



U.S. Department of Transportation
Federal Highway Administration

ROAD BUSINESS



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Above: Road agents spend some time going through their "Quick Guides" while observing good culvert and erosion control techniques

On The Road In New Hampshire

More than 100 town road agents, engineers, town officials, public works personnel, and contractors recently met at the Moultonborough town garage for an informative and exciting "Demonstration Field Day."

The field day featured demonstrations on how to install culverts, construct vegetated and stone lined ditches, construct a sediment basin, construct a beaver pipe, installation of catch basins and other erosion control techniques.

All participants received "A Quick Guide for New Hampshire Towns." The guide contains ten fact sheets. Each fact sheet addresses common problems for road crews and provides solutions. The guide will be expanded upon later with other helpful information for towns.

Displays from Front Runner, Inc., A.H. Harris, All States Asphalt, Inc., Resource Conservation Service, Inc., Arthur Whitcomb, Inc., Catch Basins and Red Hed Supply were setup for participants to view.

This field day and "Quick Guide" were developed through a cooperative effort involving the USDA Soil Conservation Service, NH Assoc. of Conservation Districts, Belknap and Carroll County Conservation Districts, The North Country RC&D Area, UNH T² Center, and UNH Coop. Extension.

Federal Emergency Management Agency (FEMA) and the NH Office of Emergency Management provided partial funding. This undertaking is an effort to prevent problems of road washout, erosion, and flooding, such as those experienced by several of our communities during Hurricane Bob.

More field days will be held in the Spring. If you are interested in attending a "Demonstration Field Day," contact Richard R. DeMark, Project Coordinator, The North Country RC&D Area, Inc., 103 Main Street, Suite 1, Meredith, NH 03253 or call 603-279-6546.

photos on p.4

Sand Spreaders

Some important and frequently overlooked features

With an ever-increasing number of sand spreaders becoming available on the market today, the choice to purchase the right one can be a difficult task. Budget constraints are now forcing road agents to take a closer look at the "low bid". But, does low bid necessarily constitute the "best bid"?

What you purchase now for a sand spreader can make your job easier today and in the years to come.

Following is a list of items to

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Sand Spreaders...
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consider when shopping for your next sand and salt spreader.

Body Construction

10 gauge steel is most generally the standard used for body sides and ends on most single axle six yard spreaders. There is a major difference though in the construction of the body sills which is the main frame or foundation of the spreader. Specify heavier components of 3/16" (7 gauge) construction. This is where the rust begins first.

Chain Shields

An integral part of the spreader, chain shields are indeed a wear item and are often overlooked at the time of purchase. Bolt-on chain shields are a definite advantage because of the ability for easy replacement. Formed shields, on the other hand, require the use of a torch and welder for replacement - a time consuming and costly task.

Conveyor Chains

Most manufacturers offer a 24" wide conveyor chain as standard equipment. A narrower chain could result in undue stress on the drive components. Choices of either a standard barflight or the optional "belt-over-chain" are available. What you choose depends entirely on what type of spread pattern you desire, and with the amount of money you have to spend. When making your choice compare the thickness of barflights and the ply of the belt.

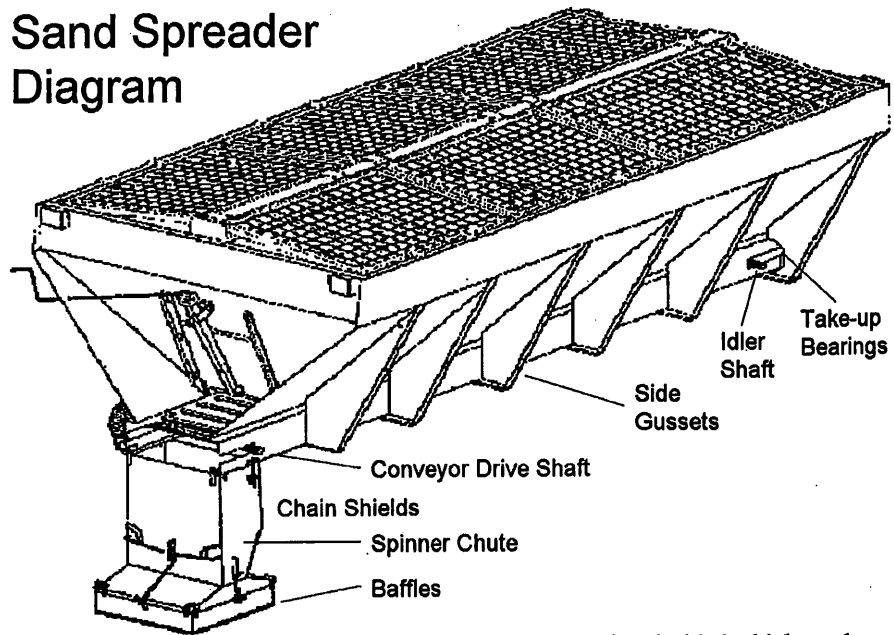
Spinner Chutes

Again, not much consideration is given in this area but there are choices to contemplate. Look for a chute that is wide throughout and will properly handle the amount of material for which the conveyor supplies. Tapered chutes have a tendency to plug up when the material sticks to the sides of the chutes during wet and heavy storms. The last thing you want to do in the middle of the night is to chisel out a spinner chute which has become frozen with material.

