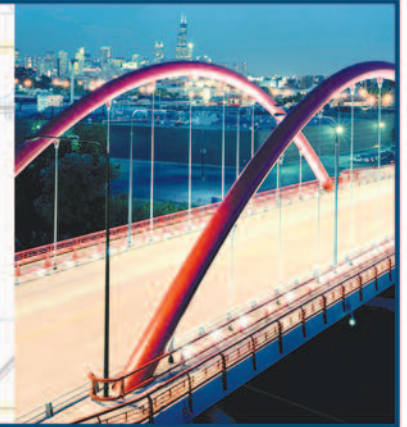




# Illinois Interchange



Illinois Technology Transfer Center

Vol. 17 No. 2 Summer/Fall Issue 2009



## IPWMAN

**Illinois  
Public Works  
Mutual Aid Network**

By Tammy Bennett, P.E., Foth Infrastructure & Environment, LLC

IPWMAN recently had our first deployment to Carterville, IL where we were activated as a State Asset. Six of our member agencies responded to the incident and assisted with debris removal for four days. Since we were deployed as an asset of the State of Illinois, we were able to receive reimbursement from the State. The response and support were overwhelming. The week we sent crews to southern Illinois, we also saw massive storms with heavy rainfall and straight-line winds come through Central Illinois, so we realize that there is always a need for more member availability since the possibility

of multiple disasters at the same time is likely. If you have been thinking about joining, the time is now. The future success of IPWMAN is based on growing our membership base. In addition, this is also a great time to become a member, as we will be nominating IPWMAN representatives from each region for elections to be held in October at the first annual IPWMAN conference. These members will be involved in the decision making process for IPWMAN.

This program is geared towards all public works departments, township highway departments, unit road districts, county highway departments,

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Please pass this on to other interested parties in your office.



Illinois Department of Transportation  
Bureau of Local Roads and Streets



Federal Highway  
Administration

*Continued from page 1*

public water and wastewater agencies in Illinois and any other public works related public agency. Any agency that has survived an emergency or disaster understands the benefit of having access to assistance when local resources have been exhausted.

In addition to a number of local and regional mutual aid programs, there is another statewide mutual aid program exclusively for water and wastewater agencies called ILWARN. It is designed as a neighbor to neighbor program focusing on discipline-specific assets (i.e. generators, spare parts, chemicals, etc.). IPWMAN has a focus on response to and recovery from natural and man-made events and the return of the entire community to normal. IPWMAN and ILWARN are two separate programs and most often will act independently of each other during an event.

### About IPWMAN

Illinois Public Works Mutual Aid Network (IPWMAN) is a statewide network of public works related agencies that:

- Prepares for the next natural or human-caused emergency.
- Organizes response based on NIMS standards of protocol.
- Provides aid and assistance during time of need, through a standardized agreement.
- Trains regularly to enable a rapid, efficient response to emergencies and disasters.
- Is recognized by the State of Illinois as the primary mutual aid program for the Public Works Sector.
- Has worked with multiple state agencies and developed key relationships to benefit the members of IPWMAN before, during, and after a disaster.

- Has established working relationships with other first responder mutual aid partners.
- Is a recognized partner with the Illinois Emergency Management Agency (IEMA).

IPWMAN mutual aid resources can be used for (but not limited to):

- Removal of debris
- Tree trimming, removal and chipping
- Restoration of water/wastewater operations
- Flood control/sandbagging
- Traffic control and detours
- Equipment repair
- Standby power
- Damage Assessment

### How the program works

To become a member of IPWMAN, an agency must have the support of its legislative body. The agency will sign the mutual aid agreement and submit the ordinance/ resolution, mutual aid agreement, resource inventory survey (or proof of submission of a resource list to your county emergency management agency) and its membership dues. The request for membership will be reviewed by the Membership Committee and approved by the Board of Directors. Once

reviewed, the applicant will be notified of acceptance into the IPWMAN.

