PennDOT LTAP
technical
INFORMATION
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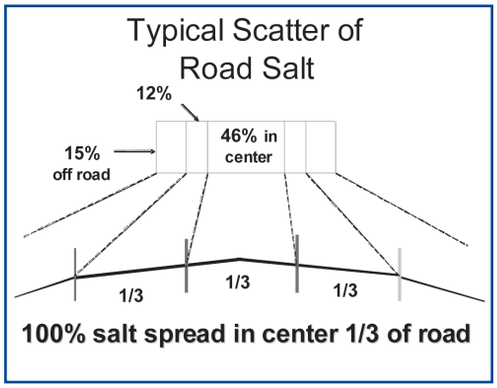
Pre-wetting Winter Materials

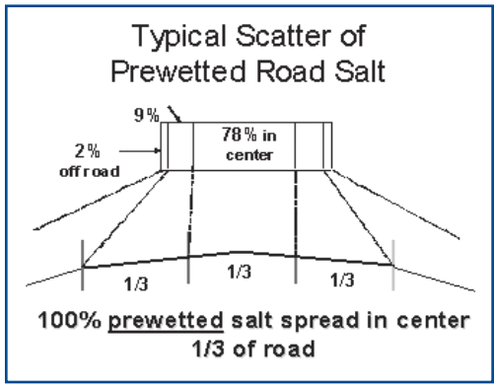
The world we live in today is highly mobile. Whether it is for work, family obligations or recreation, people expect to be able to travel at all times with minimal disruption. As public works practitioners it is your responsibility to provide a safe and reliable transportation system year round.

Winter maintenance is a highly visible operation that leaves a lasting impression, good or bad, on your constituents. It is also one of the most costly roadway maintenance functions performed. The more strain winter services place on your municipal budget, the less money is available for roadway preservation operations to maintain your assets.

One technique used in the transportation industry that improves operations and helps control costs has been the use of pre-wetting winter materials. Pre-wetting is the adding of a liquid chemical to the winter materials prior to applying them to the roadway. This technique is predominately used when applying straight salt for winter operations but has also been used to enhance anti-skid – salt mixture with similar results. Not only does this method improve roadway conditions, it has also been proven to decrease costs through a reduction in material use.

Dry material bounces or blows off the road, resulting in some loss. Because pre-wetting causes more material to stick to the road, 20 to 30 percent less material may be used. This saves money and reduces environmental impact. The charts below for dry versus pre-wet salt illustrate this savings.





Liquid chemical can also increase salt's effectiveness by jump-starting the melting process. Dry salt needs to form a brine to start its melting action. Adding liquid chemical to dry salt expedites this action. In some cases, depending on the liquid used, this process can also lower the material's effective working temperature allowing for chemical deicers to work at lower pavement temperatures.

Pre-wetting can be accomplished by applying the liquid chemical onto the material at the spinner as the material is being applied, or over the truck bed or loader bucket at the stockpile. If the liquid chemical is to be added at the stockpile care should be taken to perform this operation on an impervious pad to alleviate leaching problems.

Various chemicals can be used as pre-wetting agents. Salt brine, calcium, and magnesium chloride have been successfully used for this function. Salt brine is the most common liquid produced in-house. Commercial brine makers are used to manufacture brine at stockpile locations to store on site. A drawback to salt brine is that it loses its effectiveness when the pavement temperatures drop below 15º. The brine is added to the winter materials at a rate of 8 to 14 gallons per ton of dry material.

Liquid calcium and magnesium chloride are normally purchased in bulk and stored in tanks at the stockpile sites. This material has the ability to enhance the dry salt and increase its effectiveness to -20º for calcium and -10º for magnesium. Calcium chloride is applied at a rate of 6 to 12 gallons per ton of dry material. Magnesium chloride is applied at a rate of 6 to 8 gallons per ton.

Winter materials should be applied at different application rates depending on the storm event and pavement temperature trends. Research has shown that the addition of the liquid chemical to straight salt or a salt/anti-skid mixture allows the material to be applied at lower application rates with the same or improved results. In the past, dry chemicals have been applied at rates of 200-800

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pounds per lane mile. With the addition of the liquid the same results can be obtained at application rates of 80 to 400 pounds of material under similar storm event conditions.

Winter material application rates and techniques are determined by weather and road conditions at the time of the event. Forecasted conditions and road surface temperatures should be taken into account when deciding whether to use solid, pre-wetted, or liquid materials in your operation. Regardless of the method used, a good plan that considers the use of all available resources will help maintain safe motoring for the public. This proven technique of pre-wetting winter maintenance material should be considered to enhance your operation and help you achieve this goal.

Pre-wetting Salt – An Economic Analysis

Winter operations research has indicated that agencies that pre-wet winter materials are experiencing a 20% to 30% reduction in material usage. For this example, assume the following:

Base Data:

- Salt Usage – 1000 tons;
- Cost of salt - $45.00 per ton;
- Cost of calcium chloride - $0.85 per gallon;
- Rate of application – 10 gallons of calcium chloride per ton of salt;
- Reduction of annual salt usage – 30%.

Material Cost Savings:

- Amount of salt saved – 1000 X .30 = 300 tons/year;
- Cost of salt saved – 300 X $45/ton = $13,500;
- Amount of calcium chloride used – 10 gallon/ton X 700 tons = 7000 gallons;
- Cost of calcium chloride – 7000 gallons X $0.85/gallon = $5,950.

Annual net material savings - $13,500 less $5,950 = $7,550

This annual savings should easily offset the cost to upgrade your operations to incorporate pre-wetting systems in a year or two.