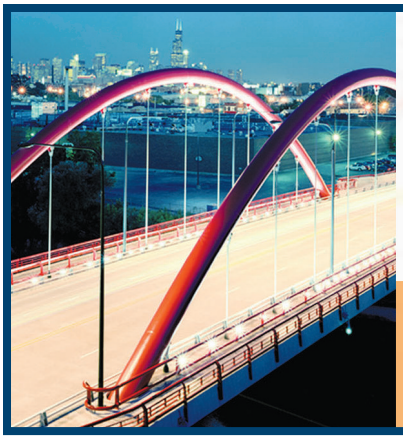

ILLINOIS INTERCHANGE

January 2017

ILLINOIS TECHNOLOGY TRANSFER CENTER

TECHNOLOGY TRANSFER CENTER UPDATE

Tim Peters – Local Policy and Technology Engineer

Within the past year, the Illinois Department of Transportation's Technology Transfer (T2) Center has experienced a significant turnover in staff. Gabie Richardson took a new job at the end of last year and Gwen Montgomery retired in May. Both these women played key roles in building the T2 program. Their hard work and dedication helped shape the T2 Center into what it is today. Fortunately, the T2 Center has been able to hire several individuals to help continue the progress of these two wonderful women.

In August, David Maziarz, former Graduate Public Service Intern (GPSI) assigned to the T2 Center, officially joined the T2 team. Dave received his Master's degree in Communication from the University of Illinois at Springfield, prior to accepting the position of Training and Graphics Specialist for the T2 Center. Through his years as an intern, Dave gained a great understanding of the purpose and procedures of T2. In addition, his internship involvement included: completion of Learning Management System (LMS) training, scheduling classes, and updating training presentations.

Also in August, the T2 Center welcomed Anji Williams as the new GPSI. Anji brings an array of skills to the team with her studies in Public Administration. In addition to this knowledge base, Anji also brings with her experience from working in Springfield's public schools. Anji's skillset has been a great addition to the T2 Center.

Then in October, the T2 Center hired Stephanie Stoverink as the new Training Development Technician. Before joining T2, Stephanie worked in IDOT's Bureau of Local Roads and Streets in District 8. Prior to moving to Illinois, Stephanie was a special education teacher and coach for nine years in southeast Missouri. Since joining the T2 team, Stephanie has attained certification as a flagger training instructor and as a Real Colors® facilitator. Her training and enthusiasm have enabled T2 to reduce the backlog of flagger trainings which had developed without a trainer.

Although the T2 Center is a relatively small group, it has experienced something that is not unusual in the

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INSIDE:

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

State of Illinois
Illinois Department of Transportation

Illinois Department of Transportation
Bureau of Local Roads and Streets

Federal Highway Administration

FHWA'S REGIONAL WORKFORCE DEVELOPMENT CENTERS

By: Tim Peters – Local Policy and Technology Engineer

In 2014, the Federal Highway Administration established five new regional centers to deal with workforce development challenges facing the transportation industry. One of the most significant challenges facing the transportation industry according to FHWA's analysis is more than 50% of the transportation workforce will be eligible to retire in the next 10 years. This creates not only a significant loss of specialized knowledge and experience, but also a need to train a new generation of workers and leaders. The transportation industry, like all industries, is also being affected by changes in technology, resulting in additional needs for related training as well.

The Regional Surface Transportation Workforce Development Centers are one-stop shops for transportation workforce development. Each center has the people and resources needed to plan and coordinate priority issues unique to its region. These centers have been tasked with examining future workforce needs, as well as current gaps related to the transportation industry. Collectively, all of the centers work as a coordinated nationwide network to achieve workforce related objectives that impact the country as a whole.

Individually, each center has specialized information directly related to its regional needs. Ideally, these centers were created to assist organizations in adjusting to workforce changes. Free webinars, reports, and links to resources and programs may be obtained from each center.

The Midwest Center is located at the University of Wisconsin – Madison. Areas of focus for the Midwest Center include: infrastructure, construction, planning, inland waterways, sustainability/environment, STEM, and stackable credentials.

