ILLINOIS INTERCHANGE
TECHNOLOGY TRANSFER TODAY for TOMORROW
T²
BUREAU OF LOCAL ROADS AND STREETS L.T.A.P. QUARTERLY
Vol. 11 No. 4 Winter 2003

Season's Greetings from the Illinois Technology Transfer Center

Kevin *Roy*

Amy *Kyle*

INSIDE:

Please pass this on to other interested parties in your office.

Illinois Department of Transportation

From the Desk of . . .

What does your agency's Christmas wish list include? How about reducing pothole failures? Potholes continue to be major headache for highway authorities especially at the local level. Because of the continuous freeze thaw cycles, winters in Illinois provide a perfect environment for potholes to occur. Therefore, your agency should consider alternate methods to the decades old practice of throw-and-roll.

According to Strategic Highway Research Program's (SHRP) Report SHRP-H-353 (IL T^2 Publication # L005), failure rates are significantly improved by using high performance materials or different placement procedures. This report evaluated several high performance material options. The Bureau of Local Roads and Streets recently issued LR 442 Bituminous Patching Mixture for Maintenance Use that includes Group I mixtures, standard emulsions or PG binder for materials, and Group II mixtures, high performance proprietary materials. If used, this special provision will ensure that your agency is using IDOT approved materials. LR Special Provisions may be downloaded at http://www.dot.state.il.us/blr/lrslist.html.

The report also found that improved placement procedures - Edge Seal, Semi-Permanent, and Spray Injection - also improved failure rates. Edge Seal and Semi-Permanent are modified versions of throw-and-roll. With edge sealing, potholes are filled by throw-and-roll; however, the next day the edges of the patch are sealed with a tack coat and then cover aggregate is placed over the tack coat. Semi-Permanent begins by removing all water and debris from the pothole. Next, the pothole sides are squared on all sides, leaving only sound pavement on the edges. Patching material is then placed and compacted in the pothole. While these methods improve the failure rates, they require more time, manpower and lane closures.

Spray Injection technology requires special equipment that is available from several manufacturers; however, regardless of the equipment the process is the same. The equipment allows an operator to clean, fill, and cover a pothole without changing equipment. First, water and debris are blown from the pothole using air flow from the aggregate delivery system. Next, an emulsion is introduced to the air flow to place a tack coat on the pothole. Then, aggregate is added to the air stream creating an emulsified bituminous mixture. The operator fills the pothole with this mixture. Finally, the emulsion is shut off and a cover aggregate is placed over the patch. Depending on the type of equipment, this may be a one or two man operation plus necessary traffic control.

There are two basic equipment configurations. First, is a self-contained unit that allows the operator to perform the repair from within the cab of the truck. Second, is a trailer or truck mount unit that requires the operator to perform the repair on the pavement. The self-contained unit allows for a one man operation; however, it requires a very skilled operator. The trailer or truck mount unit is easier to operate; however, workers are exposed to traffic. Before purchasing this equipment talk with other agencies that have purchased the equipment. Please contact the T^2 Center for information on equipment dealers.

Have a safe and happy holiday season.

Kevin Burke
T^2 Program Manager

Teresa Price, IDOT, fills a pothole using spray injection technology with the assistance of Cliff Dickehut of Dura Patcher.

Out in the Cold

By: Mike Ayers, Ph.D., and Steve Waalkes, Contributing Authors

Frost heave

Frost heave – Frost action is best described as the expansion and eventual consolidation of fine-grained soils due to freezing. A number of factors must be present for frost action to occur including:

- A frost-susceptible soil (generally a silt or silty clay);
- An adequate supply moisture (due to infiltration, ground water movement, capillary rise and others); and
- Sustained temperatures below freezing (the soil must freeze – ambient air temperature can be used as a predictor, as can historic climate data).

Frost heave occurs when adequate moisture is present in frost-susceptible soil that is then frozen. These conditions lead to the formation of "ice lenses" in the soil. Because ice occupies a greater volume than water, a wedging action or expansion of the soil results. As the ice lenses form, additional water is drawn in, leading to further expansion. When the soil thaws, the ice lenses melt and consolidation of the soil occurs.

