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TranSafety, Inc.
1-800-777-2338
(U.S. and Canada)
(360) 683-6276
Fax: (360) 683-6719
info@usroads.com

Dust: Don't Eat It! Control It!

(This article is reproduced with permission from the Rhode Island Technology Transfer Center. The article appeared in the spring 1995 issue of "Link'n Node Notes.")

When you see dust coming up from your roads, you're really seeing dollars thrown to the wind. Road dust is made up of fine particles that are important to the stability of the road. These fines are small enough to pass through a No. 200 sieve and feel like powder when rubbed between your fingers. When fines blow away, the gravel road begins to break down. Traffic scatters the coarser aggregate, causing potholes, ruts, washboards, loss of profile, loss of ditch lines, and other problems. Wetting the road surface helps to keep dust-related problems in check. Moisture helps fines adhere to each other and to aggregates, allowing for optimum compaction. The trick is to keep the road moist. There are several ways to do it.

Calcium Chloride. What Is It?

Calcium chloride absorbs water vapor from the air and liquid water from the road bed. At 77 F and 75% humidity, for example, it absorbs more than twice its weight in water. In addition, calcium chloride solutions attract more moisture to the road than they give up in evaporation.

The road remains dense and compact under almost any level of traffic because calcium chloride keeps materials on the road by keeping moisture in the road, even under a burning sun on a sweltering day.

Calcium chloride is generally sprayed as a 35% solution using a tank truck with a rear- mounted distribution bar that spreads the liquid evenly over the road. One pass will cover an 8- to 12-foot-wide road. Two passes are needed on roads 16 to 18 feet wide.

As soon as calcium chloride enters a road, it's attracted to negatively charged soil particles, such as clays, which help resist leaching. Calcium chloride may move deeper into the base during wet weather but will rise toward the surface during dry spells.

Road projects and engineering studies have shown that using calcium chloride reduces the replacement cost of gravel and other materials up to 80%, as well as cuts grading costs as much at 50%.

An unpaved road stabilized with calcium chloride retains a smooth dustless surface. The moisture retained keeps the surface plastic enough so fines can migrate into gaps formed between aggregates under the varying pressure of car and truck traffic. In short, calcium chloride does the following:

- reduces the amount of gravel needed in construction and maintenance
- extends the service life of the gravel-wearing course, decreasing blading and shaping
- serves as a viable cost-effective alternative to an asphalt surface treatment
- controls dust and reinforces stabilization
- helps improve roads when used over time.

User Reports

Brian Barden, road agent for Dublin, New Hampshire, applies 6,000 gallons of calcium chloride annually on 8 of his 18 miles of dirt roads. He says the investment has paid off.

"The roads require less preparation and maintenance compared to when I used nothing at all," he reports. "They harden up so well that I only grade them once or twice a year compared to four times without the calcium chloride."

In New Boston, New Hampshire, road agent Lee Murray first used liquid calcium chloride last year and reports the same results. Mr. Murray applied 3,000 gallon of the 35% solution to treat 3 to 4 miles, primarily in front of homes and on steep grades. "The calcium chloride cut grading by two thirds in the areas where it was applied. That alone makes the stuff valuable."

Joseph Tani, director of highways for Newtown, Connecticut, had been using road oil to try to control dust. After laying down 20,000 gallons of calcium chloride on the town's major unpaved roads, he found that it not only effectively held down the dust and was cheaper than oil, but did much more.

With the oil, the roads were graded up to 5 times during the summer, compared to 3 times with calcium chloride. This cut wear and tear on the grader nearly in half and reduced the use of gravel by a third.

Their preparation for the summer months now begins in April, when the road crew grades the roads, pulls aggregates in from the shoulder, and crowns the roads to allow drainage. The highway department has its own spray truck, which applied a 35% calcium chloride solution immediately after grading so traffic doesn't degrade the road surface. The spray truck lays down the solution at approximately 0.3 to 0.5 gallon per square yard. "I couldn't believe how hard the roads set up with the calcium chloride," said Mr. Tami.

