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Technovations in Transportation

In this issue:

- Dr. Ahmed Abdel-Rahim Chosen to Lead NIATT
- U.S. Department of Transportation Secretary Anthony Foxx Visits UI
- Enhancing Safety with Simulation
- NIATT Students Recognized at 21st Annual Conference
- 54th Annual Idaho Asphalt Conference
- Faculty at a Glance
- Faculty Feature: Dr. Axel Krings
- Snapshot Day
- NIATT Student Brett Seely Wins Coral Sales Company Scholarship

Dr. Ahmed Abdel-Rahim Chosen to Lead UI's National Institute for Advanced Transportation Technology

by Rob Patton



University of Idaho College of Engineering announced today the selection of civil engineering professor Ahmed Abdel-Rahim as the permanent director of the National Institute for Advanced Transportation Technology (NIATT). Abdel-Rahim has been serving as interim director since the spring and has been an active NIATT researcher since 2000.

“Ahmed brings a rare combination of excellent research credentials and discerning leadership skills to the NIATT directorship,” said Jon Van Gerpen, associate dean for research

in the College of Engineering. “I have been impressed with his problem-solving skills and willingness to collaborate.”

Abdel-Rahim's research focuses on traffic operation and controls, transportation systems, modeling, highway design and traffic safety, and, most recently, security and survivability of transportation infrastructure.

Since 2009, Abdel-Rahim has been a part of 25 externally funded research projects totaling over \$2 million in awards, 18 of which he has led as principle investigator. Abdel-Rahim's research has been funded by a wide range of organizations including the National Cooperative Highway Research Program, Federal Highway Administration, Idaho Transportation Department and the U.S. Department of Transportation.

In addition to his role as NIATT director, Abdel-Rahim also serves as the director for the U.S. Department of Transportation's Transportation for Livability by Integrating Vehicles and the Environment, or TranLIVE, a \$6.8-million university research consortium led by the University of Idaho which includes partners such as Old Dominion University, Syracuse University, Texas

Southern University and Virginia Tech University.

Abdel-Rahim is also the recipient of the College of Engineering's outstanding faculty award in 2010 and the University of Idaho's midcareer award in 2012.

Abdel-Rahim also coordinated a recent visit to UI by U.S. Secretary of Transportation Anthony Foxx, underscoring that NIATT has made the campus a focal point for developing, implementing and deploying 21st-century transportation solutions not only for the state and region, but for the nation.

"Ahmed is a proven leader and mentor," said College of Engineering Dean Larry Stauffer. "As interim director he has provided terrific leadership, and I expect this to continue now that he is the permanent director, continuing to develop the college's reputation for excellence in transportation research and education."

U.S. Transportation Secretary Anthony Foxx Visits University of Idaho

The U.S. Department of Transportation Secretary, Anthony Foxx, visited the University of Idaho in early October to meet with NIATT students and even tried out the Vandal Formula Hybrid Race Car which won the 2014 National Formula Hybrid Competition. The car was sponsored in part by USDOT University of Transportation Centers (UTC) Tier 1 grant (DTRT12-G-UTC17) awarded to the TranLIVE consortium led by NIATT.



Foxx said he was here to have a discussion with the future of transportation and that is what he did. NIATT students took turns asking him questions in a roundtable style forum. Questions included vision for transportation over the next 30 years with safety, alternative fuels, careers, and more.



NIATT was a recipient of the USDOT's UTC Tier 1 program from 1998 through 2012.

Enhancing Safety with Simulation: Human Factors Researchers Study Transportation, Control Systems with High-Tech Scenarios

by Tara Roberts

A rural railroad crossing at night, an airplane landing in rough conditions, and a bank of nuclear reactor controls all fit into one lab at the University of Idaho.

The Human-in-the-Loop Simulation Laboratory features multiple simulators and analysis tools for understanding how human behaviors affect safety outcomes, and how those behaviors can be influenced. The lab is operated by Brian Dyre and Steffen Werner, faculty in the UI College of Letters, Arts and Social Science's Department of Psychology and Communication Studies' graduate program in human factors.