Frost action affects all pavement types, although concrete pavements are less susceptible to it than asphalt pavements. It is most detrimental during the formation of the ice lenses which result in expansion of the soil. Pavement distress typically involves longitudinal cracking and differential vertical movement of the slabs. The most problematic areas are transition zones between materials of different frost susceptibility.

Methods to minimize or eliminate frost action include:

- Removal of the frost-susceptible soil and replacement with a more suitable material;
- Cross hauling to eliminate differential frost susceptibility;
- Addition of soil modifiers to reduce frost susceptibility; and
- Minimizing the level of moisture present through proper drainage, pavement maintenance and design features.

A pinch of salt

With winter weather comes seasonal pavement maintenance and lots of salt. Although most concrete pavements placed in the last year should have resistance to any detrimental effects of deicing salts, a certain amount of caution should still be exercised before salting.

The concern with putting deicing agents on concrete is based on the ability of the saltwater solution to penetrate into the surface of the concrete and then refreeze. The basic reaction is mechanical – freeze-thaw – and not chemical. Regardless of the deicing chemical, it still melts the ice/snow, which can make the concrete susceptive to scaling (the pavement distress that results from freeze-thaw damage at the surface). However, concrete pavements are designed to be resistant to this effect.

Deicing salts are detrimental to concrete pavements in the following situations:

1. The new pavement has not undergone an air-drying period of 30 days after placement. The 30-day period of air drying allows the concrete to seal and prevent a saltwater solution from penetrating into the concrete;
2. There is inadequate air entrainment. It is best to have around 6% (no less than 3.5%) for harsh freeze-thaw environments; and
3. There was insufficient curing. Acceptable curing methods include: curing compound, plastic sheeting or misting, among others.

Therefore, if the concrete pavements are at least 30 days old, had adequate air and underwent an adequate curing regimen they should survive a harsh, salty winter without problems.

Chill factor

A common question this time of year has to do with the difference between melting rates on light-colored and dark-colored pavements.

There is no clear relationship that darker pavements (new asphalt or dark-colored concrete) will affect ice and snow control to an advantage over lighter surfaces. Older reports have shown a possible 6-8°F temperature differential between concrete and asphalt surfaces exposed to sunlight in

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FHWA Has New Look

by Mark Sandifer, FHWA Resource Center - Olympia Fields

FHWA Resource Centers

www.fhwa.dot.gov/resourcecenter

Atlanta
Construction and Project Management – Rob Elliott, 404-562-3941
Finance – Thay Bishop, 404-562-3695
Pavement and Materials – Monte Symons, 404-562-4782

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Geotech and Hydraulics – Peter Osborn, 410-962-0702
Structures – Shoukry Elnahal, 410-962-2362

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Safety – Pat Hasson, 708-283-3595

San Francisco
Air Quality – Robert O'Loughlin, 415-744-3823
Environment – Donald Cote, 415-744-2650
Planning – Lisa Randall, 415-744-2649

Federal Highway Administration has changed in the way the agency's Resource Center is organized to better meet today's transportation challenges.

The new FHWA Resource Center is structured to improve our ability to serve our partners and customers. We now operate as one Resource Center at four locations, with the enhanced capability to provide training and technical assistance across state, national and geographical boundaries. With this new structure, we are also better able to embrace new ways of thinking and become more specialized to support program delivery and technology deployment.

Under the new structure, the FHWA Resource Center will have 10 specialized Technical Service Teams (TST). Each team has a national Team Leader to quickly coordinate responses to your calls and requests. The FHWA Resource Center locations will remain the same, with offices in Atlanta, Baltimore, Olympia Fields (Chicago) and San Francisco.

The new structure enhances unified and coordinated coverage and assistance. Each Team Leader manages a Technical Service Team with technical specialists located across the country in the FHWA Resource Center offices. This structure allows the team members to align goals and activities on a national scope, continue to provide geographical service to customers, and draw upon the national team for the best practices and additional expertise.

