



Quarterly



Dust Busting

by Joe Kisic, *The Pennsylvania Local Roads Program*

Dust from your unpaved roads can create two major charges against your budget: expenses for frequent repair and expenses for large amounts of replacement aggregate. You can control dust, and save money in each expense category, by properly installing good aggregate (stone, gravel) in the first place, appropriately applying dust suppressants, strategically placing geosynthetics, and performing routine maintenance.



Sign of the Fines

Dust in the air above your unpaved roads is a sign that the fine particles of aggregate, the "fines," that were included in the aggregate mixture you purchased from the local quarry, are escaping. Fines also result from traffic's grinding the larger stones in the aggregate mixture into smaller pieces. When the fines are moist at the time of placement, and when they

remain moist, they help interlock the stones in the aggregate mixture to create a hard, stable surface for traffic. They are the "Elmer's Glue" of the aggregate mixture. They are to unpaved roads what asphalt is to bituminous roads.

Dust on the Wind, Stone in the Ditch

When the fines are dry at placement, or are allowed to dry out, they can begin to blow away as dust immediately. During the course of a year, you can see literally tons of your fine aggregate on the wind. If you don't re-blend the road surface to bring more fines to the surface, or if you fail to install more fines and aggregate, as needed, you'll also lose the larger stones as vehicles kick them from the road onto the shoulders and into the ditches. Then you'll face expenses for frequent repair of potholes, washboards and washouts, and for re-grading the road's crown, which is essential for proper drainage. You also may face other serious maintenance associated with migration of aggregate and fines into your ditches and storm sewers. Not to mention expenses to replace aggregate frequently.

Replacing Aggregate

It is becoming increasingly apparent that aggregate for the wearing-surface of unpaved roads must be hard, durable, moist at the time of placement, and of appropriate gradation (contain proper percentages of stones of different sizes, from large stones down to the fines). Often, aggregate you

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obtain from the quarry does not contain enough fines or moisture.

Obtaining Good Aggregate. Buying aggregate according to the recommendations below will help reduce the loss of fines and stones from your unpaved roads, minimize repair, and prolong the service life, by allowing the creation of a hard, stable surface that has proper cross-slope (crown):

- Aggregate should be granular; that is, it should have gone through the quarry process of crushing and fracturing.
- Aggregate should be well graded, from coarse (larger) stones down to the fines.
- Fines should make up 8 to 15 percent of the aggregate mixture by weight.
- The aggregate should be free of vegetation.
- The individual stones of the aggregate mixture should be hard. (A test to determine hardness is the Los Angeles Abrasion Test.)
- The pH value determined for the aggregate should be in the neutral-to-alkaline range. (pH is a measure of the acidity or alkalinity of a solution, with 7 being the reading for a neutral solution, higher readings indicating alkalinity, and lower readings indicating acidity). Limestone solutions produce alkaline readings. Using aggregate that produces alkaline readings will help maintain the pH balance of roadside streams, as rainwater drains through the aggregate and enters the streams, sometimes carrying fines and stones

with it. In some areas, streams tend toward increasing acidity from the effects of acid rain and other acidic run-off. Increasing acidity negatively affects stream life.

- The aggregate should be moist, not dry or saturated with water, to allow its proper compaction.

Delivering Aggregate. Once you find aggregate that meets the recommendations, you must ensure that it remains moist during delivery. When you order aggregate, specify that:

- The aggregate be delivered at its optimum moisture content. (Work with your supplier to determine the best moisture content for the use and compaction that you plan for the aggregate.)
- Tarps cover 100 percent of the aggregate's exposed surface from the time it is loaded until immediately before the truck dumps it. (That includes the time the truck is waiting to dump.)