The Northeast Center is located at the University of Vermont. The focus areas of the Northeast Center are disadvantaged youth, climate change, alternative fuels, and community colleges.

The Southeast Center is at the University of Memphis and focuses on women in transportation, freight (trucking, rail, logistics), and military/veteran transition back into the workforce.

The Southwest Center is located at California State University – Long Beach. Their focus areas include: gateways/corridors, non-native English speakers, portability of skills, and traffic management/intelligent transportation systems.

The West Center is located at Montana State University. The West Center focuses on rural transportation and safety, mobility and livability, tribes, and federal lands.

The resources offered by the Workforce Development Centers will help your organization deal with changes as efficiently as possible.

Contact Information for each Center is listed below:

Midwest Transportation Workforce Center

University of Wisconsin - Madison
Teresa Adams, Director
adams@engr.wisc.edu
http://mtwc.org
(608) 263-3175

Northeast Transportation Workforce Center

University of Vermont
Glenn McRae, Director
glenn.mcrae@uvm.edu
www.netwc.net
(802) 656-1317

Southeast Transportation Workforce Center

University of Memphis
Stephanie Ivey, Director
ssalyers@memphis.edu
www.memphis.edu/setwc
(901) 678-3286

Southwest Transportation Workforce Center

California State University - Long Beach
Tom O'Brien, Director
thomas.obrien@csulb.edu
www.ccpe.csulb.edu/SWTWC
(562) 985-2875

West Transportation Workforce Center

Montana State University
Steve Albert, Director
stevia@coe.montana.edu
http://wrtwc.org
(406) 994-6114

IDOT ADA FIELD GUIDE

IDOT is now offering a field guide which provides information on practical implementation of the American's with Disabilities Act (ADA) requirements. The Accessible Public Right-of-Way Field Guide was developed through an IDOT sponsored research project at the University of Illinois. It includes checklists and illustrations that allow users to identify and evaluate ADA issues related to their projects, as well as ensuring compliance with all applicable regulations mandated by the State of Illinois. Overall, this guide is a practical resource for field staffs to utilize in seeking a better understanding of how ADA requirements apply to their projects, as well as for developing self-evaluation and transition plans for their communities.

This guide is available on IDOT's website at: **http://www.idot.illinois.gov/about-idot/civil-rights/ADA-and-Accessibility** under the "Construction Guidance" tab.

REACHING DEVICES

By:Phillip Anderle Indiana DOT This article was provided in a SICOP News update

Reaching devices were developed by Michael Neace, HT 3 – Sellersburg Unit, as a tool for hooking and unhooking salt beds from the bed hangers while standing on the ground. In addition to eliminating the use of ladders for this operation, it also eliminates employees from putting their hands and fingers near pinch points when hooking and unhooking salt beds.

Recommended handle length is 5 to 7 feet. The handles are made out of conduit. The ends are welded onto the conduit and made out of stainless, with a tapered end. Two different styles are used at the Sellersburg Unit, one is "V" shaped and the other is "L" shaped. Either shaped end works, but employees at Sellersburg prefer the "V" end style. It is recommended that three reaching devices are available when hooking and unhooking the salt beds.

ROADBUMP – App for Measuring Road Roughness

By: Dave Grimmer – Grimmer Software

There is a new product available that is especially well suited to county/municipal road maintenance and engineering professionals. RoadBump from Grimmer Software is an Android app that measures the roughness of any type of roadway. RoadBump provides objective road roughness data (expressed in terms of the industry standard International Roughness Index or IRI) that previously was available only through very high cost inertial profilers. Many counties and municipalities do not have access to the high-end/high cost profilers that most states use.

RoadBump uses your existing Android device's GPS and accelerometer sensors to measure the roughness of a road. It displays a map of the road that was measured, and allows you to zoom in to measure the roughness of any part of the traveled path. RoadBump produces estimated IRI graphs as a moving average or in segment lengths that you specify (such as .1 mile or km). An accelerometer graph shows individual bumps, dips, and waves.