When an emergency or a disaster occurs, mutual aid parties will contact the local accredited/certified County Emergency Management Agency Coordinator by phone. Through the chain of contacts, the IPWMAN call center will be contacted. Once contacted, the emergency equipment database will match resources to a member party's needs during the event. Providing personnel and equipment is never mandatory. This is a volunteer program providing emergency services to member agencies.

Some agencies have already completed applications for membership, so I apologize if this is redundant info. However, we also need YOUR help in spreading the word. Please feel free to forward this information to anyone else who you feel might be interested in joining. We need to reach as many people as possible that have an interest in public works. In addition, if you know of any groups that may be interested in a presentation on this program, please let us know.

Remember - no agency is too large or too small to need help and no agency is too small to help....

If you need more information, please feel free to visit our website

**WWW.IPWMAN.ORG**

or contact

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## IPWMAN First Annual Conference Springfield, IL October 22, 2009

**Registration** Please print or type.

Name: \_\_\_\_\_

Municipality/Agency: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

Email: \_\_\_\_\_

**IPWMAN Member:** YES NO

**Member Region:** 2 3 4 6 7 8 9 11

**Conference fees:**

Member: \$25.00/per person x No. Attendees = \$

Non-member: \$50.00/per person x No. Attendees = \$

Vendor/Sponsor: \$250.00 - \$

Attendee Name:

**Payment information:** Check enclosed payable to **IPWMAN**

**Mail registration and checks to:**

Monica Risse

IDOT 2300 S. Dirksen Parkway, Rm. 009

Springfield, IL 62764

**Special Notes:**

1. IPWMAN members are afforded free lodging if registered to attend the 1st Annual Membership Conference at the Crowne Plaza. Members must be registered by September, 30, 2009.
2. If you become an IPWMAN member after the conference, and before December 31, 2009, the \$50.00 registration fee will be applied toward your 2010 agency Annual Membership Dues.
3. If you become an IPWMAN member prior to September 30, 2009, your lodging will be furnished for the night of Wednesday, October 21, 2009. Each person listed as a member agency's representative is considered a member.
4. All non-members are offered the opportunity to stay the night on Wednesday, October 21, 2009 at the Crowne Plaza. Cost of the room is \$70.00 + tax if reserved before October 16, 2009.  
Crowne Plaza Springfield, 300 S. Dirksen Parkway, Springfield, IL. 62703, 217-529-7777

## COLD IN-PLACE RECYCLING AND FULL-DEPTH RECYCLING WITH ASPHALT PRODUCTS RESEARCH

Adapted from Research Report ICT-09-036

The objective of the cold in-place recycling (CIR) and full-depth recycling (FDR) with asphalt products research conducted through the Illinois Center for Transportation (ICT) was to assist the Illinois Department of Transportation (IDOT) with evaluating and implementing recently developed CIR and FDR technology.

In the 1960s, 1970s, and 1980s, many local road agencies in Illinois successfully used conventional asphalt emulsions for in-place recycling to produce emulsion-aggregate mixtures (EAMs). In more recent years, these emulsions have not been widely used for cold in-place recycling construction. A major constraint to the continued use of EAMs was the long drying time (loss of moisture following mixing and prior to compaction) associated with the process. The use of foamed-asphalt” and improved emulsion compositions (engineered emulsions) has alleviated some of the concerns that have limited the use of emulsions for in-place recycling.

*There are two types of cold in-place recycling procedures:*

- Full-depth recycling (FDR): The entire depth of the existing asphalt-treated material is incorporated into the mixture.
- Cold in-place-recycled (CIR): Only a portion of the entire depth of the existing asphalt-treated material is incorporated into the mixture. Thus, there may be a significant thickness of hot-mix asphalt (HMA) with varying (and largely unknown) distress remaining.