Miscellaneous

Compare the size of take-up bear-

Sand Spreader Diagram



ings, drive shafts, idler shafts, sprockets either keyed or welded to the shafts, whether side gussets are fully welded to the side of the body or just spot welded.

Ground Speed Control Systems

Automatic ground speed control systems have become more and more popular. The principle behind the ground speed system is to properly distribute the amount of material required per lane mile to effectively treat your roads. Many towns that have recently purchased ground speed controls have realized a cost savings on salt and sand while still maintaining their roads properly.

Ground speed control systems operate in conjunction with the speed of the truck. A speed sensor senses the truck's speed and transfers this information to the actuator and control system. The need for an operator to start and stop the spreader at stop signs is eliminated and operator fatigue is reduced. A "blast" button is provided on the consoles to allow the operator to distribute material more heavily where required. Some manufacturers offer optional printers which can be useful in compiling data from storm to storm and/or year end totals.

After You've Made Your Decision

Once you've decided which sand spreader meets your requirements and fits your budget, one of the most important parts of your purchase rests within the dealership from which you make the purchase. Will the dealer provide you with the parts, service and adequate backup that you deserve? Go one step beyond and ask the dealer to show the supply of parts on the shelves. Any dealer can order parts, but to have the necessary parts in stock and get you back to work in a timely fashion should be a factor in your decision. Pay special attention to the amount of conveyor chains, bearings, hydraulic motors and sprockets your dealer stocks. It can be expensive to be your own parts center and down time is critical in a storm.

The above article was written and submitted to *Road Business* by Dana Wright, Branch Manager of Howard Fairfield, Inc. Dana may be reached for questions at 603-225-9576 or you may contact the Technology Transfer center at 800-423-0060.

We are always looking for interesting pieces of information to share with our readers. If you would like to submit an article please send it to the T2 Center, University of New Hampshire, Dept. of Civil Engineering, Durham, NH 03833. ■

Cone Signs Give Added Safety for Your Work Zone

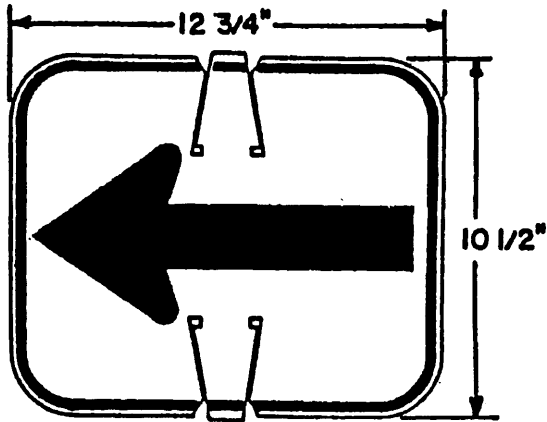
Traffic cones, delineators, and barrels, although critical to your work zone set-up, can only alert people to changing traffic patterns ahead. They do not give directions. However, there is an inexpensive way to improve the safety of your work zone and give extra direction

to the motoring public through the use of cone-topped directional signs. They give fast simple directions at a glance and effectively guide the flow of traffic.

As the drawings below suggest, the signs are very easy to use. Working in a similar manner to a paper clip, they are

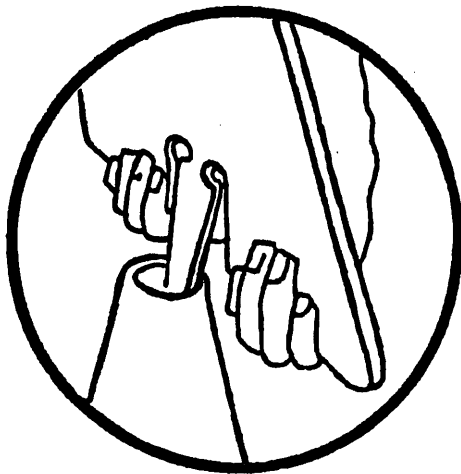
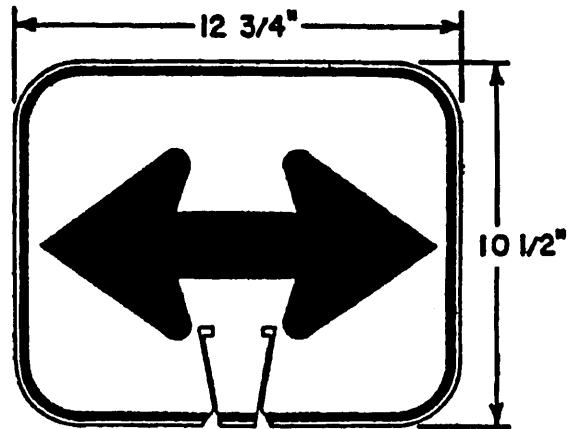
flexed and simply snapped on top of the cones.