Each FHWA Resource Center office hosts two to three TST's, and each Team Leader is located in the offices that house his or her specialty:

In each location, the Resource Center has a core staff, which includes Administration, Civil Rights, Information and Analysis, Marketing, Media, Quality and Strategic Planning, and Technology Deployment that supports the efforts of each TST as well as the overall efforts of the Resource Center.

FHWA Website Highlights

Specifications: http://fhwapap04.fhwa.dot.gov/index.jsp
Winter Maintenance: http://www.fhwa.dot.gov/winter/index.html
Asset Management: http://www.fhwa.dot.gov/infrastructure/asstmgmt/index.htm
MUTCD: http://mutcd.fhwa.dot.gov/
Expertise Locator: http://highwayexpertise.fhwa.dot.gov/ELMain.nsf/Main?Openagent
Highway Safety: http://safety.fhwa.dot.gov/
Complete List: http://www.fhwa.dot.gov/fhwaweb.htm

The Basics of Salting and Sanding

Clearing winter roads to the bare pavement usually requires deicing chemicals. The most common chemical is salt, which usually comes from mined rock salt that has been crushed, screened and treated with an anti-caking agent. Deicing salt is relatively light – just over one ton per cubic yard – and comes as a mixture of 0.375-inch granules to fine crystals.

Another commonly used chemical, calcium chloride, comes from natural brines. It comes dry in pellets or flakes, or in solutions of various concentrations.

Research continues on alternative chemicals. Calcium magnesium acetate is being produced and has few of the negative environmental impacts associated with salt and calcium chloride. Additives to reduce chemical's corrosive properties are also being used. Currently, these alternative materials are more expensive, but can be useful in special situations.

Deicing chemicals work by lowering the freezing point of water. A 23.3% concentration of salt water freezes at –60 degrees F and a 29.8% solution of calcium chloride freezes at –67 degrees F. These low freezing points are what makes salt and calcium chloride useful.

Before a dry deicing chemical can act, it must dissolve into a brine solution. The necessary moisture can come from snow on the road surface or from water vapor in the air. Calcium chloride has the ability to attract moisture directly from the air.

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

Factors to consider

Chemical concentration, time, pavement temperatures, weather conditions, type of road surface, topography, traffic volume, width of application, and most importantly, time of chemical application all affect the process of melting snow and ice.

If too much chemical is used, not all of it will dissolve into solution and some will be wasted. Too little chemical may not sufficiently lower the solution's freezing point. The ice will not melt or melted snow may refreeze and waste the chemical.

The surface temperature of a snow or ice covered road determines deicing

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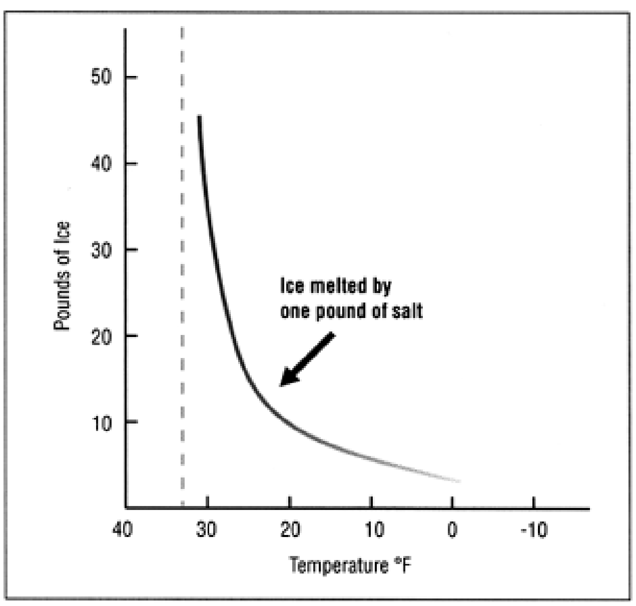

