Countryside alliance

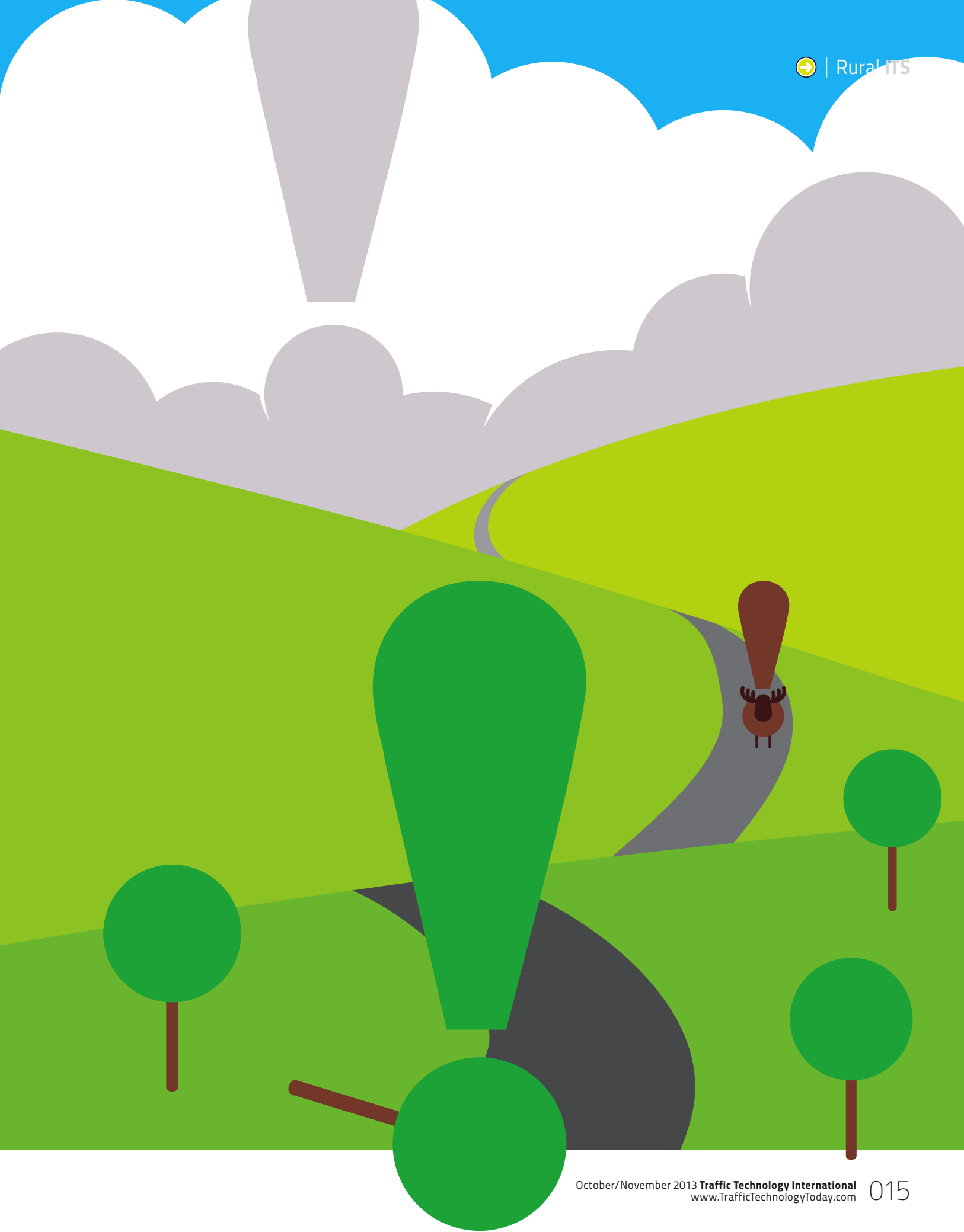
Timothy Compston looks into the specific challenges of deploying and maintaining ITS solutions in rural locations and speaks with the experts championing the cause

Illustration courtesy of Patrick George

Given the scale and isolation of our rural areas, it's hardly surprising there are hurdles aplenty for ITS solutions to overcome for them to be as effective as they are in our cities and urban regions. Providing power and links to the wider communication infrastructure are a constant source of consternation, while even simple maintenance tasks can be complicated, especially with devices in the field being hundreds of miles away from where DOT resources are concentrated.