There are many types of cone signs available commercially. An example of two signs approved for use in Pennsylvania are shown below.

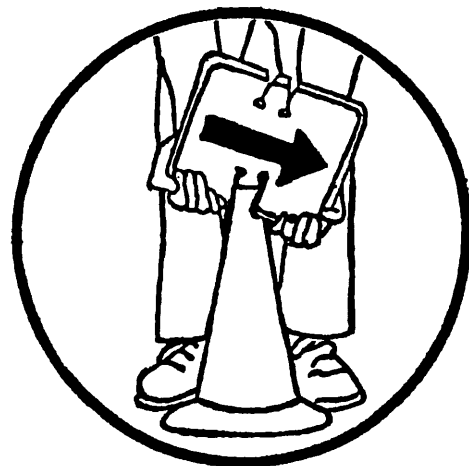


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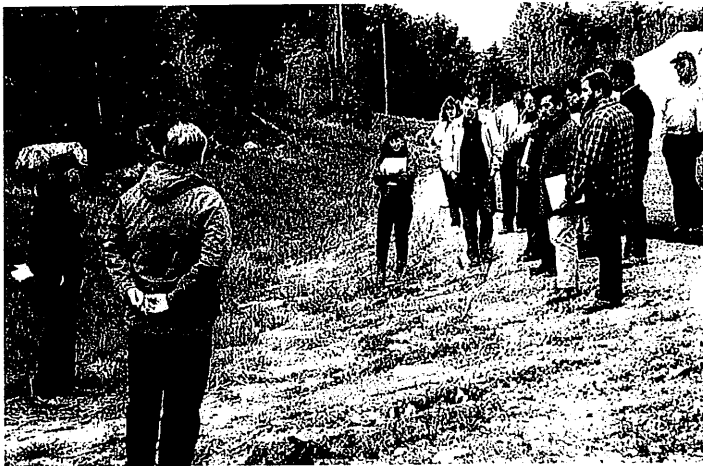


Easy to Install



Easy to remove

The above idea comes from the Pennsylvania Local Roads Program, Fact Sheet #49



Left: Road Agents take a good look at ditching practices. When the most important consideration of a road is water, good ditching makes sense.

Right: Field day participants learned how to construct a pipe especially designed to control water levels when beaver dams threaten to cause problems.



Left: Hay bale barriers were constructed to show how to temporarily store runoff water.



All of the demonstrations at the field day were written up in the new "Quick Guides for New Hampshire Towns." To get your own set of "Quick Guides" see page 10 of this newsletter.

Training Pays Off

ALL THE HORSEPOWER in the world doesn't do any good unless you have competent, well-trained human power. This requires training.

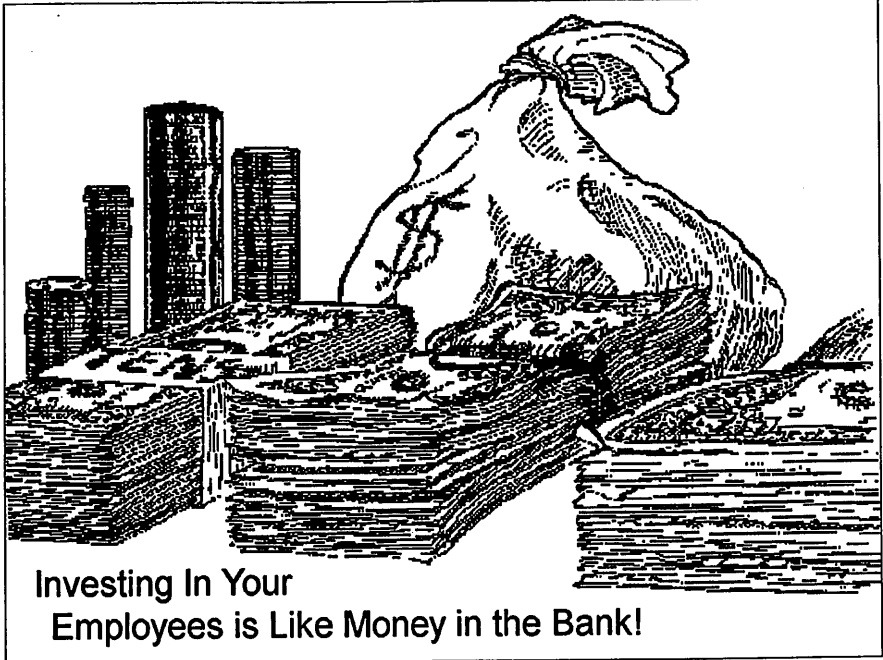
Training and education are not expenses, but investments. As in any investment, you want to get the best possible return. To do so, you need to know your workers. What are their strengths and weaknesses? Which of them have special talents? Can you make trainers out of them?

