Above: A dump truck drops a load of gravel during the installation of a geotextile fabric on one of Temple's gravel roads.

On The Road In New Hampshire

Six towns explore a new solution to the muddy New Hampshire gravel road

Some times sweeping your troubles under the rug is the best approach. On the 15th of November the town of Temple took this idea to heart and literally pulled the rug over one of their more troublesome gravel roads. “I’m real pleased to be putting a fabric on this road. In the spring of the year this area is truly impassable” said Tim Fiske, road agent for the town. “If this does the job, I’ve got a few other places that could use the same treatment. ‘The best part of the operation is that it only calls for 4 inches of gravel on top of the fabric and will cost us less money and headaches than if we built the road the conventional way.”

The town of Temple’s highway department wasn’t the only one interested in this process. Mason, Wilton, Lyndeborough, Greenville, and New Ipswich were all in attendance and were lending a hand with the installation. “We do a lot of helping out with each other around here” mentioned Curtis Dunn, road agent from the town of Mason. “We don’t find ourselves competing with each other as much as we work together to keep all of our towns in shape.”

Curtis Dunn is on the board of the Road Agent Association and was responsible for setting up the demonstration. The 600 feet of geotextile non-woven fabric was donated by Phillips Fibers Corporation. “I called around,” said Curtis, “and Tim mentioned that he thought he had a good test area in Temple for us to try out.” The road was narrow and boggy. It was about 17 feet wide which fit well with the 16 1/2 foot wide rolls of fabric.

It took no time at all to lay out the fabric. The operation started around 9:45 and the vast majority of the work, gravel and all, was completed by noon. “All we did was to follow the procedures established at Oklahoma State University,” explained Tim. “The directions were easy to follow and the rolls of fabric were easy to handle. I guess we’ll just have to wait now and see how things hold up during mud season.”

For more information see the article in this newsletter on installing geotextiles on gravel roads.

Salt And Sand For Winter Maintenance

Basic information and practical tips on how to use de-icing chemicals and sand

To clear winter roads for traffic, highway personnel usually must use either chemical de-icers to melt ice and snow or sand to provide traction. Since chemicals are costly and may have negative environmental impacts, you need to know how they work. This article gives you basic information and practical tips on how to use de-icing chemicals and sand.

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De-icing with chemicals

Clearing New Hampshire’s winter roads to the bare pavement usually requires de-icing chemicals. In New Hampshire, the most common chemical is salt or sodium chloride. De-icing salt is relatively light – just over one ton per cubic yard – and comes as a mixture of 5/8 inch granules to fine crystals.

A second commonly used chemical, calcium chloride, is manufactured or extracted from natural brines. It is available in dry form (pellets or flake) or in solutions of various concentrations.

When air temperatures are below 32° F, you must have three elements to melt snow and ice: a de-icing chemical, and a heat source to provide energy for melting.

The de-icing chemical works by lowering the freezing point of water. Any material that will dissolve in water lowers its freezing point. Sugar water, for example, will freeze at slightly below 32° F. A 23.3 percent concentration of salt water freezes at -6°F and a 29.8 percent solution of calcium chloride will freeze at -67°F. These low freezing points make salt and calcium chloride useful highway de-icers.

Before a dry de-icing chemical can act, it must dissolve. Moisture can come from snow on the road surface or water vapor in the air (humidity). Calcium chloride attracts moisture and can draw it from the air.

Changing ice or snow into water also requires heat from the air, the sun, the pavement, or traffic friction. Even when pavement temperature is below freezing, it holds some heat which can help melt snow and ice.

The process of melting snow on roads is similar to putting an ice cube in a glass of pop. The warm liquid becomes colder, losing its heat to the ice cube which melts. When the liquid’s temperature is the same as the ice, the cube stops melting. Similarly, road ice continues melting until the heat source is diminished or the solution becomes so diluted that its freezing point rises to that of the air and snow temperature.

Factors affecting de-icing action. Chemical concentration, time, pavement and air temperatures, weather conditions, type of road surface, topography, traffic volume, width of application, and, most importantly, time of application all affect the process of melting snow and ice.

Concentration. If too much chemical is used, not all of it will dissolve into solution and some will be wasted. Too little chemical doesn’t sufficiently lower the solution’s freezing point. The ice will not melt or melted snow may re-freeze and the chemical is wasted. Recommended concentrations are described in “application.”