Inside the lab, banks of enormous liquid-crystal displays become an immersive environment for test subjects. Instruments measure their reactions to simulated situations down to the level of eye-movement and breathing rate.

The lab features a small aviation simulator and a process-control simulator designed in partnership with Idaho National Laboratory. But the focal point is the driving simulator built from a Chevy S10 pickup cab complete with simulated side-mirror images, a dashboard display, and the sounds of a rumbling engine and squealing brakes.



The simulators are the work of psychology professors Dyre and Werner, who use the lab to train their graduate students and serve external customers with top-of-the-line research.

Such work is vital to helping students understand how the psychological and statistical techniques they learn in class translate to the real world, Dyre says.

“It makes the knowledge real,” says graduate student Zach Spielman, who works with the flight simulator to study how new formats for airplane instrument systems affect how accurately pilots can land in bad weather.

Dyre, Associate Civil Engineering Professor Mike Dixon (1970-2014), and UI's Social Science Research Unit recently partnered on a project for the Idaho Transportation Department to study the effectiveness of a reflective warning sign used at rural railroad crossings, known as Idashield, which is up for a redesign. Dyre used the driving simulator to study how real drivers on realistic, simulated roads responded to the signs. Preliminary results show the signs are helping prevent accidents.

“It seems to be having a positive impact in keeping people, especially at night, from crossing in front of trains,” Dyre says.

Two other projects utilize the driving simulator to find ways to improve passing behavior on rural highways.

The first—in partnership with UI's National Institute for Advanced Transportation Technology,

University of Alaska, the Alaska Department of Transportation—studies ways to encourage people to drive slower in the right-hand land of passing zones.

“They were having very, very severe, often fatal, accidents occur in these brand new passing zones they put in,” Dyre says.

The team discovered the best tactic was introducing different speed limits for different lanes, and Alaska is planning to request permission from the Federal Highway Administration to test the split speed limit in the field.

Building on the Alaska project, Dyre is working with UI civil engineers to look at passing behavior on two-lane rural highways in general. His research team will use the driving simulator to understand how sight distance, road geometry, traffic, vehicle size and other factors contribute to drivers’ speed and safety.

“What factors do people take into account when they’re deciding whether to pull out into that oncoming lane to pass?” This and other projects are part of Dyre’s recent focus on issues related to rural roads.

“It makes sense to be doing this type of research that applies to Idaho and the Northwest, but it’s not getting a lot of attention anywhere else,” he says.

For more information on the IdaShield project and the final report see http://www.webpages.uidaho.edu/niatt/research/Project_Descriptions/KLK567.htm

NIATT Students Recognized at 21st Annual Conference on Rural Public and Intercity Bus Transportation

by Heloise Abtahi



Civil Engineering students Christopher Bacon, Riannon Heighes, and Brett Seely (pictured with Dr. Kevin Chang, UI CE Assistant Professor on right) have won paper competitions administered by the National Conference on Rural Public and Intercity Bus Transportation. Each student received a cash prize and travel funds to attend the

conference October 26-29, 2014 in Monterey, California. This year’s conference theme was “Setting Our Course for the Future.” Students were asked to envision four alternative perspectives for our transportation future: a vision of continued growth, one of disciplined or constrained growth, a future of decline and collapse, or one of transformation. Understanding these four alternative perspectives is important as many believe that the way we envision our future actually shapes the future.

Christopher participated in the graduate student research paper competition. His paper, entitled “Real-Time Information Projecting Towards the Future,” received second place honors and focused

his research on how GPS-tracking on city busses could make a positive impact in the future. Outside of his presentation, which went very well and even netted a request from one audience member to share his research sources so that it might be used on another project to implement a GPS tracking system in another city, the conference was a great opportunity to network and learn a great deal about a staggering variety of topics. “By sitting in on a variety of topics, something that would be hard to do outside of a national conference like this one, it really opened my eyes to see what is going on in that sphere of transportation engineering.”