*The Asphalt Institute (2007) identifies three construction processes:*

- Single-unit trains: The single-unit train consists of a milling machine that does the milling, RAP sizing and blending at the cutting head. (NOTE: Frequently, the pavement is pulverized in an initial pass and the asphalt is added in the second pass.)
- Two-unit trains: The two-unit train consists of a milling machine and a pugmill-mixer paver.
- Multi-unit trains: A multi-unit train consists of a milling machine, a portable screening and crushing unit, and a portable pug-mill mixer.

The majority of the projects involving full-depth recycling with asphalt products (FDR) in Illinois are constructed using a stabilizer/reclaimer type machine. A milling operation is used for projects involving cold in-place recycling with asphalt products (CIR). Some agencies prefer the multi-unit train with the inclusion of a paver operation. Equipment innovation and development is constantly occurring.

In some projects, additional material (generally aggregate) is added to improve the gradation of the final mixture or to increase the thickness of the asphalt-stabilized layer. Typical thicknesses for the asphalt-stabilized layer are 3 to 8 inches. Many CIR projects are 3 to 4 inches in thickness. FDR projects generally are thicker. Current rotomills and stabilization equipment can effectively process to depths > 8 inches. Surfacing options include surface treatments and variable Hot Mix Asphalt (HMA) overlay thickness.

CIR and FDR mixture design procedures, field mixing equipment, and construction procedures have been—and continue to be—improved. CIR and FDR technology typically results in lower construction costs for flexible pavement reconstruction, rehabilitation, and resurfacing projects. Thus, CIR and FDR has emerged as a viable and cost-effective in-place recycling alternative. The final research report is available from the ICT website - <http://ict.illinois.edu/>



**ILLINOIS CENTER FOR  
TRANSPORTATION**

## ULTRA THIN WHITETOPPING RESEARCH

*Adapted from Research Report FHWA-ICT-08-016*

The objectives of the ultra thin whitetopping (UTW) research conducted through the Illinois Center for Transportation (ICT) were to provide the Illinois Department of Transportation (IDOT) with UTW thickness design method and guidelines for UTW design, concrete material selection, and construction practices. During this study, existing UTW projects were reviewed with the focus on the concrete mixture designs and field distress data to assist in generating an optimal state-of-the-art design method. The UTW projects studied that had premature distresses were typically thin or highly distressed hot mix asphalt (HMA) sections and high cement content mixtures. In order to evaluate the in-situ properties of UTW, falling weight Deflectometer (FWD) tests were performed on some of the projects. Due to the variability in the HMA thickness and stiffness, unbound material support layers, and UTW slab size, backcalculation of the layer properties was difficult and was not included at this time. However, FWD testing allowed for an in-depth look at the joint load transfer efficiency and was an indicator of the concrete-HMA bond condition and the condition of the UTW support layers.

A new mechanis-

tic-empirical design method was proposed based on a modified version of the American Concrete Pavement Association (ACPA) design method for UTW. This proposed guide calculates the required UTW thickness based on traffic level, pavement layer geometry, climate, materials, and the pre-existing HMA condition. Laboratory testing of UTW concrete mixtures suggested many proportions and constituents can be successfully used as long as consideration is made to minimize the concrete's drying shrinkage (e.g., limited cement content) and maintain the concrete-HMA bond.

The laboratory testing coupled with previous fiber-reinforced concrete (FRC) slab tests suggested that structural fibers should be utilized in future UTW projects in order to

reduce the required slab thickness without increasing the concrete strength, limit the crack width, expand the required slab size, and to extend the functional service life of fractured slabs and potentially extend the performance of non-reinforced concrete joints. A residual strength ratio was proposed to characterize the performance of any FRC mixture to be used in UTW systems. This residual strength ratio can be calculated based on measured parameters from ASTM C 1609-07 and has been incorporated into the design guide to account for the structural benefits of using FRC. Finally, recommendations for saw-cut timing and construction techniques were also researched. The final research report is available from the ICT website - <http://ict.illinois.edu/>.