Preparing the Road. Before you place the aggregate, or before you apply a dust suppressant for that matter, you must perform routine maintenance on the road and, if necessary,

more serious repair. The activities should be performed when the road is moist, as outlined below:

- Routine blading may be all the maintenance that is necessary to re-blend, smooth and compact the road surface so that the fines and stones can again interlock to form a hard wearing-surface. Even when dust is controlled, the surface of an unpaved road will break down over time from the action of weather and traffic, and will require re-blending and smoothing.
- Reshaping may be required, however, to repair potholes, ruts and washboards, and to restore the crown for proper drainage. Reshaping involves working the aggregate, sometimes to a depth of 8 inches or more, to achieve the proper blend of fines and stones of different sizes, then grading to achieve proper cross-slope. The motorgrader must cut as deep as the deepest potholes, washboards and ruts to prevent their recurrence.
- Reshaping a road should give it a cross-section in the shape of a flattened "A." The road should slope from its center, at ½ inch to ¾ inch per foot, to its outside edges.
- The surface should be compacted after blading or re-shaping.

Other repair may include removing aggregate of poor quality, addressing soft spots (this is where geosynthetics may apply), fixing washouts, cleaning ditches and pipes, and improving drainage facilities.

Blading and, if necessary, reshaping will reveal where you may need new aggregate. If, for some reason, you

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plan to place new aggregate where the road has maintained a hard surface, you must at least scarify (roughen) the road's surface to a depth of ½ inch to 1 inch. New aggregate won't "knit" to a hard, crusted surface, and the boundary between old surface and new aggregate could become a slip plane. A motorgrader equipped with a carbide-tooth blade will scarify a surface well.

Installing Aggregate. Your goal should be to prevent the aggregate from losing its moisture before compaction. To accomplish this, you must distribute the aggregate quickly and evenly, and work it as little as possible with the motorgrader. Therefore, you should consider distributing the aggregate with a spreader box or paver instead of dumping (tailgating) it directly onto the road from a truck. If you dump the aggregate, you'll have to work it more with the motorgrader, and that could dry it further and segregate it (separate the fines from the larger stones). Here are the particulars:

- In a complete replacement of aggregate, distribute the new aggregate so that the compacted depth can be 8 inches.
- If you use a spreader box or paver, keep the level of aggregate in it at or near capacity. Set the spreader box or paver to distribute the aggregate in a way that minimizes the grading needed to achieve uniform thickness and crown.
- If you tailgate the aggregate, spread it to a uniform thickness along the center of the road in an amount that enables the motorgrader to set a proper cross-slope from the center of the road to the

edges with a minimum of passes for each travel lane.

Compacting Aggregate. Renting a compactor is worth the money that it will save by reducing aggregate loss. Compacting with a truck, or not compacting at all, is not recommended.

- Perform compaction with an 8- to 10-ton, vibratory, steel-drum roller.
- Make overlapping, longitudinal passes with the compactor, beginning at the shoulder-side of the road and working toward the crown. Don't run the roller along the top of the crown.



Using Dust Suppressant

If you have decided to use dust suppressants on your unpaved roads, they are usually applied in spring. Depending on conditions or product, a second application may be needed in late summer or fall. The weather forecast should not call for heavy rain, and the road surface should be damp but not wet. If you use cutback asphalt as a dust suppressant, the road should be dry.

Choosing a Dust Suppressant. Choosing a dust suppressant that suits your needs involves consideration of:

- The materials on your road and any aggregate you intend to in-

stall—the dust suppressant must match them; analysis is crucial.

- Traffic type, volume and speed.
- Frequency of blading, reshaping and other maintenance.
- Degree of dust control required.
- Climate and terrain—a road that is almost always in sun has needs different from a road that is shaded.
- The environment—dust suppressants can negatively affect vegetation, streams, wetlands and groundwater, depending on their own characteristics and where and how they are applied.
- Corrosiveness to steel and aluminum structures along the road.
- Product and application costs.
- Product handling according to the Material Safety Data Sheet.
- Service life of the product.

