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IOWA STATE UNIVERSITY
Institute for Transportation

Sky's the limit with drone technology

It's said a picture is worth a thousand words. But the Institute for Transportation's Halil Ceylan says a picture could be worth a million bucks thanks to the possibilities created by utilizing drone technologies.

Ceylan, a professor at Iowa State University, could spend hours listing off those possibilities in just about every industry or profession, but he's spent the past three years identifying how drones can be used in infrastructure health monitoring and management using drones, or unmanned aerial systems (UAS).

“This is such a big business,” Ceylan said. “The sky is the limit. Without any exaggeration.”

He's not alone in that assessment. One estimate from the Association for Unmanned Vehicle Systems International nonprofit suggests the industry will create 100,000 jobs and have an economic impact of \$82 billion by 2025.

Ceylan believes that's a conservative estimate based on his research.

Ceylan, who is also the Iowa State University site director for the Partnership to Enhance General Aviation Safety, Accessibility and Sustainability (PEGASAS), has given talks to county engineers and Iowa Department of

Transportation staff, and gave a presentation at January's Transportation Research Board annual meeting about drone potential uses.

Though traditional pictures can give engineers some details, Ceylan sees thermal imaging cameras and lidar data collection as better options for getting better insights into infrastructure.

Ceylan said the technology already exists to do many infrastructure monitoring tasks, whether it's identifying rutting or potholes in county roads or inspecting bridges for bats or soundness or capturing images throughout construction. He also wants to better utilize robotic arms for non-destructive testing.

“Most of the time, the real work starts after you collect the images and video,” Ceylan said.

He said the main challenges in utilizing the technology is having the equipment to process the data the drones can capture—for instance, he said lidar can collect 300,000 data points per second—and abiding by the Federal Aviation Administration (FAA) regulations.

While the cost can seem prohibitive, Ceylan estimates a cost of \$0.74 per mile because each mile of measured road represents

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Drone technology has many potential uses for transportation engineers

Acronyms and Abbreviations in *Technology News*

AASHTO	American Association of State Highway and Transportation Officials
APWA	American Public Works Association
FHWA	Federal Highway Administration
IHRB	Iowa Highway Research Board
InTrans	Institute for Transportation (at ISU)
Iowa DOT	Iowa Department of Transportation
ISU	Iowa State University
LTAP	Local Technical Assistance Program
MUTCD	Manual on Uniform Traffic Control Devices
NACE	National Association of County Engineers
TRB	Transportation Research Board



U.S. Department of Transportation
Federal Highway Administration



About LTAP

LTAP is a national program of the FHWA. Iowa LTAP, which produces *Technology News*, is financed by the FHWA and the Iowa DOT and administered by the Institute for Transportation at Iowa State University:

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From the director: Mentors: Them, Us, All

During the last quarter, two people that I considered my mentors and friends, and were highly influential to my life and career, passed away (or, as I like to think of it, moved to another stage of being). This circumstance, of course, makes me contemplate the impermanence of all things. An acceptance of this reality about the next stage of life, when it is those you care about, is one of the most difficult experiences we humans face with regard to embracing impermanence. These two people taught me many things about myself, including how to be a better person and a better professional.

I met Dr. Raymond Krammes when I became his student at Texas A&M University. After working for some time, I had decided to go back to graduate school, and Ray was always there to help me along in so many ways. Ray moved to the FHWA in Washington, DC near the end of my graduate program, but we stayed in touch for a number of years after that occurred. What he instilled in me, though, has stayed with me.

Upon arriving at Iowa State University in the late 1990s (my first round working here), I met Dr. Jim Cable. Everyone reading this column here in Iowa, knows of or knew Jim. Both his smile and, again, his willingness to help. What you may not know is that when I first arrived back then, Jim was assigned as my mentor. I was a new, not young, assistant professor. We talked when needed, but mostly, for me, Jim led by example. What I saw was a no-nonsense kind of guy that had a passion for his application-oriented research and for educating his students.