### Midwestern Pavement Preservation Partnership 2009 Annual Meeting

We would like to invite you to join us for our upcoming annual meeting which will be held October 26 – 29, 2009 at the Chicago Marriott in Schaumburg, Illinois.

Watch for details about registration and training opportunities on the website:

[www.pavementpreservation.org/midwestern](http://www.pavementpreservation.org/midwestern)

# WANTED

## SNOWPLOW OPERATORS



Don't forget to calibrate the spreader control system on your horse before saddling up this winter.

### THE CALIBRATION KID

Is your spreader control system calibrated?

A spreader controller over-applying materials by 5 percent on a truck that applies 225 tons of salt per year will waste 11.25 tons of salt. At \$63 per ton, that costs the department an extra \$708. Multiply that by 900 snowplows and the DOT would spend an extra **\$637,875** per year.

A spreader controller over-applying salt by 10 percent would cost an extra \$1,417 per year for each snowplow. Multiply that by 900 snowplows, and the DOT would waste **\$1,275,750** per year.

# REWARD:

Saving ~~UP TO~~ **\$1,275,750**

# WANTED

## SNOWPLOW OPERATORS



Save your horse, and complete your ride as quickly as possible without compromising yourself or your duty.

### QUICK CLARA CASSIDY

Fastest in the Midwest at putting snow and ice to rest

Operator costs per hour **\$32** (including benefits)

Truck costs per hour **\$30**

Salt costs per hour **\$236** (application rate of 250 pounds per lane mile at 30 mph)

Total cost per hour of operation **\$298**

Cost of 900 trucks operating statewide for one hour **\$268,200**

# REWARD:

Saving ~~UP TO~~ **\$268,200** per hour

# WANTED

## SNOWFLOW OPERATORS

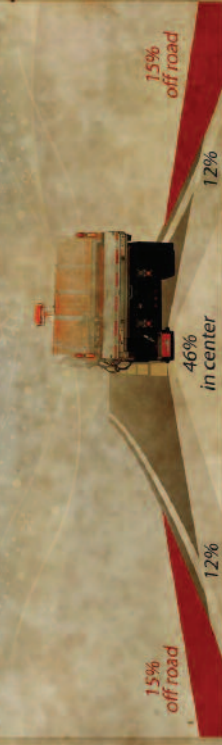


Don't forget to make it stick by combining liquids to your dry materials at the spinner every time you ride.

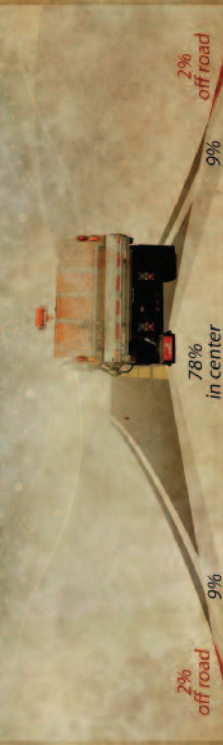
### PECOS PETE PREWETTER

#### Is your dry material prewetted or in the ditch?

Typical scatter of road salt *without* prewetting



Typical scatter of road salt *with* prewetting



Source: Michigan Department of Transportation

# PREWARD:

## Keeping UP TO 26% more salt on the road

# WANTED

## SNOWFLOW OPERATORS



When the pavement temperature goes below 15 degrees, salt doesn't do a lick. Better conserve it if it ain't gonna do the trick.