There are many dust suppressants "out there," but the most common are the chlorides of sodium, calcium and magnesium, with calcium chloride being the most widely used. Applied to a road, the chlorides reduce the rate at which moisture evaporates from the road, and actively absorb moisture from the air into the road surface. Thus, the fines remain moist enough to stay put and serve as the glue for the larger stones of the aggregate mixture. (*Sodium chloride is not a good dust suppressant because it does not absorb moisture below 76% relative humidity and it reduces the rate of evaporation by only 1.3 times.*)

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Other dust suppressants, such as resins, lignin derivatives, and asphalt emulsions and cutbacks, act as adhesives to bind the fines and larger stones.

Applying Dust Suppressant. Heed the manufacturer's instructions. Generally speaking, you should first blade and, if necessary, reshape the road and make other repairs, as outlined in the section on preparing the road for new aggregate. Apply the dust suppressant after compacting the aggregate, whether compaction follows installation of new aggregate or blading and re-shaping the road. If you delay the application of dust suppressant until traffic has used the road following compaction, consider scarifying the surface

to a depth of 1 inch before applying the dust suppressant. If your suppressant is a liquid, scarifying will diminish the amount that can run off the road. Then re-compact the surface.

Suppressants come in liquid or solid form. Consider distributing liquids from a truck equipped with a spray bar. If you use a homemade applicator, you may apply too little for effective dust control, or too much, which wastes money and may cause the dust suppressant to run into the roadside environment. The most common way to apply solids, which come as flakes or chips, is with the spreaders you use for de-icing operations, but you must first calibrate the spreaders for an effective rate of application.

The application rate varies among products and road conditions. Work

with your supplier to determine the appropriate rate for your road to achieve the degree of dust control you expect. Consider:

- Condition of the road and its wearing-surface.
- Volume, speed and type of traffic.
- Climate and weather.
- Frequency of maintenance.

Comments

These tips should help you keep a stable, sturdy surface on your unpaved roads, obtain longer service from these roads, and reduce their need for replacement aggregate and frequent repair. Dust control won't make a bad road good, but it will keep a good road good.

Sign Step

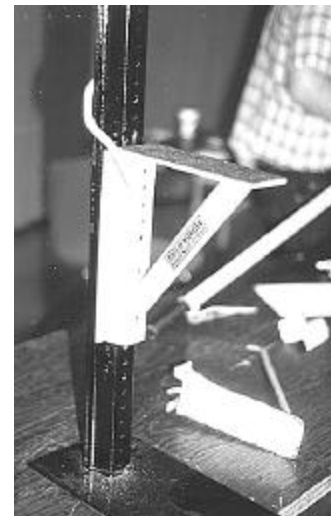
The sign step provides a safe and efficient way to make minor repairs to signs that are too high to reach from the ground without lugging a ladder or having an expensive lift system on a vehicle. The step is set into position with three bolts and anchored with a rolled one-half inch rod that is bent to hook around the sign post and catch in the channel.

Burnell Nieuwenhuis of the Nebraska Department of Roads conceived the *Sign Step*. He is responsible for signs on the Cherry County, NE road system. Safely planting a ladder in a stable position is often impossible. With the sign step, all he has to do is attach it to the sign post, secure it and step up.

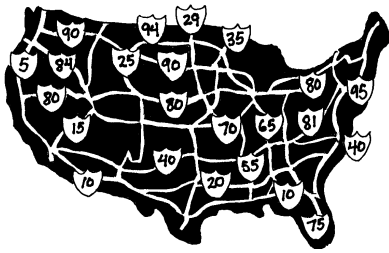
The sign step is easy to construct. According to Nieuwenhuis it should hold up to 225 pounds.

Call or e-mail T³S for a copy of the plans for the *Sign Step*.

*Reprinted with permission from the
Nebraska T² Interchange.*



Interstate Highway History



President Franklin Roosevelt considered establishing a U.S. Interstate Highway System during the Great Depression of the 1930s in an effort to create jobs. In 1944, Congress passed the Federal-Aid Highway Act to create a 40,000-mile interstate highway network. Construction began three years later, but funding and interest lagged. By the time President Dwight Eisenhower took office in 1953, only 6,000 miles had been completed.