By the same token there are specific rural problems that require the development of specialized systems – wildlife detection being a fine example – many of which are unlikely to feature high on the agenda in the urban domain. Maybe ITS has more of a role to play in the big country. Despite the lower traffic volumes, rural roads are proportionally the scene of more accidents per mile traveled than in our urban areas (the fatality rate for rural crashes is more than twice that for urban crashes). And when such incidents do occur, emergency response times just aren't on a par with our cities, so preventing accidents from happening in the first place is key. From a safety perspective, technologies that are paying dividends include rural intersection conflict warning systems to address right-angle collisions, the use of dynamic speed feedback signs on dangerous curves, and in-road sensors and RWIS to provide a better indication of the conditions that drivers are likely to face.

Such solutions are a relatively inexpensive way of addressing blackspots or points of concern, as opposed to physically remodeling



Strategic importance

Jon Jackels from **Minnesota DOT** reveals some of the benefits to agencies of uniting with private industry in order to improve safety, reduce maintenance costs and enhance operational and logistical efficiencies in our rural areas

As far as maintenance and operations management go, thinking strategically is of vital importance when it comes to rural ITS. Having taken part in a panel discussion at the National Rural ITS Conference, Jon Jackels from Minnesota DOT says that one of the challenges is that the counties and smaller towns don't have the technical expertise to maintain what can often be high-tech electronic systems. "You'll find there's much resistance to adopting that technology and putting it at the roadside for safety and warning applications," Jackels says, offering an example. Minnesota DOT operates around 1,700 traffic signals and has the electronic capability to manage these systems. "But continually adding systems without being able to add the personnel and extra hours to conduct the necessary maintenance on them is a resources challenge," he explains. "What happens is that we realign our priorities depending on which system is more important. Is a traffic signal more important than an intersection warning or curve warning system, for instance?"

> "It's financially impossible to spend millions on every intersection – a warning system may be a better option

So are there any solutions to such dilemmas? Jackels believes there are some opportunities that need to be explored. "One of those is reflected in an ongoing project on rural intersection conflict warning systems," he responds. "These can provide a dynamic warning to an approaching driver on the through road that a vehicle waiting is entering the intersection and, crucially, the driver at the intersection is alerted to traffic on the through road." Right-angle crashes tend to be severe, and Jackels says, "Without building an interchange or completely changing the geometry of an intersection – it's financially impossible to spend millions

hundreds of junctions or road features. And with developments in wind and solar power offering options to keep systems up and running, the potential to deploy a credible, effective ITS capability in challenging rural locations has never been greater.

Weather warnings

And Iceland is a good place to start. With a population of just 322,000 people and only 245,500 vehicles in an area the size of England, the country's road administration, ICERA, is responsible for 12,898km of roads outside of Iceland's towns and cities. At the mercy of the North Atlantic and being so close to the Arctic circle, the organization certainly appreciates the challenges that rural deployments present ITS managers.

According to Einar Pálsson, the chief of technical development in ICERA's service department, Iceland's inclement weather drives much of its ITS deployments: "We have weather stations on our high passes in the mountains, but more recently we've been adding them in the lowlands as slippery road surfaces are more of a problem there, so it's important for us to let travelers know about the conditions." The 95 or so weather stations the ICERA has deployed are more often than not situated well away from any power source. "Hence we produce the electricity for the stations ourselves, which can be a challenge because although Iceland is a very windy country, we do have periods without wind for several days and in the cold dark winter months you can't really rely on solar power either," Pálsson explains. Fuel cells have been called upon from time to time too. "We have found ourselves using them for our cameras, but due to cost if we can avoid using this technology, we will."

ICERA's variable message signs (VMS) are highly valued by Pálsson and his colleagues. "They're typically placed in the highlands before drivers start ascending our mountain passes so, if necessary, travelers can stop and evaluate if it's safe for them to pass – should there be high winds, for example."

For many of the high passes, Pálsson says that ICERA must refrain from servicing the roads during winter when the windspeed is more than 15m/s: "You can have snow blowing and zero visibility so we can't conduct any maintenance in those conditions. We can display a message on the VMS about road blockages or closures, with specific details about why there are problems. And we

Variable message signs are used by Iceland's ICERA to show windspeed, wind direction, temperature and, in extremely exposed areas, wind gust

on every intersection – a warning system may be a better option."