Temperature. The snow- or ice-covered road surface temperature strongly influences de-icing chemical amounts and melting rates. As temperatures go down the amount of de-icer needed to melt a given quantity of ice increases significantly. Figure 1 shows you can melt 5 times as much ice at 30°F as at 20°F. Melting rates become very low below 20°F.

Time. The longer a de-icing chemical has to react, the greater the amount of melting (see Figure 2). At temperatures above 20°F both salt and calcium chloride can melt ice in a reasonable time. At lower temperatures salt takes much longer.

Weather. Heat from the sun warms the pavement, speeding up melting. Radiant heat may cause the pavement temperature to rise 10°F or more above air temperature. Use less chemical when temperatures are rising.

Applying chemicals during blowing snow and cold temperatures will cause drifting snow to stick to the pavement. If chemicals are not used, the snow is likely to blow off the cold road surface. continued on p. 4
All Computer Users In Transportation Should Know A few Things

A quick review of three very good sources of computer software in transportation, by Dr. Dot

I am getting more and more calls from New Hampshire public employees who are looking for specific types of software. There are two very good sources of transportation software which operate out of universities and one source which is more general but I have found to be very helpful.

The first place you should know about is The Center for Microcomputers in Transportation known as McTrans. This center opened up in July of 1986. Its primary purpose is to serve as a center of technology exchange for microcomputer software in transportation. Its support staff includes specialists in the areas of traffic engineering, hydraulics, construction management, rural and urban planning, pavements, safety and highway design, and others.

McTrans offers an excellent Software and Source Book as well as a professional easy to understand newsletter. Their customer service is excellent. They send out software quickly and they are always eager to help us poor frustrated users when we call. They have made a concerted effort to keep software prices to a minimum and they are highly recommended for beginners and advanced users alike. For more information, McTrans can be contacted by calling 904-392-0378 or by writing to:

McTrans
University of Florida
512 Well Hall
Gainesville, FL 32611

The second place you should be aware of is the University of Kansas Transportation Center. These people also offer a wonderful newsletter, PC-TRANSmision. They have an excellent staff, they offer top customer service, they have a library of good transportation software (PCs in Transportation Software Directory), they have an excellent software distribution service, they keep their charges to a minimum, and I wouldn't be without them. They are an essential addition to the transportation computer user. For more information call 913-864-5655 or write to:

University of Kansas
Transportation Center
211 Learned Hall,
Lawrence, KS 66045

The final place you may wish to be aware of is a private operation which distributes shareware and other public domain software. These people offer a magazine titled, Shareware. They also have a library catalog called, The PC-Sig Library. This outfit offers low-cost software from soup to nuts and I often browse through their offerings when I'm in the market for a particular type of software application. For more information call 800-245-6717 or write to:

Shareware
1030 D East Duane Ave.
Sunnyvale, CA 94086

One thing is for certain, the world of microcomputers can be confusing and overwhelming. If you have any questions on software, shareware, freeware, hardware, etc. — give us a call! We'll help you sort out the mess. We can be reached at the Technology Transfer Center by calling 1-800-423-0060 or send in your question on the mailer attached to this newsletter.

Tort Liability And The Highway Agency

The state of New Hampshire now has a level of pending tort claims totaling between $4,000,000 and $5,000,000.

The liability of highway agencies for proper design, operation, and maintenance of roadway facilities is coming to the forefront of public sector awareness. Litigation stemming from traffic accidents frequently involves the applicable highway agency for purposes of establishing the agency’s actions, or lack thereof, as contributory to the resulting accident. Public sector costs of this litigation can be staggering and methods of reducing exposure to this liability need to be addressed.

A legal term, "tort," is described as a wrong committed by a person or agency which results in some damage or injury to the person or property of another. In the context of highway operation and maintenance, tort liability is typically associated with "negligence" on the part of the highway agency or official with regard to the design, operation or maintenance of the traveled roadways. Negligence can be either the doing, or failure to do, something that an ordinary, reasonably prudent person might have done or not done under comparable circumstances.

On July 3, 1985, the state of New Hampshire repealed its "sovereign immunity" from suit in tort cases. Since then, negligence suits against the State for defective highways has been increasing to a present level of pending claims totaling $4 to $5 million. Applied to the approximately 4,800 miles of state owned highways, this translates to a currently pending claim of about $1,000 per mile of highway! Note that this does not include present claims against town and city maintained roadways.

