December 2013
tranliveutc.org

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University of Idaho

Old Dominion University

Syracuse University

Texas Southern University

TranLIVE NEXUS (Transportation for Livability by Integrating Vehicles and the Environment) is a quarterly newsletter produced in association with a university research collaboration focused on developing technologies to reduce the environmental impact of the transportation system.

DIRECTOR'S MESSAGE

Welcome to the first edition of the TranLIVE NEXUS, a quarterly newsletter produced in connection with the university research collaboration Transportation for Livability by Integrating Vehicles and the Environment (TranLIVE). This research consortium is led by the University of Idaho and includes Old Dominion, Syracuse, Texas Southern and Virginia Tech universities.

Why NEXUS? The simple definition of nexus is a series of connections linking two or more things and there is no better way to illustrate contemporary transportation challenges and research. Nexus also means group. TranLIVE is premised on the group effort between partner universities and the concept that the whole is greater than the sum of its parts. TranLIVE is focused on developing technologies to reduce the environmental impact of the transportation system and to accomplish this mission each university involved brings expertise to make the product(s) of our efforts that much better.

At TranLIVE we have leveraged our partners expertise in order to position us to best accomplish our mission and goals. At the University of Idaho we focus on clean fuels, vehicle engine design as well as traffic operations and controls. Texas Southern University specializes in vehicle emissions and testing. Old Dominion University researchers focus on sustainability, smart growth, intelligent transportation systems, and the environment. These are complemented by work at Virginia Tech University that focuses transportation system safety & driver behavior as well as data collection and visualization. Finally Syracuse University lends the last piece of the puzzle to develop decision support tools, and other information in a format policymakers and planners can use in decision making.

In the past two years we have deployed the above experience to pursue four goals:

Goal 1: Integrate real-time data systems and advanced transportation applications to better manage congestion while minimizing environmental impacts.

Goal 2: Develop modeling, simulation, and visualization tools that assess energy, environmental, and emission impacts of transportation systems to support transportation decision making at the local, regional, and national levels.

Goal 3: Increase the number of students in our research and education programs and use advanced curriculum design to enhance the transportation workforce.

Goal 4: Transfer the results of our research program to practicing professionals in forms that are usable to them to improve the quality and performance of our workforce.

We have made significant progress towards accomplishing these goals and our intent with the Nexus is to begin to communicate the progress we are making. We will use the Nexus to highlight research and results, our educational programs and participants, and to discuss our technology transfer successes. Please stay tuned for future communication from TranLIVE.

Sincerely,

Karen Den Braven, Director

Virginia Tech University

TranLIVE LEAD COLLABORATORS

The **University of Idaho** in Moscow, Idaho leads the TranLIVE Tier 1 University Transportation Center, which is funded by the Department of Transportation's (DOT) Research and Innovative Technology Administration (RITA). The University of Idaho has several research collaborators at U-Idaho and from four partner universities, **Old Dominion University**, **Syracuse University**, **Texas Southern University**, and **Virginia Polytechnic Institute and State University**.

Ahmed Abdel-Rahim
University of Idaho

Karen Den Braven
University of Idaho

Mecit Cetin
Old Dominion University

Asad Khattak
Old Dominion University
Affiliate at University of Tennessee

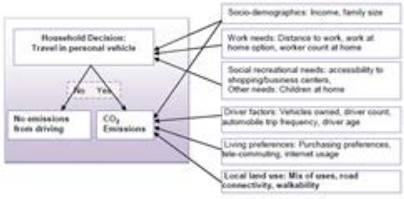
Ossama Salem
Syracuse University

Lei Yu
Texas Southern University

Hesham Rakha
Virginia Tech University

TranLIVE RESEARCH HIGHLIGHTS

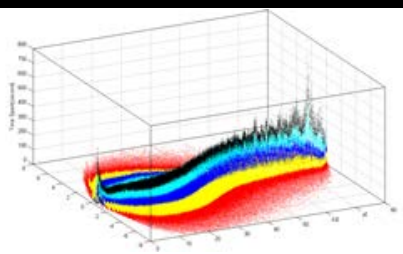
IS SMART GROWTH ASSOCIATED WITH REDUCTIONS IN CO_2 EMISSIONS?
Findings by Old Dominion Researchers to be Published in Transportation Research Record