Both of these men had similar characteristics and positively influenced my life. But, I doubt they ever knew or would have been all that comfortable with me telling them. They both had a natural approach to helping people that was neither forced nor contrived.

They were just always there to help, lend a hand, and assist in some manner. They could have followed another path, but in my opinion, chose the one less traveled. I encourage everyone to think of those that have positively impacted your life. Reach out to them and let them know in some manner. Impermanence or change is constant.

Remember also that mentors can be anyone. Mentors are “them” for many years in our life. But, somewhere along the way, mentors have to become “us.” In reality, I think, mentoring is really any and “all” of us just looking out for each other and lending that hand. It’s listening, conversation, and actions that are all about being there for someone else. Doing this isn’t easy, nobody is perfect (however that might be defined), but we all do what we can at the time.

Be sure to check out some of the professional development events that will be occurring in the next quarter. These include the Innovations in Transportation Conference (free registrations for local agencies are available for this, just contact me) and the Pavement Preservation Tools Workshop that follows. The Local Road Safety series is also happening in October, and we have a National Highway Institute (NHI) Fracture Critical Inspection Techniques for Steel Bridges course in the same month. Also, by the time this newsletter is released, registration for the Iowa County Engineers Association (ICEA) Annual Conference in Des Moines this December will be out. Lots of exciting new changes occurring.

Have a safe fall. ■

Keith

Drone technology continued from page 1

a network 26 times larger. He also notes different drones have different applications, so buyers should know their intended uses to make the best decision for their needs.

Beyond that, though, Ceylan also believes the UAS is faster, more efficient, and most importantly, safer.

He said bridges, for example, can be inspected without anyone having to face heights or bodies of water. He also said power lines and wind turbines can be

inspected from safety, and drones could be used to safely find open routes during floods, as additional safety examples.

“You can do all kinds of things with drones. We’re just scratching the surface,” Ceylan said.

Understanding FAA’s small UAS rules

- Remote pilot certificate required
- UAS, with equipment, can’t weigh more than 55 pounds

- Can’t fly over people
- Fly at 400 feet or below
- Top speed can’t exceed 100 miles per hour
- Must maintain line of sight on UAS
- Operate during daylight or twilight
- UAS must be registered with FAA

For more information about FAA rules, see https://www.faa.gov/uas/getting_started/part_107/ ■

One estimate from the Association for Unmanned Vehicle Systems International nonprofit suggests the industry will create 100,000 jobs and have an economic impact of \$82 billion by 2025.

AASHTO TC3 library opens to practitioners

A new partnership between the FHWA and AASHTO will allow local and tribal transportation professionals to access AASHTO’s Transportation Curriculum Coordination Council (TC3) library.

The goal of TC3 is to create and maintain a curriculum to respond to the changing needs of transportation technical workers. The courses are developed by subject matter experts and include national best practices. The catalogue offers over 190 training modules, all of which are available at the TC3 website and also on the TC3 mobile application available for both iOS and Android systems.

The courses are developed using a model that focuses on the technical categories of construction, employment development, maintenance, materials, pavement preservation, and traffic and safety. They are further divided into four skill levels, from entry level to management. Transportation professionals can build their own library of the available courses, and start and stop the courses based on their schedules. More

than 90 percent of the courses qualify for professional development hours.

FHWA funding for the access will help it advance the mission of its Center for Local Aid Support (CLAS), which is to provide training and technical assistance to transportation practitioners across the US through technical assistance programs like Iowa LTAP.

Browse and access TC3 course offerings at <https://tc3.transportation.org/>, and learn more about CLAS at https://www.fhwa.dot.gov/innovativeprograms/centers/local_aid/. An AASHTO account is required to access the FHWA sponsored online training courses. To get an account, visit <https://register.transportation.org>, select “Register,” and then enter your agency email to create an account.