The above noted claims against the state of New Hampshire can be apportioned, approximately equally, among the following three categories:

- Defects related to snow and ice conditions or snow and ice removal
- Defects related to standard maintenance -- potholes, ditches, existing signs, signals, etc.
- Defects related to the roadway facility -- guardrail, roadway alignment, signing, roadside obstacles, etc.

continued on p. 5
Salt and Sand... continued from p. 2

Road surface type. Snow and ice melt more rapidly on concrete surfaces because it gives up heat more rapidly. Because asphalt absorbs more solar radiation it may have more heat available for melting snow. This is why snow melts rapidly next to bare asphalt pavement areas.

Topography. Ice tends to form where topographic conditions like high banks or dense vegetation screen the road surface from the sun; and the longer the area is shaded, the more likely that ice will form. Since pavement temperatures are lower in shaded areas, you may need more chemicals there.

Traffic effects. Traffic helps de-icing by spreading and mixing chemicals into the snow and ice, and supplies some heat from tire friction. Tire action also breaks up ice layers weakened by salt and can throw slush off the road. Roads with light traffic can be more difficult to maintain because they lack this mixing and breaking action.

Application width. Studies show that snow melts faster when salt is applied in narrow strips. The amount of snow melted over a period of time is the same, however, regardless of application width. If you concentrate spreading (windrowing), you can expose a portion of road surface to the sun quickly. It can then absorb heat and help increase the melting rate.

After a road is first plowed, de-icing chemicals are usually applied in a windrow two to four feet wide down the middle of a two-lane road. To remove glare ice or keep snow in a plowable condition, you may have to apply chemicals across the whole traveled roadway.

Time of application. Timing is the most important factor in successfully clearing snow by chemical treatment. Spreading a small amount of chemical de-icer on the snow when it is loose and unpacked melts a little snow and causes the rest to form into slush. Traffic cannot pack down this slushy snow which is 15 to 30 percent water and plows can remove it easily.

Environmental impact. Environmental impact is a major concern in using chemicals for winter road maintenance. Studies show that soils, vegetation, water, highway facilities, and vehicles are all affected. It is very important therefore to use these chemicals wisely.

Most soil and vegetation impacts occur within 60 feet of the road with more impact nearer the pavement. De-icing chemicals can accelerate deterioration in concrete and steel structures. New construction methods are reducing this impact, but highways and bridges do suffer from chemical damage. Vehicle corrosion is also accelerated.

Protect chemical supplies.

Environmental damage attributable salt use has come from stock pile run-off. Since such run-off is saturated to maximum concentration with chlorides from the salt, any exposed environmental element receives a very large does. For that reason, you must control any stockpile run-off before you can contaminate ground or surface water by piling salt on an impervious base to prevent rain or spring thaw run-off from seeping in. Such bases are generally constructed of asphalt or concrete.

Large salt stockpiles exposed to weather can lose .13 percent of the pile's initial weight per year for each inch of rainfall. To insure maximum protection many highway agencies store salt inside a covered, waterproof structure. When it is not possible to store the salt inside a building, the stockpiles are usually covered with a tarpaulin or other waterproof material.

Chute vs. spreader. A spreader and spinner is the most common way of applying de-icers. A spinner is a spinning circular plate which throws the de-icer out in a semicircle. An alternative to the spinner is a chute applicator which distributes the de-icer on the road in a windrow, usually along or near its centerline.

Some spreaders can be equipped with automatic controls. Automatic spreaders mount controls in the truck cab to automatically regulate application rates as truck speed fluctuates, so the driver need not adjust the spreader controls. This is a very good idea, though some agencies have experienced equipment maintenance problems.

Spread calibration. Calibration is essential for controlling application rates. Different materials will spread at different rates at the same spreader control setting, so you must calibrate spreaders with the material you intend to use. Each spreader must be calibrated separately; even individual spreaders of the same model can vary widely in the amount of material they

spread between 100 and 300 pounds per single lane mile. Do not use any de-icer when temperatures are below its effective range. Twenty degrees Fahrenheit is normally considered a lower limit.

Because melting action will spread across the pavement to lower areas, concentrate on the center (crown) of two-lane roads and the high side of curves.
spread at the same control setting. Furthermore, spreaders operate in a very hostile environment—low temperature, lots of moisture, corrosive chemical—so, they need to be checked every year.