Eisenhower urged Congress and the country to view the transportation undertaking as a national, not state issue. He argued that such a system would promote safety and economic development, reduce congestion, bolster the nation's mobility in the event of war, and help evacuate cities in the face of atomic bombing threats.

Richard Weingroff, the historian for the Federal Highway Administration, said a popular myth is that one out of every five miles of interstate highway must be straight to allow plane landings. "This is false, but many people believe this."

Interstate Statistics

- ♥ There are a total of 42,796 miles in the interstate highway system. They represent 1 percent of the nation's total road mileage yet carry more than 20 percent of the traffic.
- ♥ The longest interstate is I-90, which stretches from Boston to Seattle, a distance of 3,081 miles. The shortest is I-878 in New York City, seven-tenths of a mile long.
- ♥ The only state without any interstate routes is Alaska.
- ♥ Texas has the most interstate miles at 3,232 miles; New York has the most interstates with 28 routes.

Cars Can Be Ovens

Every summer some 20 children and many pets die when left in cars parked with their windows closed. On a hot day, it takes only minutes for the interior of a car to reach 150 degrees or more. Leaving the windows open a crack or parking in the shade is not enough to prevent a dangerous rise in temperature. Call the police if you see a child or a pet alone in a parked car. Dial 911 to alert them.

Dress to Beat the Heat

Want to feel cool and dry even in hot, humid summer weather? Then favor light-colored clothes made with natural fibers such as cotton, linen, and silk. Synthetic fibers (polyester, nylon, rayon, acetate, etc.) and darker colors tend to absorb and trap heat, causing skin to sweat. For greater comfort, sprinkle on talcum powder or cornstarch before dressing to reduce friction between clothes and skin.

License Plates

From the following vanity license plates, can you guess which "professionals" own these cars?

- | | |
|------------|------------|
| ① AFAV8R | ⑥ BKEEPR |
| ② 10SNE1 | ⑦ W8LIFTER |
| ③ I SK8 | ⑧ MTNBKR |
| ④ DR IBALZ | ⑨ 88 KEYS |
| ⑤ T IT UP | ⑩ B4DKCME |

Answer Key

1. Air Force Aviator; 2. Tennis Player; 3. Skater; 4. Optometrist; 5. Golfer; 6. Beekeeper; 7. Weight Lifter; 8. Mountain Biker; 9. Pianist; 10. Dentist.

A real patriot is the fellow who gets a parking ticket and rejoices that the system works.
—Bill Vaughan

Proper Flagger Training Is Crucial

Editor's Note: This article was reprinted, with permission, from Arizona Milepost, Spring 2000.

The work a flagger does at a construction site is as important as the job performed by those operating a paver, driving a roller or operating a backhoe.

Without giving proper notification to motorists about entering a construction zone, the entire crew is placed in jeopardy. That's why it's so important to properly train flaggers.

Traffic control has three main objectives:

- ☞ ensure the safety of the work force and the public,
- ☞ minimize interruptions to traffic and work
- ☞ keep road conditions as normal as possible.

Planning

The most important aspect of traffic safety is planning. Highway agencies must have a plan for sign layout and use a traffic control manual in planning as well as on the job site.

The manual will provide minimum standards for traffic control. When selecting a basic plan check with your traffic control engineer or road superintendent for special road conditions and make sure flaggers understand the plan.

Safety First

For traffic to be directed safely, the flagger must be visible to drivers. Here are some safety tips:

- ☞ On high-speed roadways proper warning signs are required to slow down traffic.

- ☞ Ask state or local police to visit the work zone routinely to reinforce the need for motorists to slow down and exercise caution.
- ☞ Adjust the location of devices when curves, hills or other features reduce a driver's view of them.
- ☞ Whenever possible, use concrete barriers to separate the work zone from traffic.
- ☞ Use a crash truck, if possible.
- ☞ All construction equipment, including pickup trucks, should be equipped with flashing yellow lights.
- ☞ Repair or replace damaged or illegible traffic control devices.
- ☞ Flaggers must be easily identified by bright reflective vests. They also should be outfitted with boots, eye protection, pen and pad for noting license plate numbers and a stop/slow sign.