To access available training courses, follow the steps below:

1. Go to <https://training.transportation.org> and log in by entering your email address and password on the left menu.

2. Search through the available training courses to select the course(s) that you would like to access and add them to the shopping cart.
3. When you are ready to checkout, click “Shopping Cart” on the top menu and enter the promotion code “D5X3-B3D9-52CB-4XCX” and select “Apply.”
4. Click “Checkout” to proceed with placing the order.

To launch purchased training courses, select “My Training” from the menu at the top of the page, which will display a list of purchased courses. Watch the instructional YouTube video at <https://youtu.be/NcFONY2R78s>, or use the “Contact Us” form at <https://training.transportation.org/> for any additional questions or information. ■

Iowa LTAP Mission

To foster a safe, efficient, and environmentally sound transportation system by improving skills and knowledge of local transportation providers through training, technical assistance, and technology transfer, thus improving the quality of life for Iowans.

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Winner named in 2018 “Build a Better Mousetrap” competition

The Webster County Secondary Roads Department had a problem moving trailers in and out of the shop. Its staff came up with a simple but smart solution that cost little more than \$600. That ingenuity earned them the top prize in the Iowa “Build a Better Mousetrap” competition.

The top three entries will get recognition plaques and between one and three free registrations to LTAP’s many training courses. The winner also gets on-site recognition with the county or city staff and a pizza lunch.

The secondary roads departments of Washington and Appanoose counties earned second and third place, respectively.

Each of the three top entries found a way to improve upon maintenance tools or methods that helped them to become more efficient, safer, or both. All three also built a relatively basic accessory to enhance their current equipment.

Here’s a summary of the top three entries’ contraptions:

- **Webster County** needed a way to move trailers with air brakes, which immobilize the trailer wheels if it is not attached to a truck, when a truck wasn’t on hand. So, they built a frame that attaches to a forklift that pressurizes

the air brakes so the trailers can be moved when a truck is not available. The invention has allowed the shop to operate more efficiently and has made it easier to maneuver the trailers.

- **Washington County** needed a quicker and cheaper way to treat intersections on U.S. 218 during snow and ice events. The traveling public doesn’t always move into the passing lane to allow tandem trucks to safely treat the intersections, and the drivers of these trucks have less visibility than a driver of a pick-up plow truck. So, the secondary roads department built a brine sprayer, using a used 70-gallon tank and some tubing, and attached it to a smaller flat-bed truck.
- **Appanoose County** needed a way to more efficiently use existing equipment to place Type III barricades on roads that need to be closed due to flooding or tornado damage. Their short-bed trucks could not be used easily to transport the barricades. So, they built a barricade holder that fit in the receiver hitch of their existing trucks; the addition allows workers to transport four barricades at a time and remove them safely with one individual. ■



Webster County’s forklift attachment earned it top prize in the “Build a Better Mousetrap” competition

From the Safety Desk: Creating a safe driving program for workers

Knowing these associated costs enables management to develop a business case that supports an investment in fleet safety and justification to invest in employee-wide safe driving programs.

According to joint research conducted by the Occupational Safety and Health Administration, the National Highway Traffic Safety Administration, and the Network of Employers for Traffic Safety (NETS), motor vehicle crashes cost employers \$60 billion in medical care, legal expenses, property damage and lost productivity annually. To assist employers in better understanding these costs, NETS has developed a Cost of Crashes Calculator that can be used by employers who want to understand the cost of crashes incurred by their occupational fleets.

The application includes three different components including an On-the-Job Crash Costs, an Off-the-Job Crash Costs, and a Return on Investment (ROI) Guidance Calculator. Knowing these associated costs enables management to develop a business case that supports an investment in fleet safety and justification to invest in employee-wide safe driving programs. To access the Cost of Crashes Calculator visit <http://crashcost.trafficsafety.org/#/home>.