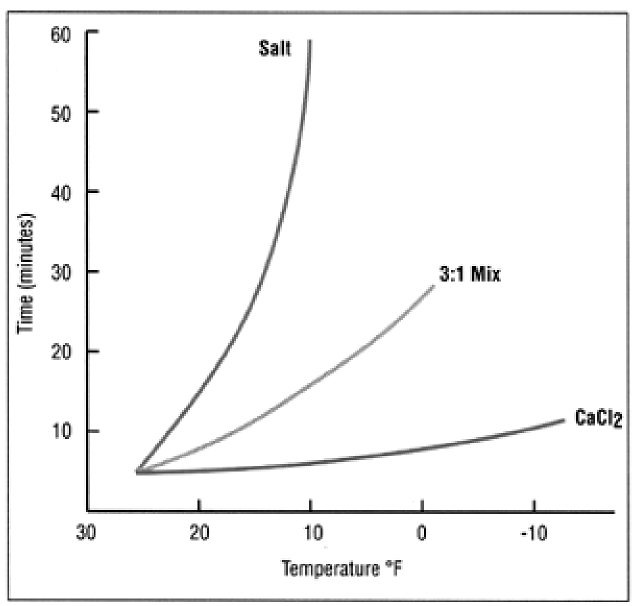

The Basics of Salting and Sanding

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chemical amounts and melting rates. As temperatures go down, the amount of deicer needed to melt a given quantity of ice increases significantly. The graph on page 5 shows that salt can melt five times as much ice at 30 degrees F as at 20 degrees F. The effectiveness of deicing is sensitive to small differences in pavement temperatures.

The longer a deicing chemical has to react, the greater the amount of melting. At temperatures above 20 degrees F, both salt and calcium chloride can melt ice in a reasonable time. At lower temperatures, salt takes much longer.

The sun's heat warms the pavement, speeding up melting. Radiant heat may cause the pavement temperature to rise 10 degrees F or more above the air temperature. On clear nights, pavement temperatures will be lower than air temperatures. Use less chemical when temperatures are rising and more when they are falling.

Applying chemicals during blowing snow and cold temperatures will cause drifting snow to stick to the pavement. If chemicals are not used, the dry snow is likely to blow off the cold road surface.

Ice tends to form where topographic conditions, like high banks or vegetation, screen the road surface from the sun. 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.

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

After a road is first plowed, deicing chemicals are usually applied in a window 2- to 4-feet wide down the middle of a two-lane road. To remove glare ice or keep snow in a plowable condition, you may want to apply chemicals across a broader portion of the road.

Timing is the most important factor in successfully clearing snow by chemical treatment. Early application is critical. Spreading a small amount of deicer when snow is loose and unpacked melts a little snow and turns the rest to slush. Traffic cannot pack down this slushy snow which is 15 to 30% water. This lets plows remove it easily.

It is better to reapply chemicals as needed than to over-treat initially. Do not plow off the chemical until it has a chance to melt the snow and ice.

IDOT snowplows easily remove chemically treated snow.

Environmental impact

A major concern in using chemicals for winter road maintenance is environmental impact. Studies show that soils, vegetation, water, highway facilities, and vehicles are all affected, so it is very important to use chemicals wisely. Most soil and vegetation damage occurs within 60 feet of the road and is greatest close to the pavement.

Deicing chemicals are highly soluble and follow any water flow. Salt concentrations in Wisconsin's surface and ground water have increased since the early 1960s, the Wisconsin Department of Natural Resources report, but aquatic life has not yet been affected that we know of. In drinking water sources, which the WDNR also monitors, salt concentrations are within recognized safe limits. In some reported cases, groundwater carrying deicing chemicals has contaminated wells, but most of these apparently were caused by seepage from poor storage facilities.

Deicing 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. Corrosion on vehicles and structures is estimated to be the largest cost impact of chloride-based chemicals. Even relatively small amounts of chloride will significantly accelerate existing corrosion.

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The Basics of Salting and Sanding

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Storage requirements

Localized environmental damage from salt has come largely from stockpile runoff. Since runoff is at a maximum concentration, any exposed environmental element receives a very large dose. For that reason, you must prevent stockpile runoff from contaminating ground or surface water by covering the salt and storing it on an asphalt base so rain and melt runoff can't seep in. State regulations require highway agencies to store salt inside a covered waterproof structure. When this is not possible, stockpiles must be covered with waterproof material and stored on an impervious pad.