Researchers from the Old Dominion University, civil and environmental engineering department Xin Wang, Asad Khattak, & Yichi Zhang have recently published TranLIVE work that examines the link between smart growth developed communities, an individual's choice to drive or not to drive each day, and the resulting CO_2 emissions produced. The study finds that CO_2 emissions are lower for households that reside in more mixed land use neighborhoods with denser roadway networks and better network connections in the neighborhood. The authors suggest that there is substantial opportunity to reduce CO2 emissions through the development of smart growth communities. --**MORE**

WHAT IS THE LEVEL OF VOLATILITY IN INSTANTANEOUS DRIVING DECISIONS?
Recent Presentation by Old Dominion Researchers at the University of Washington

Dr. Asad Khattak, recently presented TranLIVE work at the PacTrans Distinguished Lecture series at the University of Washington in Seattle. Dr. Khattak and Old Dominion University colleagues, Dr. Xin Wang, Jun Liu, Golnush Masghati-Amoli, and Sanghoon Son investigated volatility in driving decisions and its impact on fuel consumption, vehicle emissions, and safety issues. Dr. Khattak's work attempts to identify and measure driver volatility in order to determine the level of volatility associated with discrete

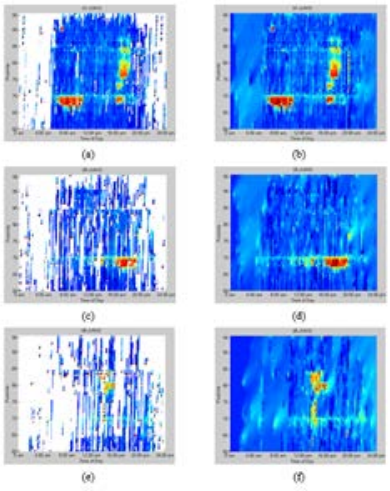


driving decisions. The authors make a significant contribution tho the literature with a quantifiable "volatility score" for each trip that will allow researchers to better understand typical driving practices in metropolitan areas. Further the Old Dominion team identifies correlates to volatile driving decisions. For example, individuals taking shorter trips, drivers of 2-seat sports cars and younger drivers all tend to have higher volatility scores.--**MORE**

TranLIVE FACULTY & STUDENT AWARDS

FACULTY AWARDS

TranLIVE researchers **Hesham Rakha** of Virginia Tech University and **Fengxiang Qiao** of Texas Southern University recently received best paper awards at the 2013 Intelligent Transportation Society (ITS) World Conference in Tokyo, Japan. The awarded papers are significant for two reasosns, one both authors are TranLIVE collaborators, and also because there were only two best paper awards given for U.S. work at ITS. The full papers are available below by clicking the "more" link.



Samples of Daily Temporal-spatial Traffic State Variation.

Dynamic Travel Time Prediction Using Pattern Recognition
Hao Chen, Hesham Rakha, and Catherine McGhee, Virginia Tech University

Travel-time information is an essential part of Advanced Traveler Information Systems (ATISs) and Advanced Traffic Management Systems (ATMSs). A key component of these systems is the prediction of travel times. From the perspective of travelers such information may assist in making better route choice and departure time decisions. For transportation agencies these data provide criteria with which to better manage and control traffic to reduce congestion. This study proposes a dynamic travel time prediction algorithm that matches current traffic patterns to historical data. Unlike previous approaches that use travel time as the control variable, the approach uses the temporal-spatial traffic state evolution to match traffic states and predict travel times. The approach first identifies candidate historical time intervals by matching real-time traffic state data against historical data for use in prediction purposes. Subsequently, the selected candidates are used to predict the temporal-spatial evolution of traffic. Lastly, dynamic travel times are constructed using the identified candidate historical data. The proposed algorithm is tested on a 37-mile freeway segment from Newport News to Virginia Beach along the I-64 and I-264 freeways using historical INRIX data. The prediction results indicate that the proposed method produces predictions that are more accurate than the state-of-the-art K-Nearest Neighbor methods reducing the prediction error by 15 percent to less than 3 minutes on a 50-minute trip. --**MORE**

Fengxiang Qiao (center) and members of the ITS Conference organizing body, Tokyo 2013.