Data from RoadBump can be exported as a CSV file (able to be read by MS Excel). The data can be extracted at a detail level (100 records per second) or at a summary level (IRI averages for a specified segment length – typically .1 miles or km). A new capability of RoadBump is to produce an extract file that can be brought into ESRI's ArcGIS product. The ability to move data into ArcGIS allows multiple recordings to be shown together on 1 ArcGIS map. It also allows the RoadBump data to be seen and used by anyone with access to the ArcGIS application. The ArcGIS product is used by more than 90% of US counties.

Methodology

RoadBump determines the roughness of a road using accelerometer data (gathered at ~100Hz) as inputs to a differential equation which models the car's suspension in real time. The model simulates the vertical movement of a wheel on a spring (vehicle suspension) with a resisting damper (shock absorber). The spring and damper model parameters vary with speed which allows roads to be evaluated at normal (varying) driving speeds. A user specified constant allows results from different vehicles with different device placements to be brought into the same range. Speed and location information for mapping come from the device's GPS capabilities which are recorded about once per second.

As is the case for many new technologies, RoadBump's results are not as accurate as the high-end equipment. RoadBump is technically a response type system. It won't stand up in court as the measurement for determining bonuses or penalties for smoothness achieved. But it wasn't meant to. RoadBump's goals are to provide an extremely low cost tool to gather roughness data, to pinpoint rough points on a road and to provide relative comparisons of different roads or the same road over time. None of these objectives require an exact IRI.

None of this is to say that the quality of the data produced is not good. In the test case described below, the IRI graphs RoadBump produced closely match the true IRI results from an ARAN van (state of Arkansas' inertial profiler). Averaged over a 19 mile road, RoadBump's average IRI estimate was within 2% of true, and over 5 subsections of various length on that 19 mile road no section's IRI was off by more than 7.3%.

Test Results

RoadBump was tested over a 19 mile section of road in central Arkansas. The state highway department provided IRI results from their ARAN van that evaluated the same section of road a couple of months before the RoadBump test. The "True" column in the table below is IRI from the state's ARAN van. The road was driven at the posted speed limit of 55 mph, slowing for some tight curves. As the state did not provide IRI data across bridges, RoadBump's recording of the 19 mile section of road

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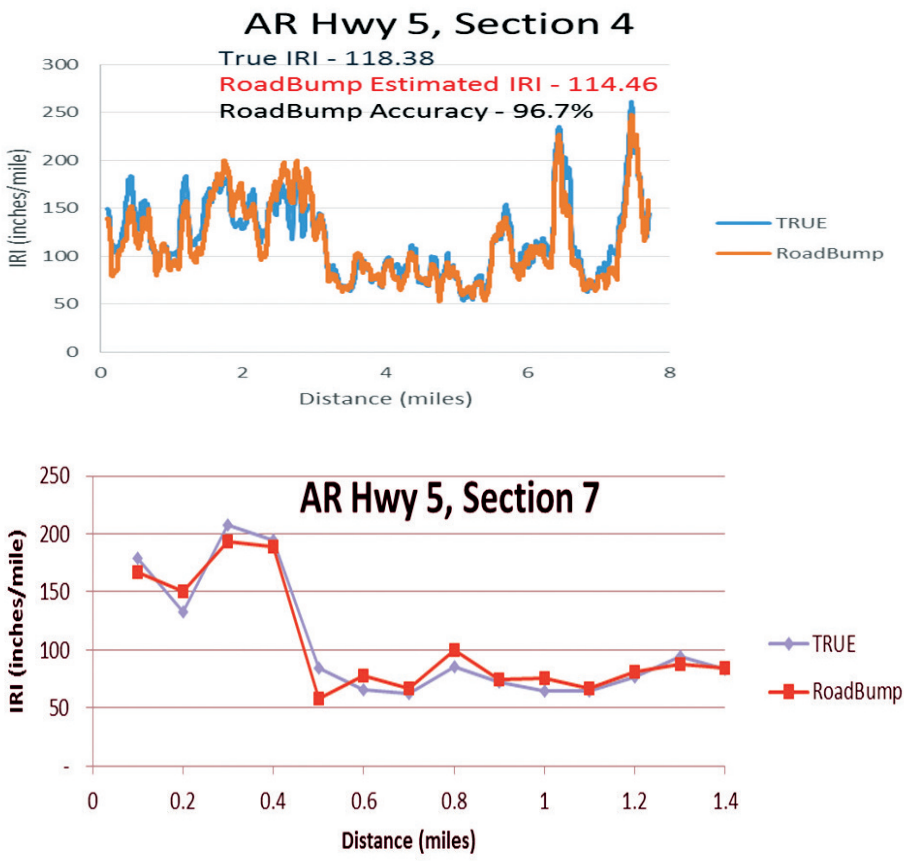
		IRI as inches/mile		
Section	Miles	True	RoadBump	Error
1	2.669	135.24	145.13	7.3%
2	3.308	140.34	138.54	-1.3%
4	7.705	118.38	114.46	-3.3%
5	2.165	118.42	110.36	-6.8%
7	1.479	105.84	106.56	0.7%
Weighted Average		124.06	122.57	-1.2%