As you look at your crew's training needs, you also need to look at your attitude toward your employees. Are they doing the best job they know how to do? If not, the problem may be that they simply don't know any better. Most people do the best job they know how to do. The problem may be that they don't know what is expected, how what they do will be evaluated, or most importantly, why they are doing certain things in certain ways.

You need to provide each employee with a clear understanding of the policies and procedures under which they are expected to carry out their duties. At the same time, you need to encourage them to think for themselves within that framework. Encourage them to solve problems by using their heads, not just their hands. Don't punish creative thinking and innovation. If someone solves a problem by breaking a rule, you may need to make it clear that the solution was not acceptable as a general rule and they probably should not do it again. This is particularly true if the solution put your agency at risk in terms of potential liability claims. But don't penalize the person for trying.

Training sessions should be regular and timely. They need to become an expected part of the work routine. Sessions should be short and simple. Several brief sessions will probably be more productive than one longer session. Active people are not used to sitting around in meetings. Take one or two topics at a time and cover them thoroughly.

You may not be able to do all



training in-house. Consider investing in attending conferences such as the APWA International Public Works Congress and Equipment Show and the T² Center Workshops. Don't just send the supervisors. Choose people carefully and objectively to avoid the appearance of favoritism. Attending training programs should be a reward for people who have done outstanding work or have exceptional safety or attendance records. Always expect those who attend to provide some feedback for the rest of the crew.

Investing a few dollars in training will pay big dividends. It puts your employees on your side when you conduct in-house training. You will have someone in the audience that you can bring into the discussion. In fact, you should probably include these people by making them part of the instructional team.

You can make "somebodies" out of "nobodies." When you send people to conferences or training sessions, publicize it in your newsletter or bulletin boards and in local newspapers. People like to see their names in print when they have done something significant.

If attending outside training is out of the question, consider pooling your resources with those of a nearby agency and work together to accomplish your training goals. Encourage your personnel to meet with crews from other towns

or counties to compare notes and learn from each other.

Technology transfer doesn't necessarily involve "high tech" subjects. "Know-how transfer" may be a better way to define what we do. In its simplest form, it means if you know something that I don't know and you tell me or show me, technology has been transferred. The implementation is up to me. I must learn to use this new information to improve my operations.

The New Hampshire T² Center maintains a videotape library which will provide tapes for in-house training. The T² Center also provides several day-long workshops throughout the year.

Without qualified people to operate your equipment, it might just as well be sitting in the salvage yard. Your staff is your most valuable resource. People really do make the difference. Training does pay off!

The above article was reprinted from *T² Newsletter*, Vol. 8, No. 2, a publication of the Wyoming T² Center. It was directly quoted and only slightly modified from an August 1991 article in the APWA Reporter. ■

Chip Seal Material

Asphalt Emulsion

As a highway official you aren't in the business of making asphalt emulsions. However, it helps to know something about construction materials if you are to have control over construction projects that require them. This article will provide some information about the ingredients of asphalt emulsions and how they work.

Asphalt emulsion is a mixture of asphalt cement, water, and an emulsifying agent (very much like a detergent or soap). Sometimes there is a small amount of solvent such as naphtha, also. Mixing asphalt with water requires an emulsifier since they do not readily mix. As the three ingredients are blended, a suspension of asphalt droplets in water occurs. The emulsifier creates a surface tension between the asphalt particles and surrounding water that permits the asphalt droplets to remain in suspension until the water evaporates. Emulsifiers create an electrical charge on the surface of the asphalt particles that cause them to repel each other, helping them to stay in suspension. An anionic emulsifier is one that makes a negative charge on the asphalt droplets. A cationic emulsifier creates a positive charge on the droplets. Figure 1 (not to scale) is a drawing of asphalt particles in suspension as an emulsion.

