric, the contract was increased from 33,000 to 56,000 sq. yd. for the same price. The city was so impressed with the initial procedures and results it increased the project to 75,000 sq. yd. After five years, the 75,000 sq. yd. placed are functioning well without any major failures.

In December of 2008, Delta received an award from the California Chip Seal Association for the annual *Chip Seal Innovation Project of the Year.* For more information on this project, visit Delta's website at www.DeltaConstructionInc.com.

Delta has been performing this GRCS process for 30 years to-date. Projects have ranged from Clear Lake, California to Lake Tahoe, Nev. (at 6,000 feet in elevation) on pavements that were reaching the "end of their useful life" and were scheduled for complete replacement.

GRCS has extended this "useful life" to a point yet unknown at a cost representing around 10 percent of replacement and 40 percent of the typical fabric/HMA overlay now used.

Additionally, due to the total lack of voids allowing air and water into the surface, subgrades dry up and pavement oxidation consequences are reduced dramatically. The subgrade then regains strength to carry the traffic loads. The high amount of binder (16-18 percent by total weight of the process) allows a surface that survives for decades without additional sealing.

Preservation treatments are best applied when pavements are in serviceable condition. Opinions expressed are those of the author. Brown is affiliated with Asphalt Consulting Services, Sacramento.