Riannon and Brett competed in the undergraduate student essay competition, finishing in first place and second place, respectively. Riannon’s paper, titled, “A Future of Transformation for Public Transit in Rural Communities,” discussed “several significant transformations that must occur in order to ensure the survival of public transportation in rural communities.” Riannon (as well as Christopher and Brett) had never been to the conference before, but said that it was “a really cool experience,” and was able to learn more about a variety of projects that appealed to her interests, including a planned partnership between federal lands/parks and public transit agencies.

Brett, too, enjoyed the conference a great deal, saying “the location, events and diversity of participants really kept me enthused and interested.” His paper was actually quite unique in that it was not set up in a more traditional research format. Instead, Brett chose to “draft [his] 2030 vision of rural and intercity bus transportation into a hypothetical city council planning meeting set in the future.” This distinctive approach, he says, was intended to “emphasize how innovation needs public involvement and support to come to fruition.”

Congratulations Christopher, Riannon, and Brett!

54th Annual Idaho Asphalt Conference

by Heloise Abtahi

From October 22-23, Moscow and University of Idaho played host to attendees and presenters at the 54th Annual Idaho Asphalt Conference. The conference took place at the Best Western University Inn and was well-attended not only by many industry professionals and contractors but by students and faculty from the University of Idaho and Washington State University. Presentations took place throughout the day on a wide variety of topics, ranging from asphalt compaction practices to recycling. The conference also included an Exhibition Hall with displays from private companies like Caterpillar, Inc. and Maxam, Inc. that remained open throughout the day.



Conference Organizers and Presenters: Dr. Fouad Bayomy (UI), Bob Horan (Asphalt Institute), Larry James (Instrrotek), Mike Santi (ITD), Thomas Van (FHWA), Mike Anderson (Asphalt Institute), Kamil Kaloush (Arizona State University), Tim Murphy (Murphy Pavement Technology), Steve Ryan (Caterpillar, Inc.), and Steve Cross (Oklahoma State University). Not pictured: John Duval

(Pavement Services Inc.), Jon van Gerpen (UI), Brandon Reall (Tensar).

Presentations (presenters pictured above) continued on the 23rd following an icebreaker the night before. The day of presentations began with opening comments from Dr. Fouad Bayomy, who has chaired the conference since 1991. Dr. Bayomy not only organizes the conference, he also uses the opportunity to get students, both undergraduate and graduate, involved. For his undergraduate Construction Materials course—which is offered during the fall when the conference is taking place—students are required to attend at least part of the conference and write a short paper on a topic that they've attended a presentation on during the day. For Dr. Bayomy's graduate students, conference attendance is also compulsory, and a paper on one of the day's topics will also be required (though in this case students will be required to write a more involved term paper).

The conference however, still maintains a balance between academic work and the professional world. John Duval, conference organizer and president of Pavement Services, Inc. in Portland, Oregon, noted the presence of private company managers, engineers, and even equipment operators at the conference. "This cross-section... it works its way into the program. What you'll notice is that...there's information you can put into practice next week, and there's also information you can put into practice maybe five years later."

Indeed, the conference has witnessed the development of ideas from brand new to theoretical technologies being implemented in the field. Dr. Bayomy noted the particular case of Intelligent Compaction technology, which dominated the last round of panels at the conference. The idea, says Dr. Bayomy, was presented at the conference about 10 years ago by a professor from Texas A&M. Years later, the technology is being field-tested and developed by private companies, and the findings are being presented at the same conference they were introduced at, a transition which Duval says the conference plays a role in.