Most people agree that anionic emulsions work best with aggregates having mostly positive surface charges, such as limestone. Usually a cationic emulsion works best with aggregates having mostly negative surface charges such as sandstone. However, the risk of severe stripping failure due to mismatched emulsion and stone is not high. Seldom, if ever, is the degree of compatibility so poor that the asphalt emulsion will not coat the stones. Furthermore, once the emulsion has broken, it behaves like an asphalt cement, and the charge on the asphalt film disappears.

Curing of Emulsions

Both anionic and cationic emulsions "cure" when the water evaporates, leaving the asphalt cement residual to bind the aggregate. The type and

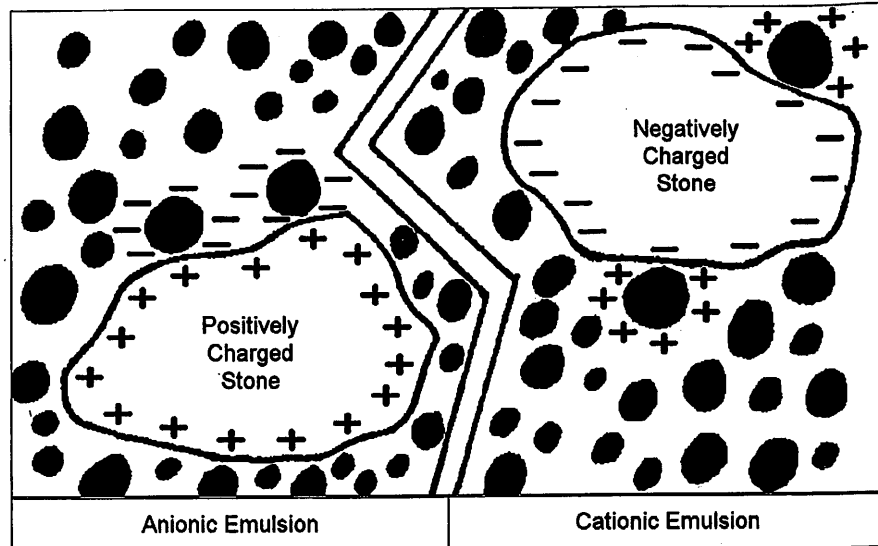


Figure 1: Asphalt Droplets in an Emulsion

concentration of emulsifier used determines if the emulsifier used determines if the emulsion is rapid setting (RS), medium setting (MS), or slow setting (SS). Cationics tend to give up their water a little faster than anionics. There are several factors which affect the curing rate of all emulsions. These factors affect how fast a chip seal will take to cure:

- *Weather conditions* - Temperature, humidity, and wind affect the breaking and curing of an emulsion.
- *Moisture content of the aggregate* - If the stone is wet when it is spread on the emulsion, water will be added to the emulsion. This could increase setting time. However, damp stone is coated more readily by the emulsion, so dry stone should be avoided.
- *The mechanical forces of rolling and traffic* - This will force water from the material to a limited extent, and speed up curing.
- *Water absorption by the stone* - A rough textured, porous stone speeds up the setting time by absorbing water from the emulsion.
- *Emulsion-stone compatibility* -

When a cationic or anionic emulsion is properly matched with the appropriately charged stone, the curing rate will be enhanced.

Rapid-setting emulsions are composed of approximately 55-65 percent asphalt cement, with the remainder being water and possibly a small amount of solvent. After the emulsion "cures", the residue left behind is the asphalt cement binder.

Type of Emulsion to Use

Chip sealing requires the use of the rapid setting emulsions RS-1, RS-2, CRS-1, and CRS-2, which break quickly. A fast breaking time is desired to ensure that the cover stone is firmly "glued" in place shortly after it is spread. Fast breaking reduces the time that the fresh chip seal is vulnerable to stripping and scarring by traffic. This keeps the length of time requiring traffic control to a minimum. The road can be returned to service as soon as possible, minimizing inconvenience to the public.

Avoid use of a medium setting (MS) emulsion. An MS emulsion takes about 30 minutes to begin to set when the temperature is hot and the humidity is low, compared to a minute or two for an RS.

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Selecting the Proper Stone

Selecting proper stone is critical to producing a successful surface treatment. There are several important properties that you should look for:

- The stone should be one-size
- It should be chunky, not flat and flaky
- The stone should be clean

The need for each of these qualities is explained below.

One-size Stone

Figure 2 compares the Average Least Dimension (ALD) of one-size stone to an aggregate that includes various particle sizes. When the correct amount of asphalt emulsion is used with one-size stone the void space between stones will be filled to about 70 percent of the ALD. In other words, the stones will be buried to about two-thirds of their height. Experience shows that a stone oriented to its flattest dimension will most likely be dislodged by traffic if less than half its height is embedded in asphalt.