was broken into sections between the bridges. Table 1, (bottom of page 4) summarizes by section the IRI results from the state's ARAN van (True) and the corresponding results from RoadBump. Sections 3 and 6 were too short to provide meaningful data.

Over each of the 5 sections, RoadBump's IRI averages were always within 7.5% of the true IRI. Also shown on page 5 are two graphs representing the IRI averages of sections 4 and 7, RoadBump's moving average closely matches that produced by the state's inertial profiler. Comparisons of the other sections also illustrate a similar, tight fit.

Factors that impact RoadBump's ability to match up perfectly with road sections with known IRI are:

- Human error in driving the same exact path as the inertial profiler
- GPS accuracy limits accuracy of placing the start and end markers to a few yards
- Distance is not measured as accurately as on the inertial profilers
- Modeling differences since RoadBump vehicle feels each bump twice (front and back)

When you launch the RoadBump app, it takes a few seconds to get a solid GPS fix and then it displays a giant Start button. Press the Start button and begin driving. When you press the Start button, the button changes to a Stop button. When you have driven the section of road to be evaluated, stop the vehicle and press the Stop button. That's all it takes to record the roughness of a road. From this point you can choose what to do with the new recording. From the start screen you also have a choice of managing, viewing, and exporting existing recordings by using the folder icon on the top row of icons.

To get the most accurate IRI results, some configuration is needed because the app doesn't know what kind of vehicle it is in or where it is placed in the vehicle. This configuration is done by providing an adjustment factor in the settings from the Start screen. The adjustment factor can be fine-tuned by recording a section of road with a known IRI value. If you come in 20% high, reduce the adjustment factor by 20%. If you don't have access to a stretch of road with a known IRI you can follow the app's suggestion of using .8 for trucks, 1.0 for SUVs and 1.2 for sedans.

When you view a recording, RoadBump displays a Google map of the path traveled along with graphs showing how the roughness varied across the recorded path. Old recordings can be compared one at a time to recent recordings to see relative changes in the roughness of the road. The screen images on page 6 show 3 representations of portions of the data displayed in the IRI comparison graphs of Section 4 (left).

The first panel shows a normal map view of the 7 mile test section on the top half of the screen and an IRI moving average graph (yellow line) below the map. The color coded path driven is similar to what Google Maps' traffic shows – red indicates roughness over 120 in/mile, yellow is 90 to 120 in/mile and green is less than 90 in/mile. The cutoffs for the color limits are configurable from the settings button on the map screen. The start and end markers can be dragged along the path to limit the data shown in the graphs.