Conference attendees had a great deal to say about the utility and worth of the conference. Clint, a University of Idaho student now in his first year of graduate school, says he attended the conference a couple of years ago as part of Dr. Bayomy's undergraduate course. He returned, he says, to hear about new technologies and stay up-to-date, as well as to maintain and make some new professional and academic contacts. Another conference attendee, an industry professional who has attended the conference on and off for the last 13 years, said he was very pleased with a lot of the days' presentations, citing Tim Murphy's "Compaction Best Practices" presentation and Brandon Reall's "Geogrids-Proper use in Pavement Structures." He also noted the number of students in attendance, saying it was "great they came" because "it's a great opportunity to gain some practical knowledge."

For more information on the conference see <http://www.uidaho.edu/idahoasphalt/>.

Faculty at a Glance

by Heloise Abtahi



Denise Bauer, Research Faculty, Department of Mechanical Engineering

Dr. Denise Bauer has been with UI since 2010. Her expertise is in human factors engineering, a knowledge of which she has brought to working on NIATT's Smart Signals project with Drs. Richard Wall and Brian Johnson. The project focuses on building new technologies for crosswalk signals, and therefore has a definite need for a team member considering the human

element of the developing technology, especially in it's new stage: investigating better ways to help the seeing impaired stay safe while crossing. Dr. Bauer has worked with the seeing impaired community to research better methods for signaling pedestrians while they're in the crosswalk so that they can know how far they've gone, how much time is left on the walk sign, and whether or not they're staying within the safe area of the crosswalk.

Students, Dr. Bauer says, are integral to the project she works on. The new ideas they bring, she says, bring a lot to the project. The NIATT students she works with get a lot of opportunities to gain practical experience, which Dr. Bauer notes is extremely valuable both to the project and the students.

However, Dr. Bauer's research into human factors does not stop there. She's also examining ways to increase the university's retention rate in engineering and education. She says this can not only lead to improve student's learning experience, but also increase student and faculty involvement in the university.

Faculty Feature: Dr. Axel Krings, Department of Computer Science



Researchers at the University of Idaho Computer Science Department, lead by Dr. Axel Krings, in collaboration with the National Institute of Advanced Transportation Technology (NIATT), have been involved in investigating the vulnerability of Intelligent Transportation Systems (ITS) to malicious attack for over 10 years now. It is all about how one can make sure that the ITS works safely. ITS safety is typically considered to be an engineering task. However, as much of the ITS is based on communications, either from vehicle to vehicle (V2V), vehicles to the infrastructure (V2I), or infrastructure to infrastructure (I2I), the ITS inherits the full spectrum of security threats. Therefore, the research focus has been on security, resilience, and survivability of ITS

subjected to pathological scenarios. Furthermore, it is assumed that sooner, or later, attacks will partially succeed, which lead to the adaptation of the principle of Design for Survivability, an approach where the mechanisms that provide resilience and survivability are designed into the systems, rather than in an add-on fashion.

Starting in 2015, all new vehicles are expected to include Dedicated Short Range Communications (DSRC) equipment, which operates in the 5.9 GHz band. These so-called On Board Units (OBU)



implement the V2V and V2I communications that is at the core of DSRC Safety Applications, such as Forward Collision Warning, that are projected to prevent up to 82% of all crashes in the United States involving unimpaired drivers.

So what would happen if an attacker would "pretend" that there is an accident, when in reality there is not; what if the communication were to be jammed in order to cause misinterpretation or confusion about events, such as hard braking, with the intend of causing drivers to react in a way that could cause a hazard? We can imagine many scenarios that could lead to disaster. Failure of DSRC Safety Applications could have catastrophic consequences and could undermine public trust and acceptance of the underlying technologies. The assumption is that

there are no assumptions about what causes the faults, and only the consequences, e.g., the fault modes they produce, are considered.

As the research has advanced, we are approaching real implementations and field tests of the concepts developed. With the help of funds from the Idaho Global Entrepreneurial Mission (IGEM), NIATT and in collaboration with ARADA Systems we have established a connected vehicle laboratory to bring the research to the next level. Currently students are developing the tools that allow communications corruption models involving OBUs, RSUs and Android-based user applications to be tested. Furthermore, we are investigating ways to bring the experiences to the classroom, with this semester's CS549 Fault-tolerant System's class in the "driver seat."