Job Responsibilities

The flagger must be in good health, possess good vision and hearing, be alert, have mature judgment and be able to communicate well with the public to explain road hazards.

Before work gets underway, the supervisor should explain the work zone safety plan to the flaggers — where to stand, equipment required, legal responsibilities and proper techniques relating to signals.

Flaggers should stand well away from the actual work site at a distance suitable for all conditions relating to the given project.

When two people are working together, they should be able to see each other to coordinate their stop/slow signs. Using radios is an excellent way for two workers to communicate easily. If they cannot see each other clearly, a third flagger may be needed between them to relay signals.

Once assigned to a position, the flagger should look for a place to escape if a driver loses control or disregards the traffic control signs.

Traffic control is a demanding and extremely important job. Motorists, as well as the entire project, depend on the flagger for safety.

Flagger Safety Procedures

- ✓ Face approaching traffic and stand just outside the line of traffic.
- ✓ Stand alone and don't allow other workers to gather around you.
- ✓ Always stand. Sifting or kneeling reduces visibility.
- ✓ Don't show your sign too late. Give motorists sufficient time to read the sign.
- ✓ Hold the sign firmly in view.
- ✓ After the first vehicle is stopped, move to a position where other cars easily can see you.
- ✓ Never leave your post until relieved of duty.

Information Request and Address Change Form

To order any of the publications, videos, or other materials listed in this or other issues of *T³S Quarterly*, complete this form and mail it or fax it to **Sandra Priddy** at the address or phone number shown below.

**Transportation Technology Transfer Service
Civil Engineering Department
Clemson University, Box 340911
Clemson, SC 29634-0911**

**Phone: 888.414.3069 (toll free)
864.656.1456
Fax: 864.656.2670**

Publications/Videos

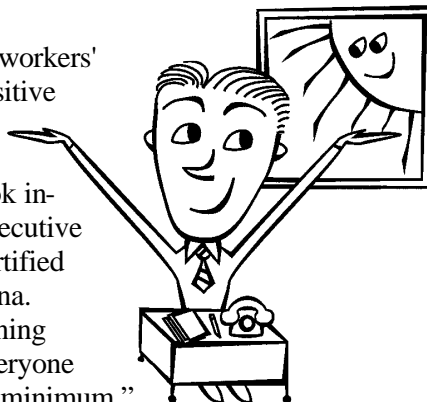
Name: _____
 Title: _____
 Address: _____

 Phone _____ Fax _____
 e-mail _____

This is a new address
 Please add my name to your mailing list

A Winning Attitude

Your attitude on the job affects your co-workers' outlooks, not just your own. So your positive attitude can be good for overall morale. "Learn to find something enjoyable in each project, even if at first it doesn't look interesting," advises D.D. Thornton, an executive assistant with the National Board for Certified Counselors in Greensboro, North Carolina. "Minimize making excuses and complaining about how much work there is to do. Everyone has work to do. Keep the negativity to a minimum."



Try the STAR technique for success:

- S** — Stop
- T** — Think
- AR** — Act Responsibly

Never tell people how to do things. Tell them what to do and they will surprise you with their ingenuity.

— George S. Patton

**Visit Our Exhibit at the
SC APWA 2000 Conference
and Equipment Show
July 12–15, 2000**

The Annual South Carolina American Public Works Association Conference and Equipment Show is scheduled for July 12–15, 2000 at the Ocean Dunes/Sand Dunes Resort Hotel in Myrtle Beach, SC. The conference will include

- ❖ technical sessions,
- ❖ an exhibit area/equipment show
(*T³S will be represented in the exhibit area!*),
- ❖ the finals of the state backhoe competition.

For information on registration, contact Wanda Dunn by phone: 803-733-8458, fax: 803-733-8648, or e-mail: projadm@columbiasc.net. Hotel information can be obtained by calling 800-845-0635.

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