### SALT SAVIN' SAM BASS

#### Do you know when to hold it and when to spread it?

Pounds of ice melted per pound of salt at different pavement temperatures

Pavement temperature (degrees Fahrenheit)	One pound of salt
30°	46.3 lbs. of ice
25°	14.4 lbs. of ice
20°	8.6 lbs. of ice
15°	6.3 lbs. of ice
10°	4.9 lbs. of ice
5°	4.1 lbs. of ice
0°	3.7 lbs. of ice

# PREWARD:

## Using salt when it's most effective

# TRANSPORTATION AND MOISTURE: WHAT IS THE POINT?

## Improving Decision Making Abilities by Measuring Atmospheric Moisture Values Will Save Lives and Resources

By Jon Tarleton, Marketing Manager – Meteorologist, Quixote Transportation Technologies, Inc.

### Introduction

For the past thirty five years government agencies in the United States and Europe have been monitoring weather conditions along our road system. The agency division responsible for the maintenance of our roads is also responsible for the safety of our road system during times of adverse road conditions. In the past three decades these agencies have used fixed Road Weather Information Systems, known as RWIS, to monitor road conditions and make decisions on how to maintain safe driving conditions. The RWIS stations have become fairly advanced with stations capable of detecting de-icing chemicals on the road, measuring the freeze point of liquid on the road by actually freezing the liquid and even monitoring conditions non-intrusively with sensors on the side of the road. The usage of RWIS by road maintenance authorities has been proven to increase the level of service, which in turn means better road conditions and lives saved. Winter maintenance personnel from several agencies indicated that use of RWIS decreases salt usage, and anti-icing techniques limit damage to roadside vegetation, groundwater, and air quality (in areas where abrasives are applied).<sup>1</sup> The major challenge road authorities face with RWIS is the difficulty in authorizing enough RWIS sites to provide a dense weather network needed for accurate decision making. The Federal Highway Administration ESS siting guide recommends that RWIS sites are spaced every 30 miles.<sup>2</sup> That kind of weather infrastructure in the United States is difficult to gain

funding for most agencies given the size of the country and distribution of population. What is needed is a solution that can assist in filling in the gaps between data points with a much smaller investment in infrastructure, while still providing data similar to that of RWIS sites. This new data network would not replace the existing RWIS station, nor stop the addition of stations, but instead add to the network of road weather information.

The next key issue is determining which weather variables should be monitored by this “filler network.” Of all the road conditions currently monitored by RWIS stations and other means, no one within the community would argue that the single biggest variable to monitor is pavement temperature. The temperature of the pavement is critical because it does not typically match the air temperature at most times and conditions of the year. Second, it is such a critical variable to decision makers, because a pavement temperature above freezing means there will be little to no impact on road conditions during a snow/ice event. Pavement temperatures also determine how effective road chemicals are when road temperatures are below freezing. Beyond pavement temperature, the choice for the next most useful value has been debated for decades. One value, which has seen little attention over the years most likely due to its lack of understanding not because of its importance, is dew point. This poorly understood weather parameter has a huge impact on road transportation. The reason for its huge impact

is the problems caused by dew point on our road system go unnoticed by the driver. Heavy rain, ice or snow has a very visible impact on the road, and the driver typically takes notice and makes adjustments to their driving behavior. Atmospheric moisture values on the other hand are nearly impossible to see, making them even more deadly because of the lack of change in driving behavior.

### What is Dew Point?

As we all know the amount of moisture in the air is not a constant. It changes just like everything else in the atmosphere. It even changes as you go higher or lower in the atmosphere. Meteorologists have several values they use to quantify the amount of moisture in the air; however, the most common are dew point and relative humidity. Of these two, relative humidity has become the most commonly used parameter by the general public for reasons that are not totally understood. Although some possible reasons are media sources tend to talk about relative humidity, public perception is that relative humidity is easy to understand (10 percent is low and 90 percent is very high), and dew point might be perceived as complicated. The truth is relative humidity is the tough one to truly understand. Dew point, on the other hand is much easier and has a direct correlation to moisture interaction with the roadway. Dew point is the temperature at which the air must be cooled for saturation of the air to occur. Dew point