Chunky Stone

Figure 3 compares a stone that is chunky to one that is flat and flaky. Notice that both the chunky and the flaky stone are labeled #1 stone. The #1 stone passes the 1/2 inch screen but is retained on the 1/4 inch. Stone that is either chunky, or flat and flaky, could be within this size range. However, when the stone is settled into its flattest orientation, a one-stone layer of flat, flaky material will not be as thick as a layer of chunky stone. The layer of asphalt required will be thinner for a flaky material. Therefore, it will be more difficult to control the correct application rate on the job site.

Figure 3 indicates that the chunky material requires 0.30 gals./sq.yd. of residual asphalt to fill the voids to the

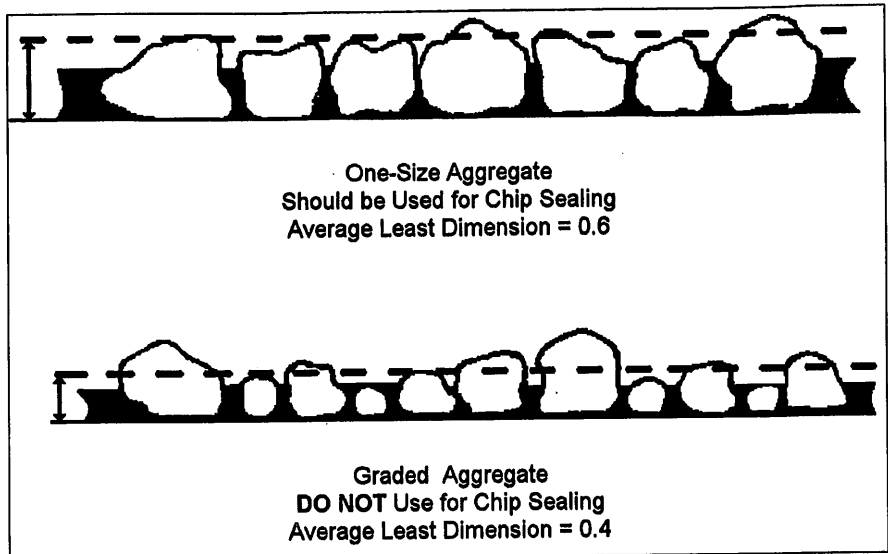


Figure 2: One-size Aggregate vs. Graded Aggregate

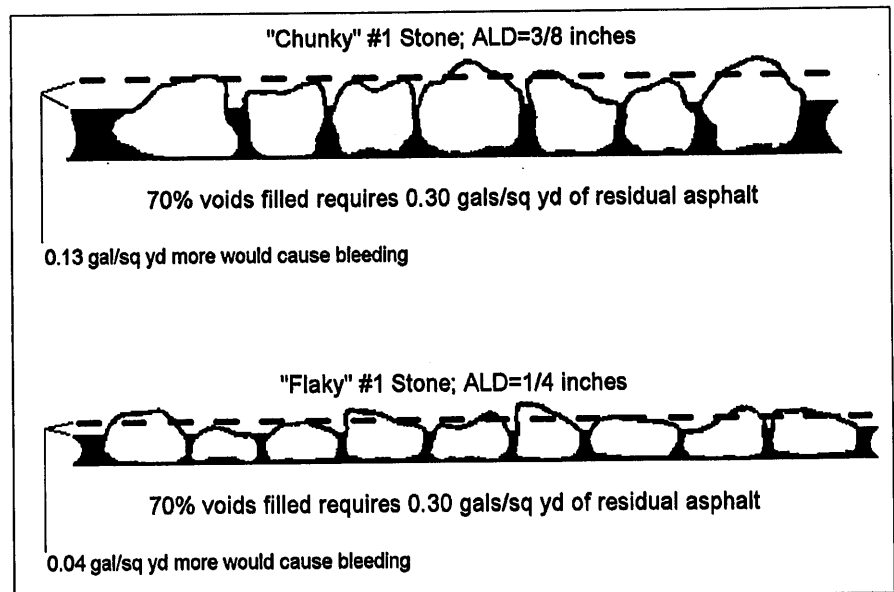


Figure 2: One-size Aggregate vs. Graded Aggregate

desired 70 percent. If an additional 0.13 gals./sq.yd. were applied, the voids would be 100 percent filled and the road would bleed. However, for the flaky material, only 0.25 gals./sq.yd. of residual asphalt are required to fill the voids to 70 percent. Furthermore, only 0.04 gals./sq.yd. more would ruin the chip seal by filling the voids completely, causing bleeding.

Clean Stone

The stone must be clean. If it is coated with rock dust, silt, or clay fines the asphalt will not adhere well to the aggregate. This, of course, will greatly increase the risk of stripping failure. To prevent the problem of dirty aggregate, precoated stone is typically covered with a 50/50 solution of RS emulsion and water. The precoating helps prevent the increase of fines. It also promotes good

Chip Seal...
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adhesion of the emulsion to the stone. However, double-washed stone should work quite well.

