Peace of mind

Paul Bridge, roads offering manager, Vaisala, Inc., describes a new cost-benefit tool which roads authorities can use to build a case for procurement of road weather information systems

Despite the significant benefits for both end users and road managers and operators, road weather remains the poor cousin to, for example, aviation weather in terms of acceptance and investment

Road Weather Information Systems (RWIS) have now been around for over 30 years and it is widely accepted that these systems provide critical information which allows roads authorities to more efficiently plan and execute their winter maintenance duties. In fact, RWIS have proven so successful that there has been a steady movement towards authorities operating the systems all year round in order to provide information for summer maintenance activities. In addition, the realisation that weather has a huge effect upon operational activities has led to a wide expansion of RWIS in the ITS arena.

Almost inevitably, more than three decades of development and operational use have resulted in RWIS becoming more accurate and sophisticated. Examples of this include the addition of new technologies and services; for example, in the past decade we have seen the introduction of cameras, non-intrusive sensors and more recently Maintenance Decision Support Systems (MDSS).

There can be little doubt that all of these advances are providing huge benefits for both the road operators and maintainers. There are also significant gains for the end user in terms of increased road safety, better travel times and, ultimately, greater peace of mind.

Figure 1: RDC input parameters

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Phone Number	123.456.7890		
Date:	6/12/2011		
Category	**Description**	**Value**	**Units**
General Information	Currency	EUR	
	Winter Maintenance Budget	25,000,000	EUR
	Number of RWIS Stations	12	Stations
	Managed Area Population	320,000	Persons
Maintenance Network Information	Number of Weather Events per Year	60	per Season
	Treatment Distance per Event	530	Lane Km
	Cleanup Distance per Event	-	Lane Km
	Number of Routes	19	Routes
	Number of Maintenance Vehicles	22	Veh
	Dry Materials Use per Event (Tons)	100	Tons/Event
	Wet Materials Use per Event (Liters)	5,000	Liters/Event

Unfortunately, there can also be little doubt that road weather remains the poor cousin to, for example, aviation weather in terms of acceptance and investment. There are mandatory requirements for strictly regulated weather observations and forecasts within the aviation industry with an obvious cost that nobody argues with. However, most of the professionals within the road weather world, and here we must include both the vendors and the system users, are constantly battling to convince those holding the purse strings that RWIS is indeed a worthwhile investment.

RWIS and MDSS

Before going any further, it is perhaps worth expanding a little on just what the differences are between RWIS and MDSS

'Road Weather Information System' is the traditional name for a collection of road weather stations at various point locations on a road network. These report the information they gather back to a central location. The term describes pretty much a basic weather monitoring and reporting system but over the years we have seen many enhancements, such as blending the road weather station data with numerical weather prediction models to provide a tailored road forecast which includes parameters such as surface condition and surface temperature. Other examples of enhancements include the provision through the RWIS system of forecast thermal maps, which are driven by road weather station observations in addition to forecasts to provide the user with an overview of the pavement temperatures across an entire road network.

It would be fair to state that these systems are already providing 'decision support'.

'Maintenance Decision Support System', meanwhile, has become the primary name for an RWIS which provides treatment recommendations to the user. For example instead of a traditional RWIS forecast stating, to give an example, that 'Frost will start to form at 11pm on Highway 1', an MDSS system may state that the user is recommended to commence spreading salt at a given location at 10pm and at a rate of 10g/m^2.

The above is an over-simplification, but it should serve to provide an idea of the basic differences.

Known benefits

Roads authorities have reported that MDSS and RWIS have allowed them to reduce their de-icing material costs by up to 40 per cent, resulting in associated reductions in traffic accidents of as much as 50 per cent. There is a slew of information on the various benefits, both direct and indirect, that roads authorities and their regions can attain. However, until now, it has been difficult to make a simple calculation that allows authorities to understand the potential effects of an RWIS or MDSS installation. This in turn has made it difficult for many authorities to justify the outlay for an RWIS or MDSS or, indeed, to secure the funding required to cover either the continued running costs or maintenance.

Quantifying value

In order to provide an objective approach for road authorities and enable them to calculate benefits, Vaisala has created a tool called the Road DSS Calculator (RDC) that allows them to enter infrastructure and cost information. The embedded algorithms produce calculated savings, based on referenced study findings, which provide a breakdown of all direct and indirect cost savings both to the road authority and the local community. The cost

savings are an obvious requirement for the purse-string holders but the RDC also provides non-financial information such as safety aspects, with the potential accident reductions, and environmental issues, such as potential carbon and pollutant reductions. This will allow authorities to demonstrate potential and real benefits to all stakeholders, which will hopefully educate the wider audience of the necessity to invest in RWIS and MDSS.

The RDC is designed to be extremely simple to use. All the user has to do is enter a number of easily accessible parameters which then define the road network size, local economy and climate. Figure 1 below shows the RDC input page where the user first selects their local currency and provides local information (in the green value column).