NIATT Projects Presented at "Snapshot Day"

by Heloise Abtahi

On Tuesday, October 14th, more than 120 students on over 30 capstone design teams shared the current status of their two-semester learning projects during "Snapshot Day." Snapshot Days take place throughout the year (this is the first of four that will take place throughout the next two semesters), allowing students and faculty alike to see the progression of students' projects throughout the year. The projects are interdisciplinary and originate from a number of UI departments, including Biological & Agricultural Engineering, Computer Science, Electrical & Computer Engineering, and Mechanical Engineering.



NIATT projects showed a strong presence during Snapshot Day with four projects presented: "Formula Hybrid Electrical Vehicle," "Efficient and Clean Turbo Two-Stroke," "Emissions Measurement System for UI Engine Lab," which is currently in its second semester, and "Lithium Polymer Battery Design."

Crystal Green and Dillon Savage (pictured above) are currently in the first semester of work on their project, "Efficient and Clean Turbo Two-Stroke." Both Green and Savage have worked with NIATT before as team members on the nationally recognized clean snowmobile team as well as undergraduate interns. Now participating in their first Snapshot Day, both are looking forward to checking in throughout the year and are excited to be working on a NIATT project, which they say are highly sought after. "[NIATT projects] are usually the cooler projects. They're usually harder, but they usually have a lot of... interest for involvement," says Savage. Savage and Green also noted that students working with NIATT (on teams as well as capstone projects) have had good luck with staying in their field. A good deal of engineers have gone to work for Polaris, says Savage. "In recent years we've had a lot more go that way, and I think they have been pleased... with the quality of the engineers they're getting from here, though the program... and the weight of our engineers over there are holding a lot more...push."

Some projects presented during Snapshot Day were already in their second semester and will be completed this fall, but projects still in their first semester will ultimately be a part of the 21st Design Expo May 1, 2015.

For more information on the Engineering Design Expo see <http://www.uidaho.edu/engr/expo>.

NIATT Student Brett Seely Wins Coral Sales Company/ Douglas P. Daniels Scholarship

by **Heloise Abtahi**



From left to right: Richard Nielsen (CE Chair), Michael Kyte (CE Professor), Michael Lowry (CE Assistant Professor), Diane Daniels Grant (President, Coral Sales Co.), Brett Seely (CE grad student & award recipient), Gabby Eddings (Brett's guest), Tom McFarlane (Regional Sales Manager, Coral Sales Co.), Ahmed Abdel-Rahim (NIATT Director)

On November 11th, 2014, Brett Seely was awarded the Coral Sales Company/Douglas P. Daniels Scholarship during a dinner at Sangria Grill in Moscow. Brett is currently pursuing his M.S. in Transportation Engineering and expects to graduate this spring. The scholarship, which was originally created in 1987, is intended for Transportation Engineering students at universities around the Pacific Northwest. Coral Sales Company, established in 1979, specializes in traffic products and highway safety. The company supplies material throughout the Pacific Northwest and calls for its Coral Sales Scholars to “excel in both leadership and interpersonal communications.”

This is Brett's first time receiving the scholarship, and he plans to use it to defray the cost of schooling as well as for potential travel expenses in the spring (when he has narrowed down his job hunt). “I am honored to have received this award and am happy to join the network of past recipients,” says Brett. During the award dinner, Brett, his guest Gabby Eddings, the President of Coral Sales Company Diane Daniels Grant, Regional Sales Manager Tom McFarlane, and four civil engineering professors from UI discussed current issues in the transportation industry, Brett's future plans, and Coral Sales Company's role in the market.

Congratulations, Brett!



Receiving the award: Brett Seely and presenting the award from Coral Sales Company: Diane Daniels Grant and Tom McFarlane

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