Selecting the Stone and Emulsion Application Rates

Most highway superintendents think of applying stone in tons-per-mile and emulsion in gallons-per-mile. Thinking in such big numbers is fine for rough estimates of the size of a project. However, if you really want to consider build up chip seals that do not strip or bleed, this is not accurate enough.

In order to prevent bleeding or stripping, the emulsion and stone application rate must be carefully selected and then controlled on the job site. Good control can only be achieved if you consider application rates in terms of pounds of stone and gallons of asphalt emulsion per square yard. You may think this is not practical. However, it is not that difficult to do. This section will explain how to select application rates in pounds and gallons per square yard.

The stone and emulsion application rates depend upon the condition of road being chip sealed and the stone that will be used. Remember that two aggregates, both specified as #1 stone, could require different amounts of emulsion due to a difference in the degree of chunkiness/flakiness. It is very possible that from year to year a 1ST produced from the same pit could have a different ALD. A change in crushing equipment or the location in the pit from which material is being taken could affect the chunkiness/flakiness of the material being produced.

Condition of the road surface will also affect the amount of emulsion needed. A surface that is extremely weathered will be porous and oxidized. It will be absorbent and therefore require extra emulsion. In contrast, a surface that is bleeding will need less asphalt.

In addition, traffic affects the amount of emulsion needed. A road that

receives heavy traffic will require less emulsion than one with light traffic. The stones of the chip seal receiving heavier traffic will likely be pressed more deeply into the road surface, and therefore need a thinner layer of emulsion to bind them to prevent bleeding. In contrast, the stones of a chip seal under light traffic may never be fully seated to their lowest possible orientation. Therefore, the void space between them will be higher than if they were completely reduced to their lowest possible orientation. This increased void space will require more residual asphalt to fill it to 70 percent.

If you use "favorite" or "standard" application rates of tons of stone and gallons of emulsion per mile, it may be the reason why year after year you have chip seals that bleed and others that ravel. If you begin to select application rates per square yard for each and every project to account for the road surface, traffic conditions, and the stone being used, you will get better results.

Many highway officials may have chip seal work done by contract where the vendor determines the application rates. Even in this case the highway department should determine the proper application rates for each road to be chip sealed prior to signing the contract and compare them to the rates proposed by the vendor. If there is a significant discrepancy the difference needs to be resolved. In addition to potential failures excessive rates are also costly.

Selecting application rates should be done well in advance of the day of construction. Enough time should be set aside to examine the road's surface condition, to estimate the volume of traffic, and to determine the spread rates.

This article is reprinted in part from the publication "Chip Seals and Surface Treatments", CLRP Report #91-5, Cornell University Local Roads Program. ■

Snow Disposal Guidelines

*by Eric J. Williams, Coordinator
Nonpoint Source Program, New
Hampshire Department of
Environmental Services*

During each snowfall season from November to April, the Department of Environmental Services receives many complaints related to snow disposal into and/or near surface water. There are several different concerns regarding disposal of snow cleared from streets and parking lots. These can be initially categorized as aesthetic concerns, such as minimizing the visibility of debris and huge snow piles, and environmental concerns, such as protection of groundwater quality, surface water quality, and aquatic life.

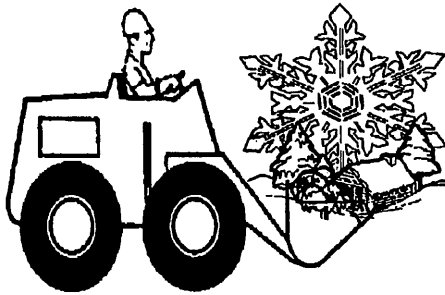
The environmental effects of disposed snow result from high levels of sodium chloride, sand, debris, and contaminants from automobile exhaust. The method of disposal determines the potential environmental effects: disposal in surface water; adjacent to surface water; or away from surface water where meltwater will discharge to groundwater.

Each disposal alternative poses different problems. Chlorides, metals, and other such contaminants are a threat to groundwater, and to some extent, surface water. Sand and silt threaten aquatic life in surface water but pose no threat to groundwater. Debris can create a water quality problem if dumped with snow into a surface water.

The following guidelines reflect the view of DES that the greatest long-term harm would occur from contamination of groundwater, but that surface water must also be protected, and that aesthetic concerns cannot take a higher priority than the environmental concerns.