Spreading

No two storms are alike, so no single set of standards will give the proper spreading rate for all storm conditions. Generally, however, only apply enough chemical deicer to permit plows to remove the snow or melt glare ice. Experience shows that it is most effective to spread between 100 and 300 pounds per single lane mile. Do not use any deicer when temperatures are below its effective range. Normally, 15 to 20 degrees F is considered the lower limit for salt. If deicing is necessary at lower temperatures, more salt is needed and melting will take much longer. Other chemicals such as calcium chloride and magnesium chloride may be a better choice.

Because melting action spreads across the pavement to lower areas, concentrate deicers on the center (crown) of two-lane roads and on the high side of curves.

A spreader with a spinner is the most common way of applying deicers. A spinning circular plate throws the deicer out in a semicircle. Alternatively, a chute can distribute deicer in a window on the road, usually on the centerline.

Spreaders can be equipped with automatic or ground-oriented controls. They automatically regulate application rates as truck speeds fluctuate, so the driver need not to adjust the spreader controls. They are proving effective in reducing waste chemicals.

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 at the same control setting. Furthermore, spreaders operate in a very hostile environment – low temperature, lots of moisture, corrosive chemicals – so, they need to be cleaned and checked every year.

Calcium chloride

Dry calcium chloride requires special handling and is more costly then salt. However, it is effective at temperatures below 0 degrees F and is fast-acting. CaCl actually gives off heat when it dissolves into brine formation. These unique properties make it valuable in severe conditions.

CaCl is usually stored in moisture-proof bags until needed. Otherwise, its ability to draw moisture can cause it to cake and form into large chunks.

A mixture of calcium chloride and salt can be very effective. Even a small amount of calcium chloride will start melting at low temperatures. The resulting brine and heat allow the salt to start working.

Pre-wetting

Pre-wetting salt has become common. Wetting provides moisture to make brine. Faster melting action may be expected. In addition, the wet salt has less tendency to bounce or be blown off the road by traffic. Savings in lost or wasted salt of over 20 to 30% are possible.

While any liquid deicing chemical can be used to pre-wet, liquid calcium chloride is used widely. Applications of 6 to 10 gallons per cubic yard of salt are recommended. Calcium chloride has the added advantage of producing extra melting due to its effectiveness.

Using salt brine to pre-wet is becoming more common because of its lower cost. Some agencies are producing their own salt brine solution (23%). Liquid CMA and magnesium chloride are also used.

Some agencies spray the salt as it is loaded into the truck. However, the application is more uniform if truck-mounted equipment is used to spray the salt as it leaves the spreader. This also eliminates the problem of handline pre-wetted salt that is not immediately used.

Savings from losing less salt to bouncing and traffic action can more than pay for pre-wetting. However, these benefits only result with lower application rates.

Anti-icing

Anti-icing is a road maintenance strategy that tries to keep the bond between ice and the pavement surface from forming. It involves applying ice-

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McHenry County Highway Department Wins 2003 Excellence In Storage Award

Eight salt storage facilities have won national recognition for the environmental sensitivity of their program as 2003 winners of the Salt Institute's annual "Excellence in Storage Award" competition.

They were selected from among a record number of applicants including the McHenry County Highway Department from Illinois.

In announcing the eight winners at the American Public Works Association Congress in San Diego, Salt Institute president, Richard L. Hanneman singled out the McHenry County Highway Department as having gone well beyond the basics of storing salt on an impervious pad and preventing rain and snow from falling on the pile.

"McHenry County has a beautiful and functional storage building, but this award recognizes the nuts and bolts of sound materials storage and the safety practices that protect the workers in this facility," says Hanneman. "This award isn't for architectural excellence, it's for superior environmental performance. McHenry County Highway Department has an outstanding program. We are proud to have them recognized as a model for all our customers in how to store salt in an environmentally safe manner."

Applications for the year 2003 competition may be obtained from the Salt Institute's web page:

www.saltinstitute.org/40.html
or by contacting:

McHenry County Highway Department salt storage facility.

