There is always the window

Jon Tarleton
Global Marketing Manager and Meteorologist
Vaisala
St. Louis, Missouri

It is a winter day like any other; you are sitting in your office trying to decide what to do—send everyone home or keep a crew over into the evening? The local television stations are all over the place; one is forecasting a major snowstorm by evening rush hour, the other is calling for more ice than snow, but is not forecasting it to start until later tonight. You keep checking your favorite weather sites on the Internet, but they seem to make the decision harder, not easier. Your boss keeps drifting into your office wondering what you are going to do. Will you play it safe and leave a crew for the evening, or send everyone home until later?

How many times have you been in that situation? No matter what the weather conditions are, or what the forecast is, the challenge is the same. Weather information and forecast need to be right to ensure proper treatment and cost savings to your agency. There is virtually no question that it is more difficult. Predicting the weather is still one of the most challenging problems mankind has ever faced. We can cure diseases, put a man on the moon, and create the Internet, but we still have trouble telling what tomorrow's weather will bring.

The good news is that over the past 20 years technology to combat winter on our roads has stepped in and begun trying to make this decision process easier. New methods and new chemicals have given us more tolerance for error and made us more effective when we are out there. The one major challenge remaining is that most of the road weather technology is still only in the hands of the larger statewide agencies, and has not made it to the level of cities, counties and municipalities. If we go back to our situation from earlier, where does someone with nothing other than the TV and the Internet begin? Well, first we need to break up the information they are viewing into two main categories: current conditions, and predictions or weather forecasts.

Predicting the weather is still one of the most challenging problems mankind has ever faced.

Here and now

Everyone that ever studied or followed weather knows that the first critical process to go through when trying to understand the weather is knowing what is going on now. The classic joke of asking a meteorologist if they have looked out the window to make their forecast is actually not far from the truth (if the meteorologist is forecasting for the area in which they are located). Viewing the sky and the conditions outside can be an important tool when making decisions about the weather, but how the sky looks is not as relevant towards understanding weather on our roadways.

For years, people (maybe many still today) would use such things as bank thermometers to determine whether they were going to have problems on the roadway. Air temperature was the key piece of information for determining whether snow would stick to the road surface; however, there are two problems with this method. A bank thermometer is far from an accurate way to measure air temperature, and air temperatures and the temperature of the pavement can be very different. In fact, there are very few times when pavement temperature and air temperature are actually the same.

This brings us to our first tool for our decision maker—pavement tempera-

ture readings. Road Weather Information Systems, or RWIS, are one of the most widely used technologies to provide us with pavement temperatures. Sensors embedded in the roadway tell us the temperature of the road or bridge surface, which is critical in knowing if the snow falling will stick, and whether chemicals will work on the road surface. RWIS sites also typically add another important benefit; they are usually installed in areas away from you or where problems regularly occur. This helps avoid the "driving around" or patrolling method of monitoring road conditions, which wastes gas and man-hours if nothing is happening.

The future is here

Large agencies such as DOTs and turnpikes have large networks of RWIS sites across their state, and have come to rely on the information to make decisions about anti-icing and deicing strategies. But what if our decision maker we talked about earlier was at a smaller agency, which does not have the budget for a typical RWIS site let alone a network of sites? Sensor technology has progressed and now offers a complete solution at a much smaller price tag, and even more importantly, recurring costs are dramatically lower. Road temperature and condition sensors available today can measure road conditions from the side or above the road surface. This sensor technology, known as non-intrusive measuring, means the sensors collect temperature and condition readings by looking down on the road surface instead of embedding them in the road. This ability means installation costs are far less because there is no need to cut the roadway or trench cables from the weather station to the sensors. In addition, there is no need for lane closures or traffic control to install the sensors. Over time, the sensors can be maintained quickly and easily from the side of the road, again providing a much lower cost to maintain.

These sensors are also able to offer a road condition measurement not previously available, which is a value of road friction. Road friction tells you how well vehicle tires will grip the road surface. Road friction gives the decision maker an actual way to see if the road is getting better or worse. Over time, this technology will likely change the way road weather data is collected across the United States. It will make it easier for more agencies to acquire the technology, and because of its lower lifetime costs will help increase the number of overall weather stations.

Non-intrusive sensor to monitor road condition

Another change is that the road weather equipment providers are introducing more and more low-cost weather equipment packages, which makes it easier than ever to get started with your own weather equipment. In addition, to help you avoid issues with servers or data collection, companies are offering the ability to collect the data for you to help eliminate the hassle of data management, which can be very challenging for smaller agencies. Data hosting also allows providers to offer more features. This includes such things as seeing other agencies' data and combining other weather information such as weather radar or satellite images. These features will likely only be available in a hosted solution. With access over any Internet connection the data can be viewed anywhere you have Internet access.

