

Ceramic Aggregate Cuts Kansas Road Costs

Chip seal material weighs less and doesn't damage vehicle windshields or paint.

PROJECT CHALLENGES

1. The Kansas DOT needed a low-cost bituminous surface treatment for a 41-mile, two-lane state road.

2. Road configurations limited dumping areas for aggregate storage.

3. The DOT wanted a treatment that would last more than five years.

4. Natural aggregates, if used, meant expensive trucking costs.



Pavement on right, four-days old; on left, one-hour old.

Due to the unusual configuration of the 41-mile maintenance project, which includes portions of State Highway 15 and federal highways in Cowley County, Kansas, there were only two staging areas where Chandler's Lite-Wate aggregate was stored. The 5,542 cubic yards of aggregate was delivered during January and February of 2002, but not installed until August. The amount required by the Kansas Department of Transportation was 5,527 cubic yards. Hi-Plains Sand Company only had a small amount left over, so the quantities turned out to be on target. KDOT often purchases materials in advance of the paving season, so suppliers will not run short during the critical summer months, when the demand is sometimes higher than the producer's screening capacity.

Bob Wacker at Hi-Plains Sand chose to use expanded shale, clay, and slate instead of heavier natural aggregates. ESCS is cost effective and provides the following:

1. Excellent performance.
2. Reduced windshield damage claims.
3. Reduced trucking costs.
4. Better bonding to asphalt emulsion.
5. Less dust.
6. Better skid resistance.

Several state DOTs, counties, and cities are specifying lightweight chip seal made with ESCS lightweight ceramic aggregate which meets the requirements of ASTM D1139 for these same reasons.

On site

Chip seal paving in Kansas generally bids from \$0.80 to \$1.15 per square yard. The longevity of this surface protection paving method is considered to be four to five years or longer, according to Wacker. KDOT reports this service life is quite cost effective.

Dennis Weinrich, assistant bureau chief, Bureau of Construction and Maintenance for KDOT in Topeka, said the four to five-year schedule is common for higher volume highways. The chip seal is expected to extend the life of the higher volume road surfaces until major renovation of the road is needed. For low volume roads, six or more years may be expected.



Traffic following a flag car on the left. Road on right has been rolled and broomed, is two-hours old, and about ready for traffic. (Inset) a close up one-hour old.

In Cowley County, the application rate of Lite-Wate aggregate was 120 square yards per cubic yard of expanded shale, clay, and slate. The application rate of the CRS-1HP Asphalt Emulsion provided by Koch Pavement Solutions of El Dorado, Kansas was 0.375 gallons per square yard on most of the project. Where the road was not thirsty, as little as 0.35 gallons per square yard was used.

Up to 10 tankers of asphalt emulsion per day were consumed due to the skilled personnel and the equipment used on this project. The equipment was state-of-the-art, and was designed for the most uniform application of both emulsion and chips.

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Due to the fact that ESCS is about half the unit weight of limestone or gravel, it does not chip windshields or paint. Years ago, KDOT allowed ESCS as an option to natural aggregates. Hi-Plains Sand chose to use Buildex rotary-kiln produced lightweight ceramic aggregate instead of limestone or gravel. This stopped the constant harassment of windshield damage

claims.

The typical 25-ton trailer can haul a minimum of 36 cubic yards (depending on density) of ESCS to a dump site. The same trailer, by comparison, can only haul 19 cubic yards of limestone, or 18 cubic yards of some types of gravels.

The same advantage exists for the smaller dump trucks that deliver from the dump site to a chip-spreading machine.

Fewer dump trucks and fewer drivers are required. This provides a major savings in the in-place cost. For example, to transport 5,542 cubic yards of lightweight aggregate from the plant to the dump site, 154 trucks are required. To deliver the same

quantity of normal weight aggregate would require 307 trucks. The use of about half the number of trucks provides a safer construction project with less air pollution, and results in a measurable environmental significance.

On the site, emulsions bonded tightly to ESCS because of the unique surface texture, plus the ionic attraction. An ESCS particle

has more than a 95% retention over the timed boiling in water, while the limestones have a retention rate much lower, often around 70%.

ESCS is essentially dustless, which provided more on-site advantages. If fines are present, they do not bond to the surface of the aggregate particles, and tend to wash away in the stockpile during rainstorms. Surface moisture on the ESCS does not interfere with the asphalt emulsion/aggregate bond.

ESCS pavement does not polish with time and wear, and therefore, maintains most of its original skid resistance even when wet. This has been shown in many tests, including a study published by KDOT.

Cost savings are important, too. Vance Brothers Manager, Gary Lyons, states that the haul from dump site to the chip spreader should be figured into any cost difference between natural aggregates and ESCS. Because there are considerably fewer back and forth trips with ESCS, the cost savings of this haul is typically \$0.04 per square yard installed.

In Kansas, Koch Pavement Solutions and Vance Brothers of Kansas City provided the hi-tech CRS-1HP asphalt emulsion designed for chip seal paving speci-

WORK BOOK

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fied by the state.

Smaller chips are part of the KDOT specification:

0.5 inch0 to 5% retained.

0.375 inch . . .0 to 15% retained.

#470 to 100% retained.

#890 to 100% retained.

#200Maximum 2% passing.

Any aggregate bonds best when it has less than 2% dust.

This smaller size chip provided a quieter road surface, and used

less asphalt emulsion than the larger size chips. The larger size will use an average of 0.40 gallons per square yard. There is no loss of pavement performance when using the smaller size, as demonstrated in Kansas. **BR**

PROJECT SOLUTIONS

1. The supplier picked Lite-Wate ceramic aggregates, an expanded shale, clay, and slate chip seal material.

2. More than 5,540 cubic yards of aggregate were delivered about six months prior to the project.

3. Chip seal with ESCS should have a six-year life.

4. About half the trucking was needed to deliver the light-weight aggregate compared to heavier natural aggregates.



Surface moisture on just-laid Lite-Wate, one-hour old, above, has lost its surface moisture.

Bill Martin, P.E., represents the Expanded Shale, Clay, and Slate Institute in Salt Lake City, Utah.

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