Addressing how the remote system is maintained, Jackels says the contractor doing the design and installation agreed to operate and maintain it for three years. "One of the reasons for this was to shift the risk element on the contractor so if they don't do a good job on the design, or have unreliable components, they have to sort things out themselves."

Jackels sees the project as a test to ascertain whether the private sector and contractors can fill in some of the rural capability gaps. "Our forces might take three hours getting to a site and back so there might be a way to reduce travel time by using resources that are spread out a little differently in the state. The local electrical contractor could for instance be trained to conduct the minor maintenance of the systems out there."

(Above) **A rural intersection crash avoidance system in Wisconsin** (Far left and below) **The systems provide drivers (on both the major and minor roads) with a dynamic warning of other vehicles approaching the intersection**

normally integrate CCTV with our weather stations so we can remotely assess the road conditions."

ICERA also receives valuable data from specialized freezing depth sensors that down to a depth of 1.2m measure temperature and conductivity (moisture) in the road structure: "Their primary purpose is to monitor the layers in the road and their load-carrying aspects for the spring thaw," Pálsson explains. "We're using them in all of the main roads where the road structure is not solid enough and there's likely to be heavy traffic and especially heavy trucks.

"If warmer temperatures come in and we experience a thaw, the top layers of the road melt while what lies beneath remains frozen," Pálsson says, detailing the impact trucks have on the roadway. "As the wet layers at the top are now weaker in regard to their carrying capacity, heavy vehicles can rather quickly cause a lot of damage." With asset protection in mind, ICERA monitors the situation carefully and if necessary puts restrictions on certain stretches. "We need at least 24 hours of advance notice about the likely conditions," Pálsson confirms.

Asked as to how technology is helping ICERA manage its network elsewhere, Pálsson says there is a strong focus on the winter service: "It's a high-cost activity so we have GPS on all of our winter equipment monitoring where they are, the salt they are carrying, where it is being used and the quantities – how many grams per square meter, for instance."

> Objects of a certain size will trigger the system and a beacon on a sign in the area will be activated to warn approaching drivers
>
> **Erik Minge, principal – ITS, SRF Consulting Group, USA**

Animal alerts

Of the 8.4 million lane-miles of roads in the USA, more than six million lane-miles are rural, hence why it's a big topic and even the focus of dedicated annual events, not least the National Rural ITS Conference. As delegates to the 2013 installment in St Cloud, Minnesota, heard at the end of August, wildlife is one of the major dangers to drivers, with between one million and two million wildlife-vehicle collisions (WVCs) estimated to occur in the USA each year – and going up. Erik Minge, principal – ITS, SRF Consulting Group, was one of the key speakers discussing his experience with rural wildlife detection.

(Right) **Highway managers can employ a wide variety of wildlife vehicle collision mitigation techniques to reduce the risk of encountering wildlife on the road** (Below) **Volvo Cars' response to WVCs is an active safety system that warns and automatically brakes for animals on the road**

VISIT US AT
GPEC ASIA & GULF TRAFFIC

TAKES YOU
WHERE THE OTHERS *CAN'T*

REDFLEX red light and speed enforcement systems are now available with non-intrusive vehicle and speed detection technology. This means that REDFLEX enforcement systems can reliably operate in built up, high traffic areas where traditional radars face reflectivity issues.

Quite simply, our revolutionary technology goes where the others can't.

Best of all, it can be installed without impact on infrastructure, is functional in all weather conditions, and offers best in class detection rates and accuracy.

Talk to us about your requirements; we can tailor an enforcement system to your needs, and have a number of outsourcing options available.

REDFLEX
TRAFFIC SYSTEMS

Delivering world-leading digital traffic enforcement solutions

redflex.com sales@redflex.com.au

Minge cites four deployments of the technology, two in Minnesota, one in Idaho and the other across the border in Ontario, Canada. "They're all similar in that they use a passive infrared detection system – you could call it a cordon or virtual fence," he explains. "Objects of a certain size will trigger the system and subsequently a beacon on a sign in the area will be activated to warn approaching drivers."

As to facts underscoring the positive impact of these systems, Minge says it is difficult to obtain good before-and-after data, although in one case the Minnesota DOT was tracking the number of deer carcasses removed from the side of the road. "That revealed a 60-80% reduction in wildlife vehicle crashes following a deployment," he says.

