# Fighting ice on the last frontier

## Alaska is used to extreme winter conditions, but the "Icepocalypse" required a different approach

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To say that Alaska is the land of extremes is a slight understatement. In sheer size, the 49th state is larger than the next four largest states combined. Alaska's climate experiences temperature extremes ranging from -80°F to 100°F, and snowfall in Thompson Pass near Valdez once reached 974.5 in. in a single winter. Geography is diverse with 29,000 sq miles of glaciers and 33,904 miles of shoreline. Towering 20,230 ft above the majestic landscape is Denali (also known as Mt. McKinley), the tallest peak in North America.

In the midst of this vast state, 3,400 dedicated people serve the traveling public as employees of the Alaska Department of Transportation & Public Facilities (ADOT&PF), supporting the department mission statement to "Keep Alaska moving through service and infrastructure." ADOT&PF is responsible for the operation and maintenance of 5,600 miles of roads, 845 bridges, 249 airports, 720 public buildings, 28 harbors and 11 vessels in the Alaska Marine Highway System fleet. In winter weather, caring for infrastructure spread over such a tremendous area is challenging, and often humbling.

Many regions of Alaska can experience winter conditions on any given day of the year, but ADOT&PF Northern Region headquartered in Fairbanks considers winter to last seven months of the year. Northern Region ADOT&PF Highway Maintenance & Operations crews have faced a major challenge of late in that the interior of Alaska has consistently experienced multiple winter rain events each year since 2010. When sub-zero temperatures suddenly rise to 40°F and are accompanied by precipitation, "freezing rain" takes on a whole new meaning to the traveling public as well as M&O crews. It only takes minutes for liquid that hits a mid-winter pavement surface temperature (-10° to -20°F) to freeze and adhere to an asphalt surface, so a continuous winter rain results in a perpetually thickening cemented layer of ice with a rain-slickened, treacherous driving surface.

Normally the first response to ice is to use abrasives for traction aid. Winter sanding methods in Fairbanks include using ⅜-in. washed chips, because of the lack of heated storage facilities necessary to prevent fine-grained sand piles from freezing solid. But during freezing rain, sand doesn't provide enough traction to improve conditions substantially since the ice continues to build over the top of


**An ice breaker provides a path for chemical deicers to penetrate beneath the ice layer and sever the bond between ice and pavement.**

applied sand. It also is cost-prohibitive to apply copious amounts of sand to entire road surfaces. Generally, accepted practice is to apply sand to hills, curves and intersections to improve traction and safety, and even when conditions are not as slick as during a winter rain event, sand tends to scatter off the road in a short time after multiple passes of vehicles. When winter rain causes ice to cement to the road, scraping with blades is a slow and arduous task. To address ice that has the potential to build substantial thickness and be there for the remainder of the long winter season, other methods had to be found to combat the problem.

## Customer expectations

Alaskans are tough and used to inclement weather. Until 2010, it was extremely rare for Fairbanks schools to close because of weather (even in -45°F). After the November 2010 ice storm (locally referred to as the "Icepocalypse") closed schools and most businesses for three days, school districts and employers realized they needed to make decisions about closures in sufficient time to prevent drivers (particularly school buses) from venturing out into treacherous conditions. The public generally accepted that M&O crews were limited in what they could do during the rain event, but that didn't change the fact that once the event was over, there were expectations to make the thick ice cemented to the road disappear. Unfortunately, this single event far exceeded the department's operational abilities and affected driving operations and road maintenance for the rest of the winter season. The biggest lesson learned was that the best possible result would be to minimize or avoid the danger of ice on the road by preventing it from accumulating in the first place; however, if conditions fail to prevent the ice from bonding to the road surface, there have been solutions discovered that support the safety and mobility of the customers served.

*Anti-icing*

Before the "Icepocalypse," most winters in Alaska's were typified by snow events sandwiched between extreme cold events. Tools to deal with winter's hardships used to be straightforward: Plow the mostly low-moisture content snow off the roads and apply abrasives as needed for traction. But after "Icepocalypse" poured continuous rain for three days during the week of Thanksgiving, what was left was thick ice that tormented crews until the spring thaw in March and April finally removed the last evidence of the event. It was hoped such an ice event was an anomaly, but we knew we had to be better prepared to combat extreme ice conditions in the future.