NETS lists the following steps employers can take to build a safe driving program for the workplace:

- Request involvement from both management and employees. Senior management involvement is essential for setting policies and allocating resources for a safe driving program. To help the effort succeed, encourage employee participation at all levels.
- Have written policies. Create clear, understandable and enforceable driving safety policies and communicate them to all employees. Post them throughout the workplace, distribute copies regularly and discuss the policies at meetings. Topics to consider addressing include a ban on cell phone use while driving, zero-tolerance for alcohol or drug consumption during company hours, and mandatory use of safety belts.
- Create driver-agreement contracts. Establish a contract with all employees who drive for work purposes – whether they drive company-owned vehicles or their own vehicles – acknowledging awareness and understanding of safety policies, procedures and expectations for driver performance.
- Perform driving record checks. Check the driving records of all employees who drive for work purposes. Clearly define the number of violations an employee can have, if any, before losing the privilege of driving for work.
- Report crashes. All motor vehicle crashes – regardless of severity – should be reported to the employee’s supervisor as soon as possible. They also should be reviewed to determine their cause and whether or not the crashes were preventable.
- Implement a disciplinary system. Develop a system for progressive discipline if a driver develops a pattern of traffic violations or preventable incidents. The system should describe what specific actions will be taken if a driver accumulates a certain number of violations.
- Conduct driver training. Provide driver safety training, as even experienced drivers benefit from periodic training and reminders of safe driving practices and skills.
- Keep company vehicles in working order. A mechanic should perform a thorough inspection of company vehicles at least once a year, and results should be kept on file.

Visit the TxLTAP Library at <http://www.txltap.org/library.cfm> for a copy of the “NETS’ Recommended Road Safety Practices Guide” and the “NETS’ Comprehensive Guide to Road Safety”.

Reprinted with permission from the Texas LTAP. Originally appeared in the Winter 2018 edition of *Better Roads Safer Roads* as “Creating a Safe Driving Program for Workers.” Read the original and more here: <http://www.txltap.org/media/news/TxLTAP%20Better%20Roads%20Safer%20Roads%20Winter%202018.pdf>. ■

Reminder

Please complete the Iowa LTAP 2018 Training Needs and Innovation Interest Assessment at www.surveymonkey.com/r/traininginnovation. ■

Federal-aid funding swap

The Iowa DOT and cities and counties in Iowa, which are referred to as local public agencies (LPAs), have been talking about a Federal-aid Funding Exchange (Swap) for a number of years. In 2017, legislation was passed to allow this to happen. The legislation allows Primary Road Funds to be spent off the Primary Road System, in place of the federal aid the LPAs would normally receive.

Each year, the regulations governing federal aid and the requirements for its use have continued to increase, resulting in additional burdens to LPAs in the delivery of projects. These requirements also lead to increased project costs associated with the administration and development of projects both at the local government level and the Iowa DOT. Both the state and its local partners have identified the Federal-aid Funding Swap as a way to remove some of the barriers that LPAs encounter while navigating the federal-aid process and also realizing individual project cost savings.

A few key points about the Swap:

- Swap funds can be used only for road and bridge construction, reconstruction, and improvements.
- Projects funded with Swap funds will continue to be let through the Iowa DOT, which does not expand the number or type of projects let through the Iowa DOT.

- Another point that the DOT and LPAs all agreed upon was that the funds should be swapped at a \$1 for \$1 ratio.

Benefits to the LPAs include overall reduced construction costs and project development time, through streamlining the project development process and eliminating some federal requirements. The Concept Statement no longer is required. This step was required to be done at least a year in advance of letting the project for construction and was what generated the National Environmental Policy Act (NEPA) process to begin. NEPA is also no longer required for Swap projects. Preliminary Plans were due six months before the letting, and that has also been eliminated. Design Exceptions no longer require approval from the DOT, and most Public Interest Finding requirements have been reduced.

Each step required by the LPA in the project development process takes time to prepare and submit, and then also takes time on the part of the Iowa DOT to review. Additionally, in some cases, it takes time for the FHWA to review or process as well. For instance, in the case of the federal consultant selection process, the LPA had to go through many steps; then, it was reviewed by the Iowa DOT; and after that review was complete, FHWA had to authorize federal aid to be spent. The federal

consultant selection process is no longer required with the Swap projects.