So where's best to deploy such a system? For starters, and thinking practically, there needs to be room at the side of the shoulder for the sensors: "You also have to think about the roadway geometry so there is a clear line of sight. A relatively straight roadway allows a 400ft spacing. On a curved roadway you have to shorten up the post spacing to follow the curve."

Mapping out workzones

Peter Rafferty from the University of Wisconsin-Madison was also present at the rural ITS conference. As the ITS program manager at the Wisconsin TOPS (Traffic Operations and Safety) Laboratory, he gave a presentation on behalf of the Great Lakes Regional Transportation Operations Coalition (GLRTOC) on multistate operation coalitions, specifically in the area of workzones.

The primary motivation for Rafferty's work for the GLRTOC was the realization shortly after its formation three-and-a-half years ago of the need to improve the coordination across state borders for the highest impact workzones. "The FHWA's Work Zone Safety and Mobility Rule has provided guidelines for users to target for individual workzones but it breaks down where one agency is achieving its goals but a workzone just across the border isn't.

"From a traveler's perspective, they're not concerned about jurisdictions – what they experience are multiple workzones that are causing them bothersome delays," Rafferty adds. To remedy this, every year during the first week of February all of the GLRTOC agencies come together and map out the workzones to identify potential conflicts. "It allows us to see the places where we may want to do more with traveler information, for example. Getting together like that really improves agency-to-agency coordination."

Initially the workzones were highlighted on a GIS map, although this has more recently moved on to a Google Maps API. The next stage will be a Multistate Corridor Operations and Management (MCOM) program of the FHWA, which is providing funding to the GLRTOC. "One of our tasks is to develop the next generation of workzone mapping applications that will really be available for anyone, even another coalition," Rafferty reveals.

(Right) **An electronic sign can warn drivers of potentially unsafe conditions at intersections in rural locations** (Below) **There are benefits to be had from coordinating projects between transportation agencies, utilities, and other agencies that may need to do construction in the public right-of-way**

> The FHWA's Work Zone Safety and Mobility Rule breaks down where one agency might be achieving its goals but a workzone just across the border isn't
>
> **Peter Rafferty, ITS Program Manager – TOPS Laboratory, University of Wisconsin-Madison, USA**

Cross-border traveler information

Situational awareness across local and state boundaries is especially useful in a rural context and is something that Caltrans and the Western Transportation Institute (WTI) have been implementing to great effect.

Doug Galarus, program manager – systems engineering, development and

Intersection action

The potential of rural intersection conflict or collision warning systems is something that's caught the attention of Dennis Tessarolo, an ITS specialist who works at Ontario's Ministry of Transportation (MTO). MTO is a member of the Enterprise Pooled Fund Study, which has representatives from the USA, Europe and Canada.

"I sit on the board of that group and we undertake and conduct a substantial number of ITS reviews and minor projects, primarily in rural areas. One of these was an intersection collision warning system and in this phased project, we're looking to develop a standardization for approaches to rural intersections – how you sign them, how you identify them, particularly in high incident areas."

Tessarolo reveals that the project leader for this initiative is from Minnesota and the FHWA has picked up on the project as well: "We're actually at the stage of looking to put this into the Manual on Uniform Traffic Control Devices (MUTCD) – the set of standards that all DOTs in the USA follow."

integration at the WTI explains more. "The One-Stop-Shop (OSS) web application provides information for travelers in California, Oregon, Nevada and Washington and features comprehensive real-time data for when you're planning a trip," he explains. "Part of the genesis of the OSS was a nod to the fact that sometimes we need information for a larger area than just one state. In the main, traveler information is handled by the individual DOTs or even jurisdictions smaller than that. If you cross borders – which you're much more likely to do in rural areas – you end up having to transition between one system and the next."

The project first started in Northern California, where Ian Turnbull is chief of the Office of ITS Engineering for Caltrans District 2. "Travel doesn't stop at political boundaries so travel information shouldn't either," he maintains. "Before OSS, you'd have to look at a variety of different sources to plan a journey." What was required was a seamless, borderless, traveler information resource. "The focus was more on rural because that's where you're more likely to be traveling longer distances."

Currently, the OSS allows you to look at CCTV images, DMS, weather information and weather stations that are along the route. "We are going to be expanding it into highway advisory radio messages, incident information from the different state police departments, accident information as well as details on construction."

