



**ILLINOIS CENTER FOR
TRANSPORTATION**



PROGRESS REPORT 2011



Above: Repairs on the structure that carries I-80 over the Mississippi River.
Photos courtesy of IDOT District 2 contractor Civil Constructors, Inc.

Cover: Improvements to Capitol Avenue between 5th Street and 7th Street in Springfield, IL. Photo courtesy of IDOT contractor Otto Baum Company, Inc.

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- Innovative Solutions
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The ICT website provides updated progress reports for active research projects, downloadable final research reports for completed projects, and much more.

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Several commonly used transportation acronyms are defined.



ICT BY THE NUMBERS

The Illinois Center for Transportation (ICT) produces groundbreaking research that directly impacts transportation policies and specifications and results in positive changes that affect the daily lives of the traveling public and transportation of goods. ICT has received strong ongoing support from the Illinois Department of Transportation (IDOT) and the Federal Highway Administration (FHWA).

142	Research projects approved to date
75	Completed projects
18	Million dollar investment by IDOT and FHWA
2005	Year the ICT was founded
90	Researchers actively contributing
137	Graduate students supported
12	Universities and Institutes participating
47	Acres available for use at the ATREL facility
67,400	Square feet of laboratory space available at ATREL
1	Ranking of the affiliated UIUC civil engineering program *

* According to U.S. News and World Report in March 2011, the University of Illinois at Urbana-Champaign is ranked #1 for undergraduate program and #2 for graduate program in civil engineering.



DIRECTOR'S REPORT

We, at the Illinois Center for Transportation (ICT), are pleased to present this progress report of our accomplishments for the fiscal year 2010-2011. Thank you for taking the time to learn more about ICT. As you will see from this report, ICT has grown to become one of the leading transportation centers in the nation since its inception six years ago.

In 2005, the center started with 12 projects; nine of which were pavement projects, and all of the investigators were from the UIUC transportation group. Today, ICT has grown to include 142 projects from many disciplines that represent true diversity in transportation research.

The tremendous growth and success of the center has given us the opportunity to create relationships with more than 12 other universities through outsourcing to match new research needs with the most specialized investigators. Our research collaboration involves other UIUC departments, University of Illinois campuses, other universities across the nation, governmental agencies, and consultants. Overall, 90 investigators are actively contributing to this success through their cutting edge research. To date, the research of the past six years has helped support more than 137 young, talented graduate students in addition to many undergraduate students, and these numbers are ever-increasing.

The ICT continues to focus on the environment and sustainability. Our researchers are leading several major national initiatives to develop more sustainable transportation systems. We are also investigating ways to make other components of transportation, including rest areas, asphalt mixes, and storm water management practices, more environmentally friendly and sustainable.

Safety also remains at the forefront of our research. Illinois recently announced plans to improve 3,248 miles of road and replace or rehabilitate 611 bridges during fiscal years 2012-2017. ICT's research on moving lane closures, speed photo-radar enforcement, and highway work zones, among other projects, will undoubtedly improve and save lives. ICT is proud to be a contributor to our state's leading role in transportation safety.

ICT is actively involved in conferences and events to educate transportation professionals about our research. At the 2011 90th Annual Meeting of the Transportation Research Board, our group of investigators presented over 45 topics. During the past year, ICT also had an active role in many national and international conferences, including the First Congress of the Transportation and Development

Institute of the American Society of Civil Engineers as well as the AASHTO's annual Research Advisory Committee meeting among many others.

It is clear that our staff, facilities, researchers, and students are second to none. This is evident in the recognitions our investigators receive, the offers of employment our students enjoy, and most of all the implementation and far-reaching impacts of our research. To build on this success, we recently agreed to another five-year contract with the Illinois Department of Transportation to continue conducting groundbreaking and useful research through

"The tremendous growth and