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is a value reported in either degrees Fahrenheit or Celsius, depending on how air temperature is being reported. Dew point follows a very important law of atmospheric science. The dew point temperature can be equal to the air temperature, but never higher than the air temperature. The dew point makes understanding the amount of moisture in the air simple. A dew point of 10° F is an example of dry air and a dew point of 70°F is an example of very humid air. The relationship between the air temperature and the dew point temperature is also important. When the difference between the air temperature and dew point are very large it takes a lot of additional moisture to saturate the air, where as when they are close together the air is nearly saturated. This is especially important in the winter with the onset of a snow storm. Snow falling from the clouds can be impacted by the amount of moisture in the air near the surface. When the difference between the air temperature and dew point is large it will take a longer time (if at all) before snow begins reaching the ground, where as when the difference is small snow fall begins reaching the ground immediately.

Dew point is a critical value to monitor for the pavement because the temperature of the pavement can (and does) fall below the dew point of the air. When this occurs, condensation begins to occur on the pavement surface. If the surface of the pavement is below freezing then frost begins to form on the surface. Frost may appear harmless on vehicle windshields or roof tops; however, on a road surface it is just as dangerous as ice or snow. If the pavement surface is below the dew point but not yet at freezing, dew (or liquid) water begins



*Vehicle Mounted Infrared Pavement Temperature System-Side View*

to form on the pavement surface. If the pavement temperature then falls below freezing the water freezes, becoming one form of black ice. Black ice is even more dangerous because it freezes from a liquid to a solid; it freezes clear, which means it is invisible to the driver.

How does the pavement surface fall below the dew point and cause problems for vehicles? There are two situations when this commonly occurs. The first is when the pavement temperature cools rapidly and falls below the dew point. This most commonly happens during the winter with bridge decks and elevated road surfaces. On a clear, calm night, surface heat from the day is released back to the upper levels of the atmosphere. Bridges and elevated structures cool quicker than the surrounding air and can many times fall below the dew point of the air, causing frost to develop on the bridge if it is below freezing. The second situation is when air with a higher moisture content moves in over a cold surface. This can happen in many different types of weather scenarios. One

example is when moist ocean air moves inland and over a roadway that has been allowed to cool earlier in the night. Almost all situations of dew point related road problems occur at night when pavement temperatures are coolest, and the pavement temperature can be below the dew point.

### **Mobile Weather**

RWIS measures both the pavement temperature and the atmospheric dew point at a given site, providing the information we need to make decisions about dew point related road weather events. However, RWIS only gives us this information at its fixed location. Pavement temperature and dew point can change dramatically over short distances. Given that we only need pavement temperature or dew point values to change by one degree to cause pavement temperatures to drop below the dew point. So being able to monitor conditions as we move through different micro climates would be key. Collecting

*Continued on page 10*

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weather data using a vehicle first began with the creation of a vehicle mounted infrared pavement temperature system in the 1990s. These systems have become very popular, and today nearly all winter maintenance vehicles are equipped with such a system. The sensors are installed to give supervisors the ability to see pavement temperature around their area of responsibility, and give snow

technology. AVL is a system that combines a digital cellular modem, a GPS receiver, and a device to collect the vehicle data and periodically transmit the data to a central location. In the early days of AVL a vehicle would have to return to the garage, so the data could be collected wirelessly by a single communication node. Today, with the improvement of digital cellular coverage and reduction in data communication costs, data can

system was a primary function instead of an afterthought? By collecting air temperature, pavement temperature, dew point, and relative humidity you begin to create a true mobile weather station from a vehicle. If you then combine data from all the vehicles in a fleet you create a mobile weather network. The vehicles provide the infrastructure needed to offset the lack of RWIS data; they can be equipped affordably, and they move around, which makes them an excellent source of additional weather data points. Imagine if other types of vehicles beyond winter maintenance vehicles were also equipped, such as police, sanitation, and utility vehicles. The benefits of this concept would be similar to the benefits seen over the years from RWIS technology. The additional data points would provide decision makers with better information, resulting in better operational decisions. The mobile data would also improve the value of the fixed RWIS sites, because now you are able to fill in holes in the data. In the example of dew point detection, areas of frost or black ice could be identified, unlike today where we sometimes rely on the first accident to trigger a response.