The construction process saves some time and money as well. The Swap eliminates Davis-Bacon Wage Rate requirements. It also eliminates Buy America requirements for steel on construction projects, as well as eliminates requirements for utilities and railroads to purchase American steel, thus, reducing cost and extensive paperwork/certification requirements. The Swap significantly reduces construction paperwork, contract administration audits, and materials audits.

There are numerous benefits to the Iowa DOT as well. The Iowa DOT is the steward of all federal aid, and charged with ensuring that local jurisdictions are meeting all federal requirements. This can be burdensome and require a lot of staff time in the field and central office. By swapping the federal aid with the state's Primary Road Funds, the same amount of federal aid is still programmed on projects every year; however, those funds will be targeted on larger Iowa DOT projects, resulting in a lot fewer federal-aid projects. This significantly reduces oversight requirements for not only Iowa DOT but also the FHWA.

Article written and provided by Nicole Fox, Iowa DOT, Office of Local Systems. ■

Both the state and its local partners have identified the Federal-aid Funding Swap as a way to remove some of the barriers that LPAs encounter while navigating the federal-aid process and also realizing individual project cost savings.

Workshop and conference calendar

Date	Event Name	Location	Contact
October 2018			
2–4	2018 APWA Operator Training and Roadeo	Des Moines	Matt Dolan
3	Local Road Safety Workshops	Cedar Rapids	David Veneziano
4	Local Road Safety Workshops	Fairfield	David Veneziano
9–10	Innovations in Transportation Conference	Ames	Judy Thomas
10	Pavement Preservation Tools Workshop	Ames	Keith Knapp
11–12	2018 APWA Iowa Fall Conference	Iowa City	Jason Havel
17	Local Road Safety Workshops	Calmar	David Veneziano
18	Local Road Safety Workshops	Spencer	David Veneziano
23–26	NHI – Fracture Critical Inspection Techniques for Steel Bridges	Ames	Paul Albritton
24	Local Road Safety Workshops	Harlan	David Veneziano
25	Local Road Safety Workshops	Altoona	David Veneziano
November 2018			
6	APWA Winter Maintenance Training	Sioux City	Peggy Englehart
7	APWA Winter Maintenance Training	Fort Dodge	Peggy Englehart
8	APWA Winter Maintenance Training	Dubuque	Peggy Englehart
December 2018			
4–6	National Summit on Rural Road Safety	Savannah, GA	Keith Knapp
12–14	2018 Iowa County Engineers Conference	Des Moines	Keith Knapp

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Event details and online registration

Watch for details and online registration information, by specific dates and events, on the Iowa LTAP Workshops page, www.iowaltap.iastate.edu/workshops/ltap-workshops/. ■

Iowa LTAP Tech Corner—Roadside Safety Field Guide

What is it?

Many questions can arise as transportation agencies consider the installation of guardrail systems or other roadside safety hardware on their roadways. Recognizing the need to clearly spell out the requirements and considerations before proceeding with installation, Ohio LTAP developed the Roadside Safety Field Guide application to summarize the guidelines established in the AASHTO Roadside Design Guide.

How does it work?

The app aims to answer questions pertaining to optimal design, installation, and maintenance of guardrail systems by offering clear explanations of the necessary considerations and then laying out easy-to-follow instructions for moving forward with any roadside projects.

Users can select from 10 initial options to better understand the guidelines in the AASHTO Roadside Design Guide. The options range from the basics to specifics on barrier types to ongoing maintenance once a guardrail system is installed. Within those options are additional considerations.

For example, by clicking on the barrier type selection, users will get a brief explanation before selecting from rigid, semi-rigid, or flexible barriers to learn more about each option, including images and guideline schematics for design.

Where can I get it?

Available for free on iTunes or Google Play ■



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