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Technovations in Transportation

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2007-2008 Research Well Underway

Six research projects began at NIATT as students returned for the 2007-2008 academic year. The projects were selected following review by NIATT's Advisory Board members in the spring of 2007.

Funding decisions in the Center for Traffic Operations and Control were based on the following three strategies:

- Completing and deploying a data collection infrastructure, both the Moscow ITS data collection and a portable video data collection system (**KLK711**)
- Developing a better understanding of driver behavior at signalized intersections, supporting the FHWA NGSIM program (**KLK712**)
- Implementing a field trial of Smart Signals technology (**KLK710**)

All three directions are specifically aligned with NIATT goals/strategies as outlined in its revised Strategic Plan (approved by UTC in August 2007).

Projects in the Center for Clean Vehicle Technology are all based on prior successes and involve

- Advancing catalytic plasma torch technology through basic research, engine work and demonstration vehicle support (**KLK752**)
- Advancing state-of-the-art in recreational vehicle design, while increasing opportunities to engage undergraduate and graduate students in transportation problems (**KLK751**)
- Converting low-grade glycerol derived from biodiesel production to short chain primary alcohols and applying back to the production process (**KLK750**)

New Lab Encourages Critical Thinking

Construction of a state-of-the-art Idaho Engineering Analysis Works (IDEAWorks) laboratory in the Gauss-Johnson Engineering Building (KLK430) continued this fall. This premiere space provides the software and hardware to conduct mechanical design optimization in transportation research, to attract and train graduate students, and to build capacity for future proposals.

Education and Technology Transfer Activities Planned for 2008

- The 8th Traffic Signal Summer Workshop will take place in August 2008. The date will be announced later.
- A second **Smart Signals conference** is in planning for the spring of 2008. The workshop's goal is to guide the smart signals research by providing developers with an opportunity to interact with public users, manufacturers of traffic signal equipment, and the agencies responsible for installing and maintaining traffic signal systems.
- A project to improve the level of understanding of basic transportation concepts in the introductory undergraduate transportation engineering course will begin in the spring.

Special emphasis in the lab is devoted to applications in transmission design, structural design and intake/exhaust design. In IDEAWorks, mechanical engineering seniors, in teams along with faculty and and graduate students, use sophisticated software to reverse engineer projects, studying the subtle thinking of great engineers and designers.

Reverse engineering processes require students to use critical thinking skills to intuit designers' intentions. Working in teams leads to greater skills in communication and an understanding of responsibility and team citizenship, skills emphasized in the Idaho Engineering Works program.

The lab features a rapid prototyping machine that takes virtual designs produced by solid modeling software and creates a physical object in plastic from that design. It is a WYSIWYG process where the virtual model and the physical model correspond almost identically. The equipment was purchased with matching funds obtained by Dr. Eric Wolbrecht from an EPSCoR grant.

Data Provides Means of Monitoring Operations

Each week, at least one researcher and/or his or her student meet with NIATT staff to review the progress of current research. In October, Dr. Ahmed Abdel-Rahim, and graduate students Yongqing Guo and Cyril Ige, described their progress in logging data in real-time, directly from a traffic controller (**KLK134**). Their device is able to capture input/output data through the 234 pins that send and receive data via traffic controllers.

Students spent a day at Northwest Signal Supply, Inc. in Lake Oswego, Oregon, in the spring of 2007 learning about the different types of controllers and cabinets, including the most sophisticated traffic controller/cabinet, the TS2-2, which uses both analog and digital communication.

TS-1 controllers have been used tested in the NIATT traffic lab. The greatest challenge so far, according to Ige, has been the wide range in voltage level that determines the off/on status of the signals received by the controller.

The aim of this project is to establish the method by which 24 hours of data, in increments of up to one-tenth of a second, can be collected from 12 new controllers that will be installed in the City of Moscow as part of the **Moscow ITS project**.

The collected data, than, will be used to evaluate cycle failure and green time utilization, for example, in signalized intersections. The data-logging device developed as part of this project provides traffic system operators, especially in small- and medium-sized cities, with a means of monitoring the operations at signalized intersections throughout the day. This allows them to identify possible

problems and make the system more reliable and efficient.