The Salt Institute at:
700 N. Fairfax St., Suite 600
Alexandria, VA 22314-2040
By Phone 703/549-4648 or
By e-mail at info@saltinstitute.org.

Facilities must have been in operation one year to qualify for entering the contest.

Upcoming Free Training Classes

Listed below are some Technology Transfer Center Training classes where room is still available to enroll. Anyone interested in enrolling can visit the Center's website at http://www.dot.state.il.us/blr/t2center.html for further information or to obtain an enrollment form.

Bloomington

Survey I-Beginning	January 27-29, 2004
Survey II-Intermediate	March 2-5, 2004
Survey III-Construction	April 13-15, 2004

Springfield

MFT Acct. & Auditing	April 14, 2004
Confined Space Awareness	January 8, 2004 (a.m.)
Trenching and Shoring	January 8, 2004 (p.m.)

Edwardsville

MFT Acct. & Auditing	April 6, 2004

Mattoon

Highway Signing	February 26, 2004
Urban Tree Preservation	April 7, 2004

Oglesby

Erosion Control	February 10, 2004

The Basics of Salting and Sanding

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control chemicals before or at the very beginning of the storm. Using this strategy often reduces total chemical use and allow a higher level of service to the traveling public.

The strategy most commonly used now is deicing – breaking the bond between the ice and the pavement. Obviously, this technique is required once the pavement becomes covered with snow or ice. More chemicals are needed to prevent the initial formation of the ice-pavement bond.

Various ice-control chemicals are being evaluated for anti-icing. Experience shows that liquid chemical applications are more likely to succeed. Liquid salt, magnesium chloride, calcium chloride, CMA, and potassium acetate are being evaluated. Pre-wetted dry chemicals may also prove effective.

Studies during actual storm conditions show that anti-icing produces equal or better road conditions with less chemical use. Liquid chemicals can be applied at fairly low rates (25 to 50 gallons per mile). These liquid chemicals remain on the pavement long enough to work. Several reports note residual effects for several days. The fairly light application rates produce a damp surface rather than flooding it. Of course the pavement temperatures have to be compatible with the effective operating temperatures for the chemical being applied.

Problems can develop if heavy precipitation continues and the storm gets ahead of the anti-icing efforts. Heavy rain, freezing rain, or intense snowfall rates can cause a problem. Under these conditions, you should switch to a normal deicing approach to accomplish cleanup.

Abrasives

Sand and other abrasives improve vehicle traction on snow- and ice-covered roads. They can be used at all temperatures and are especially valuable when it is too cold for chemical deicers to work. Sand is the most common abrasive, but slag, cinders, and bottom ash from power plants are also used.

Abrasives used for winter road maintenance have some negative environmental impact. They can clog storm water inlets and sewers.

Cleanup may be necessary in urban areas, on bridge decks, and in ditches. The materials may wash downstream and end up in streams and lakes.

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

Concern has been raised in areas with air pollution. Air pollution from particles less then 10 microns in size has been documented from winter abrasive use. As a result, cleaner abrasives and quicker cleanup after the storm are being required in areas with severe air pollution problems.

For better traction, use material with crushed or angular particles. Very small particles and dirt are actually harmful to traction. Material larger than the #50 sieve is most effective. To minimize windshield damage, use materials in which all particles are smaller than 0.375 inch.

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

If slag, cinders, or other abrasives are wet, they also need salt to be usable. Add the same amount of salt as for sand. Pre-wetting sand with a liquid deicing chemical just before spreading has proven effective in embedding the abrasive on icy pavements.

Sometimes deicing chemicals are mixed more heavily with sand. The sand gives immediate traction and the chemicals may melt the snow later when the temperature rises. To be effective, the chemical must remain on the pavement, which is difficult to achieve in most cases. Mixing with sand reduces the salt's melting effectiveness.

Abrasives are usually applied only at hazardous locations such as curves, intersections, railroad crossings, and hills. Rates of 500 pounds to 2 cubic yards per mile are common. It is important to calibrate spreaders to control application rates.