A Short Range Vehicle to Infrastructure System at Work Zones and Intersections
Fengxiang Qiao, Jing Jia and Lei Yu, Texas Southern University

Traditional safety countermeasures at work zones include setting up special signs, installing barriers and a lower speed limit in work zones. For stop sign areas, usually our countermeasure is to remove all the obstructions. For signalized intersections, we usually improve the safety by setting up the signal lights in an optimized layout. However, many accidents still happen despite of these traditional methods. Radio Frequency Identification (RFID) can provide effective solutions to improve the operations in work zones, stop sign areas and signalized intersections. The purpose of this research is to identify how to improve the traffic safety and achieve better air quality in these areas by using RFID. With the implementation of such advanced warning system, it is envision that crash rates at woke zones and intersections will be greatly reduced and the surrounding environment will be improved. --**MORE**

STUDENT AWARDS

2013 TranLIVE STUDENT OF THE YEAR

William "Andy" Edwardes
TranLIVE Student of the Year

TranLIVE is happy to announce the selection of William “Andy” Edwardes of Virginia Tech as the 2013 TranLIVE Student-of-the-Year! Andy is working on two graduate degrees simultaneously, in transportation engineering and in operations research. Andy is also working with the Blacksburg, Virginia bus system (BT) to make it more fuel efficient through improved routing and scheduling, bus assignment and a real-time dispatch support system, and with the deployment of a microscopic fuel consumption model adapted for diesel buses. Among his many extra-curricular activities Andy serves as the Alumni Relations Officer for the Alliance of Transportation Engineering Students, an organization working promote the dissemination of knowledge and information related to transportation infrastructure and systems issues, problems and solutions to civil and environmental engineering students at Virginia Tech University.

Andy will receive the award at the Council of University Transportation Centers (CUTC) annual banquet in Washington D.C., Saturday, January 11, 2014.

2013-14 CORAL SALES/DOUGLAS P. DANIELS SCHOLARSHIP AWARD WINNERS

Two University of Idaho civil engineering students and TranLIVE interns, Mitch Skiles and Riannon Heighes were each awarded a $1,000 scholarship from the Coral Sales Company in recognition of their outstanding accomplishments and leadership in the field transportation engineering. Coral Sales supplies materials to the transportation industry throughout the Pacific Northwest.

Award Dinner left to right in the group: Kevin Chang (former winner & current UofI faculty member), Ahmed Abdel-Rahim, Mitch Skiles (award winner), Kristina Skiles, Mike Lowry, Mike Kyte, Ron Green (Coral Sales), Milo Zender, and Riannon Heighes (award winner).

UNDERGRADUATE RESEARCH

TranLIVE is supporting the following 2013-14 undergraduate senior capstone research project at the University of Idaho.

"Powder Train" Clean Snowmobile Drive Reconfiguration

From left: Zoltan Kiss and Josh Dalton, Aaron Peterson not pictured.

Members of the University of Idaho Clean Snowmobile Challenge team have come up with a creative solution to improve both drive train efficiency and fuel economy of their two-stroke snowmobile. The basic idea is to reconfigure the snowmobile drive. Josh Dalton, Zoltan Kiss, and Aaron Peterson believe they can design a rear drive system that will reduce the slop in the track as it contacts the ground and as a result improve fuel economy and overall efficiency of the snowmobile. The team has considered past designs that have attempted to address the problem without success and believe their design will succeed. So much so they are considering a patent. Funded by TranLIVE the team has developed their "Powder Train" design as a rear axle drive system that can be installed on a stock chassis without modification to the chassis. The team is in the process of machining their design prototype and hope to test it in the coming months. While the primary purpose of this rear drive system is to improve drive train efficiency and fuel economy the

team hopes their reconfiguration will also increase horsepower to the ground and improve handling.

TranLIVE INTERNSHIPS

UNIVERSITY OF IDAHO INTERNS

Riannon Heighes

Senior civil engineering major Riannon Heighes is planning to use her education and research experience to make an impact. This past summer as part of her TranLIVE internship Riannon worked with U-Idaho professor Ahmed Abdel-Rahim to gain first-hand experience with fuel emissions research. Riannon collected over 100 miles of emissions data for Dr. Abdel-Rahim using a 5 gas analyzer plugged into the tailpipe of her 1997 Lexus ES300. Riannon is also the project lead for U-Idaho Engineers Without Borders. As part of a five year commitment she is planning a trip to Chiwirapi, Bolivia this June to begin construction of a village water well. While there she and her team will conduct assessment for future irrigation projects. Riannon is one of two U-Idaho recipients of the 2013-14 Coral Sales Company/Douglas P. Daniels Scholarship award given to outstanding transportation engineering students throughout the Pacific Northwest.