The top half of the second panel shows a smaller section of the path, rotated and with a satellite view. Below the map is a .1 mile segment level average graph (purple line with green and yellow cutoff limits). The segment length and cutoff limits are

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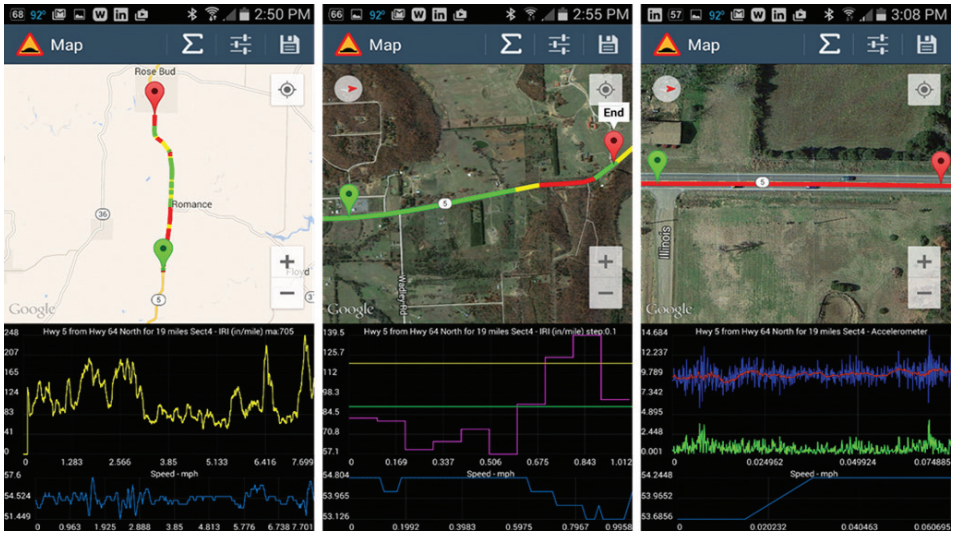
configurable from the settings button on the map screen.

The third panel shows the accelerometer data for a small portion of the path. In many cases you can see the change in the road that caused the spikes in the accelerometer graph. The blue line is the raw accelerometer data. The red line is a moving average of the previous 10 accelerometer readings. The green line is the absolute value of the difference between the raw accelerometer data and the moving average. RoadBump always displays the speed of the vehicle across the miles (or km) between the markers regardless of which type of graph is shown above.

Comparing recordings of the same road over time, RoadBump can show the impact of maintenance work done (or not done). Reviewing a single recording can provide an insight as to whether a section of road is consistently rough or has a few spots that need attention.



The testing done with RoadBump shows that it can provide results close to the inertial profilers over extended distances. While the degree that RoadBump approximated the true IRI is impressive, many will find the true value of RoadBump to be that it provides consistent, objective data for decision making. The most important thing RoadBump does is to provide an inexpensive way to gather objective data so that better, more cost effective decisions can be made.

RoadBump was developed by Grimmer Software with consulting advice from the staff at the National Center for Asphalt Technology at Auburn University and the Civil Engineering department at the University of Arkansas. More information is available at **www.GrimmerSoftware.com**.

Continued from p.1

transportation industry, nor the organizations in which it serves – changes in personnel. In fact, there are many employees in the transportation industry who are approaching the age of retirement. Similarly, your organization may be facing its own challenges associated with retirement and staff turn-over. The challenge of continuing and maintaining on-going activities can be difficult with a shortage of staff. Your resources may very well be stressed and challenged; however, you may acquire new personnel who come with new ideas and experiences which may provide opportunities to improve your organization's programs and services. The challenge and opportunity of the T2 Center is to provide essential training and information to help organizations cope with these changes. In meeting this challenge and opportunity, T2 plans to add some new course offerings and to continue to provide information and training which helps your organization with changes in personnel, regulations, requirements, and technology. On Page 2 of this newsletter, look for the article, "FHWA's Regional Workforce Development Centers," for further discussion of how transportation agencies deal with changes in personnel.

APPLYING CONTINUOUS IMPROVEMENT CONCEPTS TO SNOW AND ICE

By: Tim Peters – Local Policy and Technology Engineer

Businesses routinely monitor and adjust their processes to maximize efficiency. Often this is referred to as continuous improvement. The same concepts of continuous improvement can be applied to public sector agencies' snow and ice operations.