Since abrasives must stay on the surface to be effective, they should not be used when they will be covered with more snow or when they will be blown off quickly by traffic. Heavy traffic reduces the effectiveness, requiring repeated application.

(Reprinted from Better Roads Magazine, October 2003. This article courtesy of the Wisconsin Department of Transportation.)

Out in the Cold

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cold climates. However, this is primarily applicable to high-altitude locations where sunshine is predominant during cold temperatures. Many northern states and Canadian provinces receive very little sunshine during the winter months, especially during snowfall events, reducing the effect of solar radiation.

In general, other factors such as temperature, wind velocity and direction, sunshine, terrain, roadway grade and deicing chemicals have a larger influence on snow control than pavement surface color. In fact, the few studies(Montana 1967 and SHRP H-642, 1993) have shown that salt demand is slightly higher on asphalt surfaces than on concrete.

Concrete coming of age

The maturity method is a nondestructive approach for estimating the strength of concrete.

It accounts for the combined effects of time and temperature on concrete strength development. The strength of a given concrete mixture that has been placed properly, consolidated and cured is a function of its age and temperature history.

If the temperature of a freshly placed concrete pavement is measured over time, and those data points are plotted on a graph, the area under the curve can be called the time-temperature factor (TTF), which is a measurement of the concrete's maturity. The logarithm of the TTF directly relates to the strength of the concrete.

In developing the maturity curve for a particular concrete mixture, multiple specimens must be cast, their temperatures measured over time and their strength determined by conventional destructive testing.

The benefits of maturity include:

- Identifies earliest possible opening to both construction and public traffic;
- Allows determination of optimum time to sawcut joints;
- Facilitates both fast-track and cold –weather construction operations;
- Requires fewer specimens to fabricate and test thereby reducing QC/QA costs; and
- Facilitates earlier agency acceptance and contractor payment.

Insulation blankets

Cement hydration in a freshly placed concrete mixture is an exothermic reaction, which means that it gives off heat. Most of the heat of hydration is generated during the first three days after placement and finishing. However, the concrete must be protected from freezing so that the free water can combine with the cement in the mixture and form the hardened paste.

Insulating blankets, mats or foam sheets are commonly used in cold weather concreting to protect fresh concrete from freezing, allowing hydration to occur at a more rapid rate, because higher temperatures promote faster strength gain. However, insulation blankets do not negate the need for curing compound, which should be applied prior to the blankets.

Concrete should be protected from freezing if air temperature is expected to fall below 40°F in the three days following paving. It is advisable to maintain the concrete temperature above 40°F until the pavement reaches 2,000 psi compressive to continue the cement hydration reaction. The use of maturity meters is encouraged, because they monitor the temperature and are a very good predictor of strength, as long as the laboratory work and strength correlation curve are determined using project materials prior to paving.

Insulation blankets are capable of holding concrete slab temperatures around 120-140°F, even in cold weather. A repair project constructed in the late fall of 1999 on Highway 401 in Ontario, Canada, used insulation blankets for curing and maintaining the concrete temperature. The full-depth repairs were constructed at night starting at 10 p.m. and opening each morning at 6 a.m. When the blankets were removed to open the lanes for traffic, a thermal shock occurred because the average low temperatures were between 20 and 55°F. Combined with traffic loading, the thermal shock caused most of the patches to crack.

ACI 306R-88 recommends that concrete be cooled gradually – pavements less than 12 in. thick should not experience more than a 50°F drop in temperature. It also states that concrete that is placed and cured at a low temperature (40-55°F) is more durable concrete as long as it is protected from freezing frost.

Studded tire wear

Studded tires only give traction on ice or hard-packed snow. There is no added benefit to the road user when the driving surface is wet or dry pavement. Studded tires are a problem for both concrete and asphalt pavement types, although the damage appears more quickly in asphalt pavements. The steel studs embedded in the tires cause rapid abrasion and wearing of the

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Out in the Cold

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pavement surface in the wheelpath. This can lead to standing water during rainfall and increased possibility of hydroplaning, as well as black ice during winter months.

The first step in trying to eliminate the problem is to ban the use of studded tires altogether. Numerous studies have shown that the added benefit studded tires offer is far outweighed by the additional cost to repair the pavement damage.