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Recommended Guidelines for Snow Disposal



- Disposed snow should be stored near flowing surface waters, but at least 25 feet from the high water mark of the surface water;
- A silt fence or equivalent barrier should be securely placed between the snow storage area and the high water mark;
- The snow storage area should be at least 75 feet from any private water supply wells, at least 200 feet from any community water supply wells, and at least 400 feet from any municipal wells (note: snow storage areas are prohibited in wellhead protection areas [class GAA ground-water]);
- All debris in the snow storage area should be cleared from the site prior to snow storage; and
- All debris in the snow storage area should be cleared from the site and properly disposed of no later than May 15 of each year that the area is used for snow storage. ■

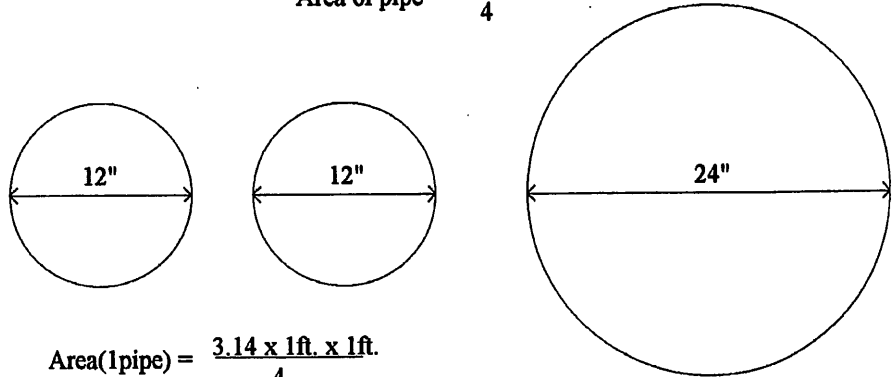
Culvert Tips

Reprinted from Maine Local Roads News, Summer & Spring 1992

Which culvert(s) carry the most volume of water?

Two 12-inch pipes or one 24-inch pipe?
(assume water velocity is identical)

$$\text{Area of pipe} = \frac{3.14 D^2}{4}$$



$$\text{Area(1pipe)} = \frac{3.14 \times 1\text{ft.} \times 1\text{ft.}}{4}$$

For 2 pipes,
Area = $2 \times 0.785 = 1.57\text{sq.ft.}$

$$\text{Area} = \frac{3.14 \times 2\text{ft.} \times 2\text{ft.}}{4}$$

$$\text{Area} = 3.14\text{sq.ft.}$$

Compare

One 24-inch pipe has twice the capacity as two 12-inch pipes!

Your town needs to replace a 40 foot culvert across a road. You want to set it at a 1% grade. Using a hand (or "pop") level, what should be the difference in elevation from one end to the other?

$$\text{Grade} = 1\% = 1/100 = .01$$

Therefore,

$$H = .01 \times 40\text{ft.} = 0.4\text{ft.} = 4.8\text{inches}$$

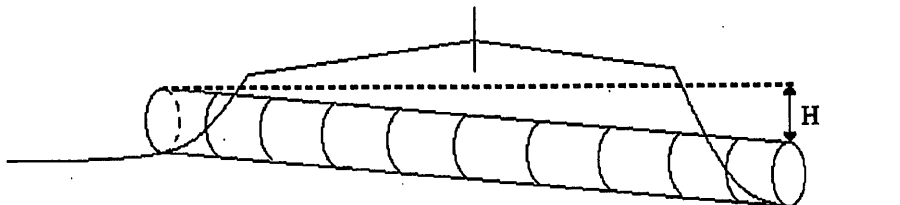


Figure not drawn to scale

We Need Your Help!

Our video library is missing a few videos, and we'd like your help to find them. If you could simply look thru your video library and see if there are any videos that you have forgotten to return to us it would be greatly appreciated. Just pop them in the mail to the *Road Business* address on the front page. It would help us a great deal, and it means when someone calls to order a video I don't have to tell them the video is not available.

Thanks in advance for all your cooperation.

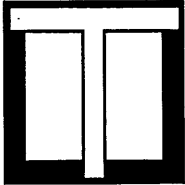
Jen

"Quick Guides for New Hampshire Towns" Now Available For The Asking!

Ten *Quick Guides* have been put together to assist towns with drainage, erosion and stabilization problems. The *Quick Guide* topics are listed below:

<u>Guide #</u>	<u>Guide Title</u>
1	Culvert Installation & Maintenance
2	Ditch/Channel Construction & Maintenance
3	Vegetative Erosion & Sediment Control
4	Non-Vegetative Erosion & Sediment Control
5	Cut & Fill Slopes
6	Beaver Pipe: Construction & Maintenance
7	Stormwater Inlets & Catch Basins
8	Mowing & Brush Control
9	Snow & Ice Control
10	Obtaining Permits

**These Guides are FREE from the T² Center!
Call Toll-Free 1-800-423-0060**



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