Mitch Skiles

Senior civil engineering major Mitch Skiles also spent time as a TranLIVE intern, and he is the other U-Idaho 2013-14 Coral Sales Company/ Douglas P. Daniels Scholarship award winner. Mitch recently worked with U-Idaho civil engineering professor Michael Lowry to test and deploy an eco-routing mobile app in participant experiments. In essence the mobile app did two things: tracked participant movement over time, and identified the proximity of other blue tooth devices, logging any interactions with those devices and the participant over time and distance. Mitch employed computer programming experience to assist with app development and to create data visualizations. He also worked with Professor Lowry to find meaning in data collected for basic research purposes to be used in future experiments. Mitch says that the experience really helped him understand "what's useful and not useful" with data.

TEXAS SOUTHERN UNIVERSITY INTERNS

From left: Damon Hall, Deyanira Rangel, Minerva Carter (our project coordinator), Mark Etim, Emmanuel Ogbeh, and Kevin Rodriguez.

An enthusiastic group of Texas Southern University TranLIVE interns working with Dr. Fengxiang Qiao and his graduate researchers were split into two groups to conduct tests and collect data for vehicle emissions testing and traffic safety and control strategies research.

The first group of interns comprised of Kevin Rodriguez, Damon Hall and Deyanira Rangel. They were tasked with testing the working range of a passive radio-frequency identification (RFID) tag at stop sign intersections. The students set up several scenarios placing RFID tags on stop signs at different angles and heights to determine the optimal location for an on-board vehicle RFID reader.

The second group of civil engineering undergraduates made up of Emmanuel Ogbeh and Mark Etim worked with Dr. Qiao and his graduate students to collect data and calculate vehicle-specific power (VSP) to estimate truck emissions in and around the Port of Houston. Intern Emmanuel Ogbeh, commented that the favorite part of the internship was how it impacted him afterwards, "every time I drive my vehicle and I see a big truck I try to imagine how much emissions is being released in the environment and how I would like to come up with a plan to reduce the pollution being produced by the truck."

OLD DOMINION UNIVERSITY INTERNS

Shani Kent Hall

During her time as a TranLIVE intern, senior civil engineering major, Shani Kent Hall worked with Professors Mecit Cetin and Asad Kattack to produce an extensive literature review on academic emissions studies. She examined work to date on emissions interacted with several variables, specifically, land use, eco-driving, vehicle technology, and driving decisions, cycles and styles. Shani's work provided valuable

Kevin Warrick

Old Dominion University (ODU) senior civil engineering major and member of the Chi Epsilon national civil engineering honor society Kevin Warrick experienced first-hand multiple aspects of transportation research as a TranLIVE intern. In his own words Kevin says, "this internship inspired me to continue developing my engineering skills to help solve the future transportation concerns facing our local

background for TranLIVE collaborators work cited above on volatility in driving decisions and its impact on fuel consumption, vehicle emissions, and safety issues.

Shani is confident that her time as a TranLIVE intern "will help me in the future because, now, I know how to do a professional literature review and academic reports." Shani is also excited about future professional opportunities to work with eco-driving technology and making transportation more efficient.

communities, cities, and nation."

Kevin was tasked by professor Mecit Cetin to review and present an analysis of research conducted by TranLIVE collaborators led by Hesham Rakha at Virginia Tech. Kevin examined the Rakha team's Comprehensive Power-based Fuel Consumption Model (CPFCM). In his review Kevin gained a better understanding of vehicle emissions measurement and what solutions are being proposed for vehicle fuel efficiency.

2013 FUNDED PROJECTS

In 2013 TranLIVE has funded individual faculty projects focused on limiting vehicle emissions, traffic monitoring, and improving engine performance. Below is a selection of work supported by TranLIVE. Each entry is linked to a more detailed project description that includes intended project outcomes, impacts and benefits. For a complete list of funded projects see the **TranLIVE project database**.

- **A High-speed Trapezoid Image Sensor Design for Continuous Traffic Monitoring**
- **Daily Travel Feedback to Encourage Eco-Routing**
- **Developing Short Range Vehicle-to-Infrastructure Communication Systems**
- **Direct Drive AC Rim Motor for Responsive Energy Control of Alternative Electric Vehicle**
- **Eco-Driving Modeling Environment**
- **Upgrading Biomass Pyrolysis Bio-oil to Renewable Fuels**

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