To address problems on existing pavements, diamond grinding will remove the pavement surrounding the worn wheelpaths, in addition to other benefits, including smoother ride, excellent friction and longitudinal texture for low tire-pavement noise.

If studded tires are allowed in the state or region, concrete pavements can be designed to withstand the abrasion from the studded tires. An abrasion-resistant concrete mixture would contain high-quality aggregate, between 540 and 760 lb/cu yd of cement, plus silica fume, fly ash or slag, with water-cement rations of 0.22 to 0.36, and would achieve compressive strengths in the range of 12,000 to 19,000 psi.

These abrasion-resistant mixes come with a big price tag. It may be best to focus on eliminating studded tires by statute.

(Reprinted from Road and Bridges, February 2003)

What's New With You?

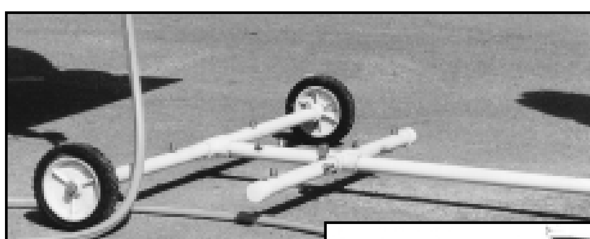
Remove Salt and Sand With Underbody Wash

For a quick and easy way to remove salt and sand build-up from beneath snow removal vehicles and equipment, try the underbody wash. It's effective and lightweight, rolls easily under vehicles, and helps prevent corrosion and wear and tear on parts.

The underbody wash was constructed by the City of Ankeny Public Works Department staff. They built it using one-inch PVC pipe, lawnmower wheels, and pressure nozzles. The wash is 105 inches long and 48 inches wide; it has two cross tubes with 15 pressure nozzles. The nozzles are adjusted to spray in various directions. The water pressure is generated by a gas powered water pump.

For more information about the underbody wash, contact Dennis Guillaume, 515-965-6481.

(reprinted with permission from Iowa's Technology News, November-December 2002)



Illinois Interchange T^2 Advisory Committee

The Technology Transfer (T^2) Program is a nationwide effort financed jointly by the Federal Highway Administration and individual state departments of transportation. Its purpose is to interchange the latest state-of-the-art technology in the areas of roads and bridges by translating the technology into terms understood by local and state highway or transportation personnel.

The Illinois Interchange is published quarterly by the Illinois Technology Transfer Center at the Illinois Department of Transportation. Subscriptions are free and are available by writing to:

Illinois Technology Transfer Center
Illinois Department of Transportation
2300 South Dirksen Parkway - Room 205
Springfield, IL 62764

Program Manager:
KEVIN BURKE .... (217) 785-5048
Graphics Design Systems Specialist:
AMY NEALE .... (217) 782-1682
Training Development Technician:
ROY WILLIAMSON .... (217) 785-2350
FAX .... (217) 785-7296

The people listed below help guide and direct the activities of the Illinois T^2 Program. You are encouraged to contact any of them to comment or make suggestions.

Craig Fink, (Chairman), County Engineer, DeWitt County
RR#2, Box 82P, Clinton, IL 61727
(217) 935-2438

Douglas Bishop, County Engineer, Perry County
3698 State Route 13/127, Pinckneyville, IL 62274
(618) 357-6556

Ed Reeder, Carbondale Director of Public Works
P.O. Box 2047, 200 S. Illinois Ave., Carbondale, IL 62901
(618) 549-5302

Lynn Krauss, Director of Public Works
9446 S. Raymond Ave., Oak Lawn, IL 60453
(708) 499-7816

Eldon Stahl, Medina Township Highway Commissioner
Peoria County, R.R. 1, Dunlap, IL 61525
(309) 579-3101

Olen Kibler, Newman Township Highway Commissioner
Douglas County, 608 North Howard, Box 73,
Newman, IL 61942
(217) 837-2723

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Illinois Department of Transportation
2300 South Dirksen Parkway
Springfield, Illinois 62764