Section IV: Dust Control and Stabilization

All gravel roads will give off dust under traffic. After all, they are unpaved roads that typically serve a low volume of traffic, and dust is usually an inherent problem. The amount of dust that a gravel road produces varies greatly. In areas of the country that receive a high amount of moisture, the problem is greatly reduced. Arid or semi-arid regions such as the desert southwest and much of the great plains region in the USA are prone to long periods of dry weather. Similar regions around the globe can have similar weather patterns. Dust can really bring complaints in these areas if there are residences located near the road and traffic is high.

The quality and type of gravel also has some effect on the amount of dust. Some limestone gravels can dust severely while some glacial deposits of gravel with a portion of highly plastic clay can take on a strong binding characteristic that will resist dusting remarkably well. Still, in prolonged dry weather, there will be dust! Whether to provide some type of dust control or not can be a hard decision to make. Virtually all methods of dust control require annual treatment.

The cost can be prohibitive if traffic volume is low. On the other hand, if traffic is high, the cost of dust control can more than pay for itself with the benefits of reduced material loss and reduced need for blade maintenance. (28) At this point, many agencies will face pressure to pave the road. It may actually be a good economic decision in the long run, especially if there is good indication that traffic will continue to increase in the future. However, never pave a road before it is ready! There is good information on making this decision in Appendix D.

Types of Stabilizers

Chlorides
These are the most commonly used products across the country. They fall into three categories: Calcium Chloride in flake or liquid form, Magnesium Chloride generally in liquid form, and Sodium Chloride (road salt). Sodium is seldom used and is the least effective. Calcium and Magnesium Chloride can be very effective if used properly. They are hygroscopic products which, in simplest terms, means they draw moisture from the air and keep the road surface constantly damp. They are reasonably simple to use.

Resins
These are products available under various commercial names. The basic composition is lignin sulfonate which is a by-product of the pulp milling industry. The product is sometimes called “tree sap” in the field. These products work best when incorporated into the surface gravel. They then provide cohesion to bind the soil particles together.

Natural Clays
Some regions of the country have excellent deposits of natural clay that
are highly plastic and provide strong cohesion when added in the right quantity to gravel. However, in prolonged dry weather, these roads will seldom be completely dust free. It can be difficult as well to haul the clay onto the road and mix it into the gravel. Because it is highly plastic, it tends to stick to the truck boxes and requires quite an effort to mix with the gravel.

**Asphalts**

The use of cut-back liquid asphalts to surface-treat gravel roads was once popular for dust control. However, because of the great amount of fuel oil or kerosene in these products, they have been banned in many places. Some emulsified asphalts may work for this purpose, but their use is very limited. The product must be applied with special asphalt application equipment.

**Soybean Oil**

This product is known technically as Acidulated Soybean Oil Soapstock. It is a by-product of the caustic refining process of soybean oil. It is a biodegradable material that has many of the characteristics of a light petroleum-based oil. It will penetrate a gravel surface and provide a light bonding of the gravel that effectively reduces dust when it is used properly.

**Other Commercial Binders**

There are too many of these to mention individually. They are marketed under various trade names across the country. It is always wise to try a test section of no more than 1000 feet in length to see how any of these products work with your gravel. One caution: do not use waste products such as crankcase drain oil from engines. This is harmful to the environment and is in violation of EPA rules.

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**Benefits of Stabilization**

Once a road is stabilized there are several benefits. On high volume roads, these benefits can make stabilization very cost effective.

**Reduced Dusting**

It may be hard to justify the use of any of these products for dust control alone. However, when the products are working well, the added benefit of a stabilized surface that controls the loss of fines through dusting is a great economic benefit. When the fines are lost from a gravel surface, the stone and sand-sized particles that remain will tend to remain loose on the surface, leading to some distresses like washboarding and reduced skid resistance. It will become very hard to maintain. Fresh gravel with a higher percentage of fines needs to be hauled in. This becomes very expensive.