The input data is then processed through a series of algorithms in order to calculate the benefits that the user can expect to realise by adopting an MDSS solution. Many of the algorithms are based on standard assumptions, such as the average cost of a road fatality, however users have the opportunity to fine-tune and change these assumptions should they wish or need to. The calculated variables utilise assumptions derived from a wide range of published materials, such as RWIS cost-benefit ratios. These assumptions are being addressed in a White Paper that is soon to be published by Dario Atallah and Paul Bridge from Vaisala, Inc., Boulder USA and Mark DeVries from McHenry Public Works Department, Illinois, USA.

Figure 2 shows the resulting benefits that the road authority can expect to make directly, which are specific to the user's input.

In addition to the direct savings that the road authority can make, there are additional community benefits that result from MDSS, as can be seen in Figure 3.

Whilst it is appreciated that there are many areas for potential differences in true savings, Vaisala has deliberately taken a very conservative approach in its calculations, especially in the community savings, which are often totally overlooked when RWIS/MDSS costs are evaluated. It is hoped that this tool will ease the pain or procurement for many who already know the true value of RWIS/MDSS and whilst it is impossible to truly measure peace of mind, at least it is possible to establish a basis for more objective measurement of benefits; there are a number of other benefits that arise from RWIS and MDSS, which the imminent White Paper will address. By the end of summer 2011, Vaisala, Inc. expects to offer use of the tool via an interactive portal on its public website.

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Figure 2: RDC direct benefits

	Summary	EUR	Hours
RoadDSS Benefits	Labour Time Savings	95,838	3,150
	Material Savings	247,374	
	Maintenance & Wear Savings	240,984	
	Increased Revenue	-	
	Total Efficiency Savings	**584,195**	**3,150**
	Percent of Budget Savings	2.34%	
	Average Savings per Region	116,839	EUR
	RWIS increased value per station	48,683	EUR
Customer Benefits	**Yearly Benefit**	**Value**	**Units**
Efficiency	Decision Time Cost Savings	7,820	EUR
	Treatment labour Usage Cost Savings	70,844	EUR
	Reduce Stress Related Absences Costs	5,875	EUR
	Dry De-Icing Materials Cost Savings	209,472	EUR
	Wet De-Icing Materials Cost Savings	22,918	EUR
	Cleanup Labour Cost Savings	-	EUR
	Vehicle Maintenance Cost Savings	60,449	EUR
	Fuel Consumption Cost Savings	12,865	EUR
	Wear Infrastructure Cost Savings	180,535	EUR
	IT HW Cost Savings	2,119	EUR
	IT Labour Cost Savings	11,299	EUR
	Increase Revenue from Toll Roads	-	EUR
	Total Efficiency Related Savings per Year	**584,195**	**EUR**
Publicity	Reduction of # Complaints Costs	5,649	EUR
	Reduction of Litigation Costs	197,119	EUR
	Total Publicity Related Savings per Year	**202,768**	**EUR**
Customer Benefits	**Yearly Benefit**	**Value**	**Units**
Efficiency	Reduction in Time Making Decisions	138,42	Hrs
	Reduction in Operator Treatment Driving Time	2,508	Hrs
	Reduction in Stress Related Absences Hours	104	Hrs
	Reduction in Dry De-Icing Materials Use	3,900	Tons
	Reduction in Wet De-Icing Materials Use	195,000	Liters
	Reduction in Cleanup Labour Time	-	Hrs
	Reduction of Number of Required Operation Vehicle	5	Vehicles
	Reduction of Operation Labour Numbers	7	People
	Reduction in Driven Km	13,992	Km
	Reduced IT Labour Hours	400	Hrs
	Yearly Increase of Toll Vehicle During Events	115,200	Vehicles
Publicity	Reduction in Numbers of Complaints	800	Complaints
	Reduction in Number of Lawsuits	2	Lawsuits

Figure 3: RDC community benefits

Community Benefits	Yearly Benefit	Value	Units
Safety	Accident Costs Savings	4,598,229	EUR
	Fatality Costs Savings	13,999,312	EUR
	Total Safety Related Savings per Year	18,597,541	EUR
Mobility	Traffic flow		
	Local Economy Losses Reduction	104,085,283	EUR
	Total Community Related Savings per Year	104,085,283	EUR
Environment	Pollution Cost Reduction	1,405,095	EUR
	Total Environmental Related Savings per Year	1,405,095	EUR
Community Benefits	Yearly Benefit	Value	Units
Safety	Reduction in Number of Accidents	26	Accidents
	Reduction in Number of Fatalities	5	Fatalities
Mobility	Average Speed Increase	33	KPH
	Increase of Number of Vehicles on the Road	16,000	Vehicles
	Community Time Savings due to Optimised Treatment	7,613,217	Hrs
Environment	Road Treatment Materials reduction (Water table)	3,900	Tons of Material
	Greenhouse Gas Creation Reduction	28,381	Tons CO_2
	Polluting Emissions Reduction	332	Kg NOx/VOC/CO