How to Calibrate a Spreader

- Warm truck's hydraulic oil to normal operating temperature with the spreader system running.
- Put partial load of salt on truck.
- Mark shaft end of auger or conveyer.
- Dump salt on auger.
- Rev truck engine to operating RPM (approximately 1500 RPM).
- Count and record the number of shaft revolutions per minute at each spreader control setting.
- Collect and weigh salt for one revolution, deducting weight of container.
- Multiply shaft RPM by the amount of salt discharged per revolution to get the discharge rate in pounds per minute. Multiply this rate by the minutes it takes to travel one mile at various truck speeds to get the pounds of discharge per mile.

For example, a truck which takes three minutes to travel one mile at 20 mph with 30 shaft revolutions per minute and six pounds of salt per revolution will spread 540 pounds per mile.

\[30 \times 6 = 180\] \[180 \times 3 = 540\text{ lbs/mile}\]

- Make similar calculations for each control setting.

De-icing with sand and other abrasives

Sand and other abrasives improve traction immediately. They can be used at all temperatures, but are especially valuable when it is too cold for chemical de-icers to work. Sand is the most common abrasive, but crushed slag, cinders and manufacturer's sand are also used.

Environmental impacts. Sand used for winter road maintenance has some negative environmental impact. It can clog storm water inlets and sewers. Clean-up may be necessary in urban areas, on bridge decks and in ditches. The sand may wash downstream and end up in streams and lakes.

Sand must be treated with salt to keep it unfrozen and usable. This salt has the same potential impacts described earlier. In particular, salt-treated sand can accelerate vehicle corrosion.

Sand quality. Some sand will be more effective than others. Use sand with crushed or angular particles for better traction. Rounded particles are less effective. Very small particles and dirt are actually harmful to traction. All material should be larger than the #50 sieve. To minimize windshield damage, use sand with particles less than 3/8 inch diameter.

Combining sand with chemicals.

Treating sand with 50 to 100 pounds of salt per ton is necessary to keep it from becoming frozen and unworkable. It also helps anchor the sand to the ice surface, makes the sand easier to load from the stockpile, and makes it spread more evenly from mechanical spreaders.

Sometimes de-icing chemicals are mixed more heavily with sand. The sand gives immediate traction and the chemicals melt the snow later when the temperature rises. For this to be effective, it is better to prepare the mixture with coarse-grained salt. Individual coarse salt particles will penetrate the snow without carrying along much sand. The sand stays on the surface to provide traction. When salt particles are too fine, they soften the snow, allowing traffic action to mix the sand in and losing the anti-skid effect.

Sand application. Sand is usually applied only at hazardous locations such as curves, intersections, railroad crossings, and hills. Rates of two to four tons per mile are common. It is important to calibrate spreaders to control application rates.

Since sand must stay on the surface to be effective, it should not be used when it will be covered with more snow or when it will be blown off quickly by traffic.

Summary

Knowing the properties of de-icing chemicals and abrasives can help you maintain safe, usable winter roads efficiently and economically while limiting environmental damage.

The above information was taken from the Wisconsin Transportation Bulletin, No. 6.

Tort liability... continued from p. 3

In contrast to New Hampshire, the states of California and Pennsylvania repealed their respective sovereign immunities in 1961 and 1979. Tort claims against the California department of transportation, has risen to nearly $2 billion by 1984, and claims against the Pennsylvania Department of Transportation ranged between $80 and $90 million by 1987.

A local agency's exposure to liability for highway defects cannot be eliminated, although there are measures that can be taken to reduce the exposure to tort liability, including the following:

- Consult competent professionals (attorneys, professional engineers, municipal insurance agents) for decisions related to engineering designs or professional programs
- Establish and maintain a record keeping system to document existing conditions: (accident records, road facility inventory, regular inspection programs, etc.)
- Establish a procedure for handling complaints and reports of problems
- Keep records of maintenance work
- Utilize current policies, standards and guidelines for design of traffic control devices and new roadway facilities
- Document a procedure for determining improvement priorities
- Provide liability insurance to your employees

Because of budgetary and manpower constraints, it is generally not feasible for a highway agency to either update its entire roadway and traffic control facility to current engineering standards, or identify and respond to every maintenance need of the facility as it occurs. Periodic safety inspections of existing facilities, adherence to current standards in the implementation of new roadway facilities and traffic control, and development and use of a documented procedure and program for updating and maintaining the facility, comprise the first line of defense for the highway official. It serves well to repeat the old adage: "An ounce of prevention is worth a pound of cure."