*Vehicle Mounted Infrared Pavement Temperature System-Front View*

plow operators one last decision point before applying chemical. The infrared sensor reacts quickly to the changing temperatures of the road surface, and measures the air temperature from a separate sensor hidden from the sun and engine heat. The data is then brought back to an in-vehicle display unit mounted on the dashboard of the truck. As an alternate solution, the data can be connected to a chemical spreader and display the temperatures within the spreader display.

This data was only available to the driver until the advent of Automatic Vehicle Location (AVL)

be brought back nearly real-time. A central office is then able to see the location of all the vehicles in the fleet, individual vehicle health, and driver operations. The major functions for an AVL system today are to maximize deployment of operations, fleet management, and resource management. Several of the systems have begun to collect the air temperature and pavement temperature data from the infrared sensors, but mainly as an afterthought.

### **The Future of Weather Data**

What if the mobile weather data collected and displayed by the AVL

The U.S. federal program known as “Clarus” was created to gather all road weather data into a central electronic location, was also designed to incorporate mobile weather data. By combining mobile fleet weather data in one metropolitan area, you could be viewing data from state departments of transportations, counties, and cities all from a single source. This data could also be fed into a Maintenance Decisions Support System (MDSS) to improve the MDSS software’s ability to make

*Continued on page 11*

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localized treatment recommendations. MDSS is a software system that analyzes near real-time road weather data, road weather forecasts, and actions of the winter maintenance operations to make treatment and operation recommendations to the decision maker. MDSS requires the most accurate real-time data so that it has a good understanding of what is happening on the roads. By combining mobile and fixed weather data you will greatly improve the decision making capability of the MDSS. In the future, additional weather parameters could also be sensed by a moving vehicle, providing even more information about the conditions on the roadway. One slightly surprising outcome of collecting dew point and relative humidity from a vehicle is that it opens up several non-winter applications. The process of applying roadway paint markings and vegeta-

tion control all require real-time knowledge of the humidity levels in the air. In the past, operations would require the use of data from fixed RWIS or airport observations (many miles away and possibly hours old) for this key piece of information.

Quixote Transportation Technologies, Inc. (QTT) is the first company in the world to commercially offer a sensor product that incorporates pavement temperature, air temperature, dew point and relative humidity in a single mobile platform. The product, known as Surface Patrol® HD, is an enhancement to the company's standard Surface Patrol product, which was released in the late 1990s, and only measured air temperature and pavement temperature. Surface Patrol HD is the solution to this critical need for mobile weather data. The system can also be integrated into an AVL system to begin the process of collecting multiple weather param-

eters from a moving vehicle. The biggest benefit of the Surface Patrol HD is the addition of data points between RWIS stations, making the entire road weather network rich with data. Mobile weather data is the future of road weather information, not replacing RWIS, but instead enhancing and improving the overall weather network.

#### *References*

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*Vehicle Mounted Infrared Pavement Temperature System-Back View*



The Technology Transfer (T2) Program is a nationwide effort financed jointly by the Federal Highway Administration and individual state departments of transportation. Its purpose is to transfer the latest state-of-the-art technology in the areas of roads and bridges by translating the technology into terms understood by local and state highway or transportation personnel.

The Illinois Interchange is published quarterly by the Illinois Technology Transfer Center at the Illinois Department of Transportation. Any opinions, findings, conclusions, or recommendations presented in this newsletter are those of the authors and do not necessarily reflect views of the Illinois Department of Transportation, or the Federal Highway Administration. Any product mentioned in the Illinois Interchange is for informational purposes only and should not be considered a product endorsement.

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