Lignin Sulfonate. What Is It?

Lignin sulfonate is the glue that holds three rings together. It's been used for 60 years to control dust and stabilize gravel on unpaved roads. For dust control, you can spray it on the surface. For stabilization and dust control, it's better to mix it with the top few inches of road surface. It's water soluble, environmentally friendly, easy to handle and apply, and very cost-effective.

The benefits include increased load-bearing capacity (similar to a 3-inch layer of asphalt concrete), a firmer road surface without loose gravel, dust abatement, reduced frost-heave damage, and cost-savings in both construction and maintenance.

The surface will still develop potholes, and you'll need to scrape off and remix the top layer after a few months, but by all accounts, maintenance procedures can be significantly reduced.

User Reports

Duane McPherson, President of the Spring Creek, Nevada, Homeowners Association, tried it. "The road's top 4 inches of gravel first were graded up and centered in the road (windrowed). The gravel was then respread 1 inch at a time, being sprayed with chemical at each stage." It took about 3 weeks for the road to cure and harden. The lignin sulfonate cost $8,000 for 1 mile of road. Chip sealing would have cost about $67,000, and asphalt between $80,000 and $100,000. "We were having to grade this once a week or people couldn't drive on it. Now we haven't touched it in four months. In our second year, the roads are better than in the first year because they've had a full year of seasons to set up." Mr. McPherson, like the supplier, emphasizes that planning and maintenance are crucial to the successful life of a lignin sulfonate project. This isn't a throw-and-go project.

Bill Graunke, assistant district Engineer for Tonopah, Nevada, tried out lignin sulfonate on a 7.5-mile-long gravel road. His crew had a good supply of Type 2 gravel on hand and used it to form a windrow down the center. Then, a mile at a time, they spread 1 to 2 inches of gravel from the windrow into the road. They wet this down with water brought by water trucks. Then they applied lignin sulfonate. The process was repeated to a thickness of 4 inches. While the binder was still moist, they compressed it with a steel drum vibratory roller. The next day, they applied water and rolled the road again. Compaction achieved, they applied a seal coat of lignin sulfonate. It's crucial to enable the lignin sulfonate to penetrate to the needed depth. This project used 630,000 gallons and kept three water trucks busy. The cost per mile was $28,500. Clearly this isn't a temporary fix. But it's less than half the cost of asphalt paving, and almost half of the cost was for the gravel. In the future, they plan to apply a chip seal. To talk to Bill Graunke about the project, call him at (702) 482-6475.

Sugar Beet Extract

On June 26, 1992, Milan Levett, the road supervisor in Marshall City, Indiana, and the current president of the Indiana Association of County Highway Supervisors, tested a new product called Molex on several country roads.

Mr. Levett thinks Molex could replace calcium chloride as a dust control agent. Molex is a concentrated liquid extract of beet molasses produced by Savannah Foods of Fremont, Ohio.

Molex is very hygroscopic (attaches to and holds water), has a high level of potassium chloride (which can replace calcium chloride), has a near neutral pH level (so shouldn't be corrosive), and doesn't freeze, even at -16 F.

So far, the dust control has worked as well as with calcium chloride, at half the cost.

For more information on Molex, the result of the road tests, or the application rates used, call Milan Levett at (219) 936-2181.

SOURCE: *The Roadster, Spring 1995, the Virginia Transportation Technology Transfer Center. Adapted from HERPICC Pothole Gazette, September 1992, Indiana Technology Transfer Center; Nevada Milepost, Summer 1993, April 1994, Nevada Technology Transfer Center; Road Business, Vol. 8, No. 1, 1993, New Hampshire Technology Transfer Center; and Alabama Transportation Newsletter, Vol. 11, No. 3, Alabama Technology Transfer Program.*

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