The above article was written for Road Business by Robert J. Mack, P.E., Senior Transportation Engineer, Storch Associates. We are looking for more Road Business articles from other New Hampshire organizations and businesses. If you or your organization are interested in sharing your knowledge or experience with New Hampshire public roads officials, please contact the Technology Transfer Center at 1-800-423-0080.
Installation Of Geotextiles On Gravel Roads

Selection and installation of the proper geotextile and aggregates for eliminating perennial boggy spots and trouble areas

Soil is the foundation material for all roads, whether in the form of native undisturbed subgrade materials, transported material, or native embankment material. Vehicle loads are transmitted to the roadbed and if adequate support does not exist, severe rutting or washboarding will result.

In the fine-grained materials of New Hampshire’s roadbeds, the stability is moisture dependent. In areas where there is poor drainage or subsurface water conditions it is almost impossible to keep the roadway from rutting. Even though the gravel is added to these locations, the roadway will produce ruts as soon as the next rainfall occurs. Placing a geotextile, or fabric as it is sometimes called, with 4 inches of gravel on these locations will eliminate the rutting and provide all weather service for the roadway.

Selecting a Geotextile

First, let’s look at the two distinct types of fabrics available for roadway applications. The first type is the woven geotextile. This type resembles burlap in appearance in that the fibers are actually machine woven. Woven fabrics are very high in tensile strength properties, however, the properties of elongation and permeability are lower than non-woven fabrics. Woven fabrics are not recommended for separation applications on low volume gravel surfaced roads.

The second type, and the type which is recommended for this particular application, are the non-woven fabrics. These fabrics are made from fibers placed in a random arrangement and bonded together by various processes such as needle punched, spunbonded, melt bond, etc. These fabrics resemble the lining in the trunks of automobiles. Non-woven fabrics do not have the tensile strengths of the wovens but they have tremendous elongation and permeability properties which enable them to give the excellent performance on the problem spots on low volume roads. The minimum requirements for a
fabric to be used on a low volume gravel surfaced road are as follows:

**Minimum Weight**
4 oz/sq.yd. ASTM D 1910

**Minimum Grab Tensile**
90 lbs. ASTM D 1682

**Minimum Elongation (at break)**
50% ASTM D 1682

**Puncture Strength**
30 ASTM D 1682

**Equivalent Opening (US std. sieve)**
60 min. Corps of Engrs.
170 max. CW-02215-77

*Note: If excessive vehicle weights or high volume/high velocity vehicle traffic is expected the minimum values should be increased.*

**Site Preparation**

Ideally, the roadbed should be graded smooth and a crown established in the roadbed. If the roadway has deep ruts when placing the fabric, it will take additional gravel to fill the ruts adding to the cost of the operation. Secondly, and most important, a loaded dump truck with its bed raised could tip over on its side if the rear wheels should fall off into the rut.

It is not mandatory to fully compact the section of roadway to be repaired prior to placing the fabric and gravel. In most cases, this would be very difficult to achieve chiefly because this area usually is highly saturated with water. When the roadbed material is dry enough to hold up a motor grader and loose enough to fill in the ruts; use the motor grader to shape the roadbed, filling in the ruts and establishing a crown.

In the case of an emergency or unusual condition such as a spring in the roadbed, it will not be possible to shape the roadbed. These conditions will be discussed later.

**Placing The Fabric**

Once the roadbed has been shaped the fabric can be rolled out. Since most manufacturers produce the textiles in roll widths of 12.5 feet to 15 feet, it generally will take 2 rolls side by side to completely

*continued on p. 8*
cover the roadbed. The first roll is lined up on one edge of the roadbed, starting about 20 feet away from the problem areas, and rolled out for about 20 feet. The second roll is lined up on the other edge of the roadway and overlaps the first roll near the centerline of the road. All overlaps should be a minimum of 12 inches. Continue to roll the first roll out keeping about 20 feet ahead of the second roll. This will allow for periodic shifting of the rolls to keep the alignment correct. If there are windy conditions present when unrolling the fabric, the ends and sides will need to be weighted down to keep the fabric from blowing. This can be accomplished by putting shovel fulls of gravel or soil from the borrow ditch of the ends and sides to keep the fabric down. Depending on the velocity of the wind, a spacing of eight to ten feet is generally sufficient to keep the fabric weighted down. It is recommended to place the first roll on the down wind side of the road. The second roll will overlap the first roll in the direction the wind is blowing, keeping the wind from picking up the edge of the first roll at the centerline.

