Winter is Coming!
And with it tons of salt on our roads

Shasten Sherwell

In New England, road salting is a necessity to keep people safe during snow or cold weather as they drive to work or take their kids to school. The amount of salt used for deicing roads and highways has increased over the years along with the year-round transportation of goods and services. The many benefits that road salting provides, however are matched by some opportunities for improvement. Road salt can contaminate drinking water, kill or endanger wildlife, increase soil erosion, and damage private and public property. Alternative methods are needed to mitigate these drawbacks.

The most common substance used for deicing roads and highways is Sodium Chloride (NaCl) or table salt known as rock salt when spread on the road because of its much larger granules. Nearly half a million tons is used annually in Massachusetts alone for winter road maintenance. Rock salt is very effective at melting snow and ice and is considered to be pretty cheap. But rock salt's low cost does not include the potential damage to property, infrastructure, or the environment. Though seemingly harmless to us, rock salt can have corrosive effects in large quantities that affects cars, trucks, bridges, and roads resulting in approximately $5 billion dollars in annual repairs in the U.S. alone. In addition, road salt can also infiltrate nearby surface and ground waters and can contaminate drinking water reservoirs and wells. High sodium levels in drinking water affect people with high blood pressure, and high chloride levels in surface waters are toxic to some fish, bugs, and amphibians. Furthermore, excess road salt accumulates on roadside areas killing roadside plants and harming wildlife that eat the salt crystals. Salty roads also attract animals like deer and moose (who love licking up the salt), increasing the probability of accidents and roadkill.

The environmental toll and long-term costs of rock salt have inspired some states to search for alternative management practices. Magnesium chloride (MgCl)is considered to be safer than NaCl but requires twice the amount to cover the same area, making it more expensive. Calcium chloride (CaCl) is safer for the environment but is three times more expensive than NaCL and so is typically reserved for use in vulnerable areas. Innovative solutions that limit the amount of rock salt needed are also being explored.

New technologies, such as porous pavement, are being engineered to reduce runoff from roads and have been found reduce snow and ice cover. Porous or permeable pavement allows standing water to seep through, removing water from roads that would normally go through freeze-thaw periods, thus preventing ice formation on the roads. A recent study showed that the annual median snow/ice cover on porous pavement was three times lower than that of regular pavement, and that the low amounts of ice/snow accumulating on porous pavement led to a 77% reduction in annual salt used for maintenance. Another technology gaining traction is solar roads, made up of engineered solar panels that can be walked and driven upon. This technology has the potential of converting every single road into a source of renewable energy. In addition to the added energy source, this technology could also eliminate the need for road salt by melting ice or snow through heating water in pipes embedded in the road.

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Accumulation of standing water in a parking lot after snow melt. Comparison between porous pavement (left) and regular pavement (right). Source: UNH Stormwater Center

Rhode Island has adopted several measures to reduce the amount of salt needed. Since 2012, the State has been applying a brine solution (23.3% salt-water solution) to the roads before a forecasted snow event. Known as anti-icing, this practice prevents the formation of frost on pavement, and its implementation has been increasing across New England. Another alternative is the use a 50/50 salt and sand mixture. The sand doesn't help to melt the snow or ice but increases traction, reducing the amount of road salt required. After the snow or ice melts, however, the remaining sand mixture gets washed away, filling catch basins or adjacent waterbodies with sediment, which then requires additional work hours and money to maintain and keep the basins clear. Currently, only a small fraction (5%) of the sand dispersed in Rhode Island is removed; the rest gets washed away into adjacent water bodies: clouding the water and making it difficult for aquatic plants to photosynthesize. Other alternatives include adding biodegradable substances like beet juice, pickle juice, and molasses to the salt solution to enhance performance. These salt additives lower the freezing point of water, slowing down the formation of ice; they also aid in traction, and make the solution stickier so less salt gets splashed off the roads and wasted.

The disadvantages of many current treatments have led to interest in new management approaches. New Hampshire has been successful in reducing road salt use through improved management practices and policy. In 2013 the State launched, the "New Hampshire Road Salt Reduction Initiative" to address the high number of waters impaired by chloride (19 water bodies in 2008, and 43 in 2012). In addition to the testing and use of many of the alternatives described in this article, the initiative recommends using other management practices and policies to reduce the use of road salt. These include upgrading equipment so that salt is spread using only "closed loop systems" which allow operators to accurately release and monitor the exact amount of salt applied, lowering speed limits during snow/ice events, and having mandatory use of snow tires during winter. Thanks to these initiatives the State has reduced the use of road salt by 20 percent and is on track to stop the rise of impaired waters due to high chloride levels.

While no perfect solution exists to keep our roads clear in winter, the number of tools available to public works departments continues to increase, allowing for a tailored approach to clear roads in an environmentally conscious manner without risking driver safety.