As a first approach to anti-icing, the department purchased and installed a brine-making system at the Fairbanks M&O station. Due to limited funding and because of the hope of never seeing a compelling need to use liquids in interior Alaska, the program was started with a small unit and limited brine storage capacity. Also, the Fairbanks District was able to procure a covered area to store bulk salt, because buying salt in bulk is far more economical than smaller "as needed" quantities. Bagged salt can cost as much as $400 per ton. While bulk salt can be purchased for $145 per ton it can get very costly for winter delivery—prices jump to $300 per ton for delivery after Oct. 1. Although we started out with a small program and have slowly expanded, we are thankful to have another tool to use, as we have experienced measureable liquid precipitation in every winter season since 2010. During the winter of 2014-15, measurable rainfall was experienced in five consecutive months with pavement temperatures well below freezing. In several of these events, conditions were favorable to applying liquid salt brine before the storm arrived. Pre-treating the pavement improved mobility during the events and reduced the resources needed to return the treated portion of the highway system to a bare pavement state.

As freezing rain events were rare in interior Alaska until 2010, using chemicals and liquids to combat ice build-up was a new and foreign

**Fact Finder**

In interior Alaska, bulk salt costs skyrocket from $145 per ton to $300 per ton once October rolls around and the freeze occurs.

concept to the M&O team. To advance the program, we enlisted the help of experienced winter maintenance professionals from snow regions in other states via a networking effort through the American Public Works Association (APWA). M&O supervisors received a crash course in anti-icing through the APWA's Winter Maintenance Certificate program, and this training has proved to be invaluable as a beginning point to an anti-icing program.



*De-icing*

Because of depressed pavement temperatures, oftentimes we are not able to be as proactive as we would like in responding to winter liquid precipitation events that force us to find solutions to remove bonded ice from traveled ways as quickly and efficiently as possible. In addition to scraping ice with serrated expendable cutting edges mounted on our road graders and underbody scrapers on our plow trucks, ice-breaking technology has been introduced into the fleet. The first attachment procured was a Raiko Icebreaker. This tool was originally designed to be mounted on a tractor or loader-type machine, but the equipment shop in Fairbanks was able to modify the attachment points to mount the implement on one of the high-speed plow trucks. This innovation allowed treatment of a substantially greater quantity of lane-miles per shift than would have been able to be treated with a low-speed machine. Operators found the Icebreaker to be most effective in the 15- to 17-mph range, and, even better, the weight of the implement coupled with the geometry of the tines broke up ice without any additional down pressure required, leaving no damage to the asphalt surface. To build on the initial success of the Raiko, an Arctic Shark brand icebreaker was purchased, and department employees have even manufactured their own version of an icebreaker. In addition to providing instant profile on a shiny, slick sheet of ice, the icebreakers provide a path for chemical deicers to penetrate under the ice layer and break the strong bond between pavement and ice. This speeds the removal process tremendously when conditions are favorable for chemical usage.

## Maintenance decision support system (MDSS)

A key component in any winter-maintenance program is accurate weather forecasting. While we have a great working relationship with our National Weather Service office, we found we were still missing the pavement temperature forecasting ability that is essential for

effective liquid and solid chemical applications. To fill this information gap, ADOT&PF partnered with the National Center for Atmospheric Research along with the University of Alaska Fairbanks to build an Alaska-specific Maintenance Decision Support System (MDSS). Existing systems attribute to minimal or non-existent winter solar temperature gains at our northern latitude, therefore an enhancement to traditional MDSS was required, integrating mobile weather readings from our vehicles traveling throughout our interior region. WeatherCloud, a start-up company in Colorado, provided the vehicle sensors that upload the readings to an Android device and then to the cloud for additional data verification on our forecast model.

With an enhanced MDSS system available, we have been empowered to take a more proactive approach to fighting all winter storms. Additionally, we can more efficiently allocate our resources with accurate, real-time and location-specific weather forecast data.

## Well supported

In response to changing weather patterns, ADOT&PF's winter-maintenance program has progressively evolved. While members of the public, as well as some within the department, have been skeptical of the benefits of liquid and solid chemical application to public roadways, which is understandable as the methods and tools applied in recent years are new and unusual for interior Alaska, ADOT&PF's leadership team has been highly supportive of the efforts to respond to extreme winter challenges. Also, the department has outstanding staff in our public information office that tirelessly answer countless questions regarding maintenance activities and has been proactive in sharing this message with the public through all forms of media available.

Even with all the emerging resources and tools available to address safety and mobility challenges faced throughout an Alaska winter, events that exceed our (and any) organization's capacity to respond are bound to occur. Choosing a vocation as a winter-maintenance professional requires a mentality to be dynamic and decisive. As advances and innovations come to light, ADOT&PF's Maintenance & Operations section will continue to be proactive and progressive in supporting the department's mission statement to "Keep Alaska Moving." **WM**

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**For more information about this topic, check out the Maintenance Channel at www.roadsbridges.com.**