When the two rolls are rolled out and additional rolls are needed to be placed, fold the ends of the first two rolls back over on top of themselves about two feet. Start the additional rolls in the same manner as the first rolls with the ends next to the folds of the first rolls. As soon as the additional rolls are rolled out a short distance pull the folded fabric over the ends of the additional rolls. Continue lapping the fabric in the same direction each time new rolls are placed. This is necessary as the gravel must be spread in the same direction the fabric is lapped. If the fabric has folds in it, flatten the folds in the same direction the fabric is lapped and weight the folds down as flat as possible.

Selecting The Gravel

The type of gravel to be placed on the fabric will chiefly depend on the local sources available. The gravel should range in size from a maximum of 3/4 inch to 1 1/2 inches in diameter and have at least 10% fines or dust. This dust should not contain any significant amount of clay. The gravel should not contain any significant amount of clay. The gravel should have angular sides as with crushed stone as opposed to a round river gravel. Crusher run gravel is probably the best type of gravel to use. The ideal material would conform to the following specifications:

Gradation Requirements (Percent Passing)

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>1 1/2 in. (37.5)</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 in. (19.0)</td>
<td>90-100</td>
<td></td>
</tr>
<tr>
<td>No. 4 (4.75)</td>
<td>30-85</td>
<td></td>
</tr>
<tr>
<td>No. 200 (0.075)</td>
<td>10-25</td>
<td></td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>6-15</td>
<td></td>
</tr>
<tr>
<td>Liquid Limit</td>
<td>Not more than 35</td>
<td></td>
</tr>
</tbody>
</table>

Placing The Gravel

As stated previously, the gravel must be spread in the same direction the fabric is lapped. Spreading the gravel into the lap can cause the fabric to separate resulting in unprotected spots in the roadbed. Once the roadbed has been shaped and the fabric rolled out over the problem area the gravel trucks can dump the gravel.

The two most common operations will be using end dump or belly dump trucks. The end dump trucks can either dump the gravel while driving forward or they may back dump. An experienced driver can chain the tailgate and spread the gravel very close to the required thickness of four inches. This will save considerable time in the blading operation. The belly dump trucks will dump in windrows and the motor grader will pull the material from the windrows and blade the gravel across the fabric.

The truck drivers should be cautioned against sudden hard stops or takeoffs while the trucks are on the fabric. Sudden sliding or spinning of the truck tires can tear the fabric. A smooth continuous rolling movement is advised.

Blading The Gravel

A motor grader will be needed to spread the gravel evenly across the fabric. The moldboard on the grader should be tilted forward to give a dragging action. The grader operator should not try to spread the gravel in thin lifts (less than 2 1/2 inches). Trying to blade a thin lift will cause the gravel to lock together and will drag the gravel across the fabric. This will result in tearing of the fabric.

The end result should be a four inch thickness of gravel across the fabric. Avoid turning the front wheels of the grader while it is not moving. This will tear the fabric.

Unusual Conditions

In the event of having to place fabric and gravel in boggy or extremely wet and soft locations the following techniques are recommended:

- Roll the fabric across the problem area, starting about 30 feet from the soft area.
- End dump trucks can be used to place the gravel if the trucks back dump the gravel, keeping at least four inches of gravel between the tires and the fabric.
- End dump trucks can also be used to dump the gravel in a pile on one end of the fabric. A small dozer or front end loader can then push the gravel out ahead of the machine as long as four inches of gravel is between the tracks or tires of the equipment and the fabric.
- Don't use a motor grader to spread the initial layer of gravel. The front wheels of the grader are about ten feet in front of the blade and will be on the bare fabric. This will cause the fabric to be pushed down into the mud making large ruts.

Summary

1. Shape the roadway and establish a crown.
2. Roll the fabric across the problem area. Weight the ends, sides, and folds as necessary.
3. Spread the gravel in the appropriate manner and in the direction of the laps.
4. In soft conditions, keep four inches of gravel between the machinery and the fabric.