**Reduced “Whip Off” of Aggregate**

This is another economic bonus to dust control when it is working well. As mentioned earlier, when dust control products are working well, the fine material in the gravel cannot loosen and dust away. This also means that the stone portion of the gravel will tend to remain embedded in the surface and will not be lost to the edge of the road or even whipped off onto the inslope from heavy traffic. Studies have shown that as much as one ton of aggregate per mile is lost each year for each vehicle that passes over a road daily. This means that a road carrying 200 vehicles per day will experience the loss of 200 tons of aggregate per mile each year. (7) Obviously this will vary with the amount of rainfall received, the quality of the gravel and other factors. Retaining aggregate is a good added benefit to dust control.

**Reduced Blade Maintenance**

A road surface that remains tightly bound and stable will require much less blade maintenance. The manufacturers of some dust control products highly recommend that the surface should not be bladed at all after their products are applied. While extra blading, shaping and mixing is needed to prepare a road for dust control, the overall need for blade maintenance should be greatly reduced. This can be a great savings in equipment expense and labor. A county highway official once commented: “I don’t react to dust complaints. All gravel roads have dust. But I do react to high maintenance costs. When we have to regravel a road frequently and do blade maintenance frequently, then it’s time to look at stabilizing the surface with Magnesium Chloride. Reduced maintenance is what we’re after. Dust control is just a bonus!”
Application Tips

There is not enough space to cover application tips for all products. Since the Chlorides are the most commonly used products, we will address the use of those. However, some or all of these tips would apply to the use of most other products as well.

Need for Good Surface Gravel

Keep in mind the Chlorides are not binders. They simply draw moisture from the air. The gravel itself must have a good gradation — particularly a good percentage of fine material with some plasticity. This will give the gravel a natural binding characteristic. The Chlorides then will take over and keep the surface damp and it will remain tightly bound. It will not give up its fines in the form of dust. This point cannot be emphasized enough. If good gravel is not present on the road, it will be wise to haul in good fresh gravel prior to treatment. The cost of the Chloride treatment has been virtually wasted on some roads when the gravel was poor and very short-lived dust control resulted.

Road Preparation

This is another critical point in preparing for dust control treatment. Make sure the road has a good crown in the driving surface. Also, make sure there is good shoulder drainage. Standing water anywhere in the roadway will cause the surface to soften and fail. It will leave a pothole in an otherwise good, stabilized roadway. These can be hard to correct afterwards without disturbing the stabilized surface around it. Another key to preparation is to loosen a minimum of one to two inches of the existing surface and leave it loose at a uniform depth across the roadway. This allows the Chloride to penetrate evenly and quickly into the gravel.

Do not compact the surface at all prior to applying chlorides.
Applying the Product
The most important need here is for equipment that can be calibrated accurately and that will apply either the liquid or flakes evenly across the surface. Then a good application rate needs to be selected. This will vary with the type of gravel being treated and the length of time dust control is needed. Check with vendors and experts in your area to see what recommended rates are. Next, watch the weather! If rain is forecast or appears to be likely, don’t take a chance. Rain on a freshly treated surface will leach out and dilute the Chloride and cause it to run off the road. It can temporarily harm grass on adjacent areas. But the bigger problem will be very poor performance afterwards. Also, it is ideal to keep traffic off of the road for up to two hours after application. This is not always possible, but it is very helpful. It is recommended that one side of the road be treated at a time. Rolling can be helpful, but is not essential. If rollers are used, pneumatic ones are best, and watch to see that the gravel does not start picking up from the surface. If that happens, wait until the surface cures a bit before finishing rolling.
**Optimum Moisture**

It is important to have the gravel close to optimum moisture just before applying Chlorides. This will cause the product to be absorbed much more quickly and evenly into the gravel. Never apply the Chloride to dry gravel. It will not be evenly absorbed and may show failure in spots.

**Test Sections**

It is always wise to try a test section of dust control/stabilization treatment if this type of work has not been done before. If there is uncertainty about the suitability of the gravel being used or if there is doubt about the equipment, and/or other products being applied, the process can be tried on a 500-1000 foot road test section. If the process fails at the test section level, then only a small investment and time are lost. Also you have less public complaint.

The outcome from the failed test section will present an opportunity to analyze what may have gone wrong. Another test section can then be tried with a modified process and/or materials. If field performance proves satisfactory, the process can then be applied to larger jobs.

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*A water truck being used to prewet some very dry gravel just prior to treatment. This dramatically improves the success of the treatment.*