Down to the planning

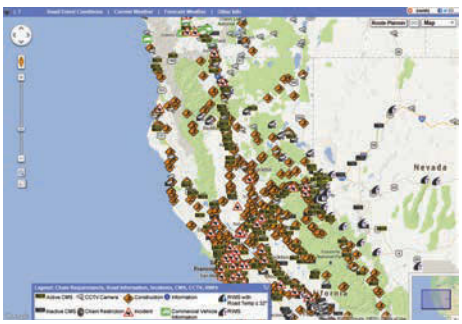
What's clear is that there is great scope for rolling out ITS in rural areas, given the availability of the right systems and the will to succeed. But Bob Scott says it's important to do your groundwork, as underlined by his National Rural ITS Conference presentation about ITS planning and implementation on a rural freeway corridor. "Nothing in terms of ITS works without good communications," emphasizes the principal of SRF Consulting when asked to distill the different approaches required for rural and urban areas.

Generally the aim is to deploy fiber optic along the freeway corridor although in some cases you might need to look at alternatives: "We may tie into the fiber optic backbone that goes throughout a state, for instance, and then use wireless and local hotspots to connect up to the freeway corridor," reveals Scott. Spread-spectrum radio tends to be used to communicate along key corridors. "You need to do a signal strength test and look at the type of interference because generally you're working with the unlicensed spectrum," he adds. "The licensed spectrum is always an option but you need to work with each state's frequency coordinator for that. Another path for communications is cellular. "We test with various cellular providers to ensure that the coverage is good. Satellite is sometimes an option, but due to the cost isn't something we generally recommend."

To help further still, Scott says SRF has developed a GIS tool that maps out all of the device locations. "It finds the best source of communications for a particular device, whether that be fiber, spread-spectrum radio or cellular." This was particularly useful for a large statewide planning project that Scott worked on recently. "We input all of the different device and plant locations where the DOT wanted them and used the GIS tool to take the first cut of recommendations for communications technology and then refined things from there."

When it comes to the gathering of rural traffic data, non-intrusive technologies such as radar are en vogue and enable volume, occupancy and speed data to be collected. A centralized system will often be used in tandem to collect and process the data, apply the algorithms, etc. Bluetooth is increasingly being used also, particularly where the cost of other detection technologies is prohibitive. "It's a great way to collect travel-time data."

Whatever the apparent barriers to deploying and managing ITS in rural areas – from how to power field devices, ensuring reliable and effective communications to keeping systems maintained and fully operational – what's clear from speaking with people is that there are always ways to resolve most of the issues.



The OSS web application provides travelers in California, Oregon, Nevada and Washington with comprehensive, real-time data that can be employed in planning their long-distance trips

Citizen reporters

The Citizen Reporter Program is a groundbreaking rural program developed in Utah. The basic idea is that members of the public will be trained up to submit road and weather reports to Utah DOT via their smartphones. "Rural roads are very important to our network but they don't get a lot of volume," say Lisa Miller, traveler information manager. "It's vital to have more eyes out there so we see this as really beneficial."

A pilot involved around 50 UDOT volunteers. "We're launching it to the public in the next few months," Miller says. "Our goal is 800-1,000 reporters over the course of the program." Groups being targeted as potential volunteers include the Utah Trucking Association as well as the Highway Patrol.

Plow crews, roadside stations and in-house meteorologists also provide weather information to UDOT.

For the purposes of road weather data, Miller says the state is split into 145 segments with the status of the road highlighted on the UDOT traffic app, the website and 511 system. On the wider ITS deployment front, Utah is in a strong position compared with many other states as it can call upon its fiber network of more than 1,800 miles: "This has been developed through UDOT installs as well as trades with private sector agencies that are keen to get their communications networks from one place to another, which lets us piggyback on them."

> We may tie into the fiber backbone that goes throughout a state and then use wireless and local hotspots to connect up to the freeway corridor
>
> **Bob Scott, principal, SRF Consulting, USA**

Optimize Your Intelligent Traffic System Network with **Ethernet First Mile over Copper Twisted Pair**

- Ultra Reliable Backhaul for Traffic Sensors and HD Cameras
- Quicker, Easier, and Less Expensive Than Fiber
- Integrates Everything Onto One Manageable All-IP Network
- Flexibly Rolls Out to Almost Any Location

Actelis Networks™

info@actelis.com | +1.866.228.3547 | www.actelis.com