The above information was taken from a research paper published by Oklahoma State University. John Hopkins, Director of the Oklahoma Transportation Center, has spearheaded investigations into the use of geotextiles with gravel roads through a grant from the Federal Highway Administration. For more information on the subject please contact the New Hampshire Technology Transfer Center at 1-800-423-0060.
Tort Liability Is A Growing Concern Of Government Agencies -- Spots For A Potential Suit --

Although local tort problems differ, there are some basic precautions that can be used in any location

Low Shoulders - Low shoulders at isolated locations, such as the bottoms of steep grades or the inside of sharp curves, sometimes pose serious repetitive problems. A solution in such instances is to pave the shoulder with an all-weather surface capable of withstanding occasional loads.

When a major shoulder drop-off exists and cannot be corrected within a reasonable period of time, install flashing barricades or low-shoulder warning signs.

Ice and Snow Removal - Identify the specific roadway sites that ice up frequently, the probable causes for the ice and the remedial action necessary. Corrections should occur prior to winter.

For those locations that ice up frequently and are caused by illegal driveways or run-off from adjacent parcels of land, write the property owners about the problem. If the property owners fail to correct the problem within a reasonable period of time, contact the agency's legal counsel to pursue appropriate legal action.

Signing and Lighting - Establish a process to routinely identify and correct signs deficiencies, not only those that are knocked down or missing, but those that are non-reflective and not in compliance with regulations.

Establish a process that will enable crews to identify signs which may be covered by foliage during spring and summer months, and take preventative action.

In recent years, city councils have begun to view street lighting as a discretionary service which might be deleted, or at least controlled in attempts to balance the budget demands with available revenues. However, cutting back on street lighting could have adverse effects not only on traffic safety, but crime rates as well.

Potholes - In the spring, when most potholes appear, the major repair emphasis is usually on higher traffic arterials. However, the maintenance strategy for pothole repair should be sufficiently flexible to also repair potholes are potentially more hazardous.

Treat major potholes judged to have substantial accident potential as emergency conditions. Consider flashing barricades or repair during non-working hours as probable solutions.

Construction Zones - A contractor should not be permitted to modify a traffic control plan without the written approval of the agency.

Prior to using a given route(s) should be thoroughly inspected to ensure that all traffic control devices conform to established regulations and that other deficiencies, such as low shoulders and potentially hazardous potholes, are corrected.

The construction contract should contain a legal clause that indemnifies the agency in the event of an accident.

Utility companies, municipalities, and other public bodies that perform work with agency rights of way should agree by contract to indemnify the agency from any claims associated with the work performed.

Guardrail Repair - Establish a process to repair accident damaged guardrails within a reasonable period of time. Immediate repairs are advisable if there is substantial potential for a serious accident.

Replace existing, blunt-ended guardrails damaged by accidents with standard, buried end guardrails.

Excerpts from Alaskan Transportation Technology Transfer Program, Fall 1987; County Roads & City Streets, West Virginia University, Vol. 2, No. 3, 1985. ☎️

Do you have one of these signs in your town? They are common signs in New Hampshire and the lawyers love them. As in most cases, the reason this sign was erected was because there was a single tragic accident at this location. Do you think that a sign like this will protect you from a drunk teenager traveling 50 mph faster than the speed limit? The point is clear -- this is not a warning sign. It does not inform the driver of anything to watch out for. However, it does inform the lawyers that they could make some money at your expense!
Did You Know?

How To Sue A Road Agent?!

Have you heard of the new book now on the market? It's sure to be a big money maker -- if you're not a road agent. The name of the book is, Killer Roads: From Crash to Verdict. The ITE (Institute of Transportation Engineers) 1988 publications catalog lists the book for $65.00 and I'm sure its a big seller.

The description below the book reads: "Written for attorneys... Discusses legal analysis, factual criteria for evaluation, and practical trial skills. Covers the full range of problems and hazards of transportation facilities, including roadside obstacles, curve design, railroad crossings, guardrails, sidewalk defects, ditches, lights and signals, pavement markings, snow removal, and construction hazards. Offers guidelines for consideration of evidentiary factors and presents practical techniques for successful litigation." ■

!!! WANTED !!!

Associate Engineer, Concord, N.H. (pop. 35,000) - performs engineering design, planning, layout and inspection work in connection with all phases of municipal engineering. BSCE and two years experience in highway and traffic design. Possession of valid E.I.T. certificate is required. Salary negotiable within position range. Closing date is February 10, 1989. Forward resume to: Personnel Dept., City of Concord, City Hall, 41 Green St., Concord, NH 03301; EOE - M/F/H.