To begin implementing the continuous improvement concept with your agency, start by answering the following questions:

Is your agency reactive or proactive in managing snow and ice operations? Is your agency adjusting its approach based on the characteristics of each individual storm, or, is your agency simply using the same approach for all storms? That approach may be effective in some instances, but not all storms are created equal. In some cases, that same approach may prove to be excessive, or not effective enough.

Does your agency calibrate its salt spreaders at the beginning of the season and after major hydraulic repairs? Calibration is a critical factor in salt application. Without calibration, it is virtually impossible for a plow truck operator to accurately judge the rate at which its salt is being applied; therefore, it is important for both ground speed based control systems and manual systems to be calibrated. The Minnesota Department of Transportation published a general guide on spreader calibration, available via: **http://www.mnltap.umn.edu/topics/snow/documents/calibrationguide.pdf**. Calibration procedures may also be obtained from the manufacturer of the truck's control system.

Once an agency's spreaders are calibrated, the agency can then effectively develop and implement an application rate table. Application rate tables tell supervisors and operators the rate at which salt should be applied, based on the pavement temperature and the type/amount of precipitation. Due to the fact each agency works under different conditions, there is no universal application rate table. The length of routes and level of service expectations of the public can vary from agency to agency. If your agency does not have an application rate table, it would be a good idea to start with an application table from an agency with similar characteristics to your own.

Here are some other questions to consider in continuing your agency's improvement:

How does your agency decide when to begin applying chemicals and plowing? What forecast applications does your agency use? Does your agency use weather data from MADIS https://madis-data.ncep.noaa.gov/MadisSurface/? Does your agency use custom transportation forecasts based on pavement temperature? Does your agency take advantage of camera images available on the Internet to help understand the weather and its impact on your roads?

Is your agency's equipment well maintained? Is communication between drivers and mechanics effective? Are problems being dealt with in advance of storms? Is the equipment being cleaned and prepared for the next event?

Does your agency have adequate supplies on hand? Is the salt covered and stored in a manner that protects it, minimizing the potential for moisture to get in? Does your agency have an adequate supply of, or source for, plow blades and other critical parts?

Is your agency's training program effective? Do your operators and supervisors understand the plan for each storm as well as seasonal plans?

Is your level of service acceptable? What resources, technologies, or techniques does your agency maybe need to add or change in order to potentially provide a higher level of service?

Does your agency look at both the results it achieves during an individual storm as well as after each season to determine what adjustments may need to be made to the original plan?

How well is communication working, both internally and externally? Are you able to reach your employees for call-ins? Are you getting the information you need from them during their shifts?

What techniques is your agency using to minimize the environmental impacts and costs of its winter operations?

Each agency is expected to have different answers to each of these questions. Some agencies may have quite effective snow and ice operations, but most agencies probably could stand to improve in at least one area.

There may be small adjustments your agency could make to be more effective and efficient in regard to a particular type of storm in your snow

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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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Visit our website at
www.idot.illinois.gov/transportation-system/local-transportation-partners/county-engineers-and-local-public-agencies/technology-transfer-center/index

and ice program. These small adjustments have the potential to improve performances and/or decrease costs for your agency. New products and services are constantly coming into the market. No agency has the time or money to try everything – this is where being involved with associations and other agencies could pay big dividends. You could speak with other agencies to learn what has worked for them. Additionally, the Clear Roads pooled fund study would also be a great source of information. The Clear Roads pooled fund study is a group of 34 states who pool their research money together to conduct testing and research related to winter maintenance. Your agency could join the Clear Roads initiative and have access to the findings of the studies at **www.clearroads.org**. Even speaking with neighboring agencies can be beneficial. Neighboring agencies often deal with same suppliers and service providers as each other and also face similar weather conditions.

You may find a neighboring agency that has encountered and solved a problem facing your agency. Every storm is different and not every tool or technique will fit every situation. Making small, incremental changes and seeing what improvements your agency can make in various aspects of your snow and ice operations can significantly help your agency reduce costs and improve its level of service. These small changes, focusing on continuous improvement, can ultimately help your agency provide the best possible service to its stakeholders.

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