Jan-Mou Li Contributes to NGSIM Work

Jan-Mou Li left Knoxville, TN, in August 2007 and made the long drive across the United States, along with his wife Yu-chen Chang and two children, Irene and Iris, to join us at the University of Idaho as a post-doctoral scholar. Li received his PhD from the University of Tennessee, where he served as a visiting scholar in the Department of Electrical and Computer Engineering and graduate research assistant at the Oak Ridge National Laboratory. His PhD dissertation was "Evaluation of Impacts on Delay, Cycle-Length Optimization, Control Types, and Peak-Hour Factor with the Randomness of Traffic."

Before coming to the US, Li held several teaching positions at the Central Taiwan University of Science and Technology.

Li has several publications to his name, including "Short or Long--Which Is Better? Probabilistic Approach to Cycle-Length Optimization," which he presented at the 86th Annual Transportation Research Board (TRB) meeting.

With his experience in data mining and information, Li is contributing to NIATT's project related to FHWA's NGSIM program, developing new data sets and algorithms for next-generation simulation models.

Stop by Poster Session 442 at the 87th Annual TRB Meeting on Tuesday, January 25, to meet Li, who, with co-authors Lee David Han and Thomas Urbanik of the University of Tennessee, will be presenting "Control type Selection at Isolated Intersections Based on Control Delay under Various Demand Levels."

ITD Traffic Engineers Receive VISSIM Lesson

On November 8, the Office of Highway Operation and Safety of the Idaho Transportation Department arranged for one person from each of ITD's six districts to attend a workshop at the NIATT to learn how to use VISSIM.

Graduate student Guillermo Madrigal introduced the simulation software to the engineers, which was fairly new to most of them. Each of the district traffic engineers brought with them information about a traffic network in their district, sometimes with backgrounds from Google Earth.

Guillermo explained that VISSUM simulationGuillermo explained that VISSIM is a powerful microsimulation tool that provides detailed output files. After showing them an animation of a Moscow, Idaho, intersection, he showed the class of engineers how to create a new file and input their background images. how to set up a skeleton intersection, add links and nodes, and then to add signals, detectors, signal heads, etc.

Many of the "students" were surprised that the navigating through the various menus and making accurate choices was so time consuming. By lunchtime, at least one engineer said he was "drowning" in information!

During the day, a number of other graduate students provide assistance to the learners as they attempted to model their sample networks. The ITD personnel were able to come away with a general understanding of VISSIM, its capabilities and uses. Many of them said that the training would help them when they get consultant work to review. As a group, they wee very appreciative of the graduate student help. As one engineer said, “Your students did great, and the hands-on and one-on-one was more than I had ever hoped for.”

Student ITE Chapter Studies Idaho Intersection

Seven civil engineering graduate students and one undergraduate electrical and computer engineering member of the UI Institute of Transportation Engineers (ITE) chapter have been especially busy this fall studying the operational efficiency of the US-95 corridor north of I-90 in Kootenai County.

By happenstance, Adam Miles, current ITE chapter president and his father Glenn Miles, director of the Kootenai Metropolitan Planning Organization (KMPO), were having one of their chats about local transportation issues. "Father" Miles was describing the traffic problems in the area that have resulted from increased growth and development, and "son" Miles was explaining how the ITE chapter was looking for a project for 2007-2008 academic year. Voila! A connection was made, and soon the ITE chapter agreed to complete a US95 Access Management Study.

ITD has been concerned about the traffic flow in the US-95 corridor, where there are a number of unsignalized intersections with access to US-95, leading to more congestion and accidents than either KMPO or ITD find acceptable.

The goal of the chapter's work is to "Determine ways to effectively manage and balance access to US 95 from adjacent streets and roads, without adversely impacting overall transportation system performance for intra- and interstate travelers."