Weather on the go

If the cost to deploy fixed sensors still seems too huge for your budget, or if you are still having reservations about the benefits of the fixed RWIS station, then you need to find another way to get pavement temperature. Another technology that has become very popular is the use of infrared temperature sensors installed on agency vehicles. The popularity of this technology was driven by cost, ease of use, and information while you drive. Selecting the sensor right for your operations is much simpler than fixed weather stations; however, your decision should not be based on upfront cost to purchase. Infrared sensors periodically need calibration, and because it is outside of a moving vehicle, life expectancy of the sensor is important to consider. How does your sensor get recalibrated? How well is it made? Upfront savings will disappear quickly if maintaining them becomes expensive.

The mobile weather sensor is in the middle of a big boost in the industry because of the advent of easy communication between vehicle and office. Weather sensors are now being considered to create a mobile RWIS network. Imagine having a suite of weather sensors on any agency vehicle on the road; from police, maintenance, parks, utility, etc., all relaying their information back to help you make better decisions. We must understand there are some drawbacks to the mobile data concept. Mobile data by nature is going to be less accurate for a variety of reasons ranging from quality of sensors, meth-

ods used to collect data, condition of the sensors on vehicles, and most importantly you are only collecting data when a vehicle is out there, unlike fixed sites that are always on duty.

The key to the mobile method is that it is an excellent way to get started looking at road conditions instead of air temperature alone. It works well for an agency starting out because the startup costs are very low, it typically focuses on a limited number of parameters such as pavement and air temperature only, and it requires virtually no training for someone to begin using. Mobile weather products are a great place to start, and hopefully will lead you to more road weather technology as you and your team become comfortable with the science.

It is not that simple

The advent of the Internet, the increase in road weather equipment technologies, and the improvement of media weather presentations have created a challenge that might not have been foreseen fifteen years ago—"I can forecast the weather!" Can you? It sounds simple; look at what is going on now, the trends, maybe a quick glance at a TV forecast and you have your answer. There are several problems with this theory. One, as discussed at the beginning, weather forecasting is such a complex thing that doing the method described above you are bound to miss something, or worse, not even know what you are missing. But the even larger issue is you and your team's confidence in you as a forecaster. How many times do you double-check the information? How many times do you still send someone out to patrol, when you yourself said nothing is going to happen for hours? Look at your actions and those of your team; if your actions don't match the forecast then no one has any confidence in it, and so how efficient is it then for you to be doing it?

This is why it is always best to turn to a trained and experienced meteorologist to get your weather forecast. Why do we not always turn to them? The simple fact that sometimes they are wrong makes it difficult to trust and believe them. Human nature is such a way that we tend to remember the ones they got wrong and forget the correct forecasts. The fact is, most meteorologists are right far more often than they are wrong. In addition, as mentioned earlier the huge increase in weather information available to us makes us feel at times that we know everything we need to make a prediction of the weather.

It is not always what they are saying

To avoid the pitfalls of others and to help get the most of any weather forecast, there are some important key elements you can use to make life easier. First, like some things in life, if some advice is good, a lot is better. That is certainly the case when it comes to weather forecasting. Meteorologists use computer models as the basis for their personal forecast, and although some may have their own proprietary model, most use model forecasts produced by the National Weather Service. Which model to use in any given situation is up to the meteorologist, and some may decide none of the models is doing a good job and may just go with their own instinct. So, during an event, when you look around at forecasts on the Internet, from the National Weather Service, and on TV, if they are all saying about the same things, chances are all the models are in agreement, and those forecasts have a good chance of being right. If not, be very careful following just one source! The chance of something unpredicted happening has gone way up.

The second key element is confidence of the delivery. How confident does the meteorologist sound? How does the forecaster sound when telling you the forecast? Do they sound sure of themselves or have they left themselves a way out? For a typed or graphical forecast it may sound impossible to determine the confidence since you cannot hear the meteorologist, but there are still ways. If their probability is near 50% or they have too broad of information, these are all ways you can still determine things might be in trouble.

The last and probably the most telling sign is the trend in the forecast from day to day. Has the amount of snow in the forecast been going down with each new forecast? Has the timing of the event been getting later and later? These are signs that the real answer is usually just beyond the last forecast issued.

The solutions are closer than you think

The problems are timeless; year after year agencies around the world battle the weather elements to try and keep the roads safe. The demand for cost saving continues to go up as agencies tighten down on their budgets and try and stretch their money as far as it will go. The one somewhat surprising outcome that typically occurs during times when money is tight is that agencies cut the very things that can save them money. Paid weather forecasts, funding for maintenance on road weather equipment, and product upgrades all are usually the first to go; however, these are the tools we need the most.

The key to developing a true winter maintenance plan is to consider everything. Funding might be tighter at your agency vs. another, but that is more reason, not less, for you and your team to have the best tools possible so the decisions are as effective as possible. We may never solve the "what will tomorrow be" question, but if we use sound techniques and sound solutions we will have a lot better chance at making the decision to send everyone home or leave a crew for the evening.

Jon Tarleton is the Global Marketing Manager and Meteorologist for Vaisala, a world leader in providing weather observation solutions. He can be reached at (314) 872-0509 or jon.tarleton@vaisala.com.