Other ITE Chapter Activities

Chapter members are also preparing to participate in the Region X student conference, a WashDOT symposium on Transpor-tation Planning, and the annual traffic bowl. The chapter also hosted students from a north Idaho tribal high school, who had an opportunity to experience Dr. Michael Dixon's racetrack introducing traffic signal design.

Students initially had to move data from VISUM, a planning software, into VISSIM, a traffic operation simulation tool. Using GIS information, Google Maps, and personal visits to the sites, the students will use simulations to study scenarios presented by KMPO and develop more of their own, evaluating outcomes of relocating some traffic from the intersections to parallel streets. They will eventually present possible solutions to the Kootenai County Area Transportation Board (KCATT), participate in two public open houses, and prepare a report on findings and recommendations based on feedback from local jurisdictions, KCATT and the KMPO Board.

Each year, the ITE members volunteer to spend their own time working on some problem in the Northwest that needs exploration. In the past, the chapter has volunteered their expertise to Kittelson and Associates and to the Idaho Transportation Department, among others.

Projects like this provide great experiences for NIATT students. Not only do they become more experienced with applying their classroom knowledge to real-life situations, they also become aware of the many stakeholders involved in local transportation problems and conflicting issues that must be resolved.

Clean Snowmobile Team Travels to Snow Shows

UI's Clean Snowmobile, which placed first in the 2007 Clean Snowmobile Competition in Houghton, Michigan, was featured at two local snow shows that attracted snowmobilers and from across Washington and Idaho. Members of the UI clean snowmobile team traveled to Boise, IdahWinter Knights Snow & ATV Showo, September 28 and 29 and displayed the snowmobile at the Idaho Snowmobile Show, sponsored by SnoWest magazine/

On Saturday, November 10, team members took the snowmobile north to the Spokane's Washington Interstate Fairground, site of the 27th Annual Snow and ATV Show sponsored by the Spokane Winter Knights Snowmobile Club. Since a feature of the show was new technology on two-stroke engines, the students drew quite a bit of attention from both manufacturers and snowmobile buffs.

NIATT 2006-2007 Annual Report Released

Our research institute has made significant and lasting local, state and national contributions over its nine years as a University Transportation Center. This Annual Report celebrates those achievements as reflected in the thoughts of the researchers, students and partners involved in those activities.

Pavement Studies Will Improve Idaho Mix Design

Dr. Fouad Bayomy, Dr. S. J. Jung. Dr. Richard Nielsen, Dr. Thomas Weaver, of the University of Idaho's Civil Engineering Department, Dr. Safwan A. Khedr of the American University in Cairo (AUC), and three UI graduate students are combining efforts as three pavement projects are underway in the Center for Transportation Infrastructure (CTI).

A joint project between UI and AUC and funded by NSF, a **USDOT-funded project**, and an **Idaho Transportation Department (ITD) project,** involve new pavement technologies that can be put to use in Idaho, other states, and around the world.

The original Superpave mix design method, as released by the Strategic Highway Research Program (SHRP), included mix performance evaluation tests in additional to traditional volumetric criteria. However, the SHRP testing methods were not readily applicable for implementation in routine DOT labs, so the Superpave method was released and recommended as a volumetric-based design system. Many US state agencies, such as ITD, need to evaluate the mix performance at the mix design stage.

In Idaho, NIATT researchers in the CTI have worked closely with ITD materials engineers to develop plans for the full implementation of the Superpave mix design systems. One of the achievements of this work was the development of the Contact Energy Index, an energy-based parameter that indicates the mix stability using a Superpave gyratory compactor. Further research at NIATT led to the development of the Gyratory Stability for Superpave mixes.

The primary outcome of the DOT and ITD projects will be the integration of reliable performance measures into the Superpave mix design process, facilitating successful implementation of the Superpave mix design system in Idaho and serving as a model for other state DOTs across the nation.

Likewise, by characterizing the Egyptian asphalt mixes using modern advanced techniques that are part of the Superpave mix design system, Bayomy and Khedr are collaborating to develop data that will serve

as a test pad for future implementation of the pavement mix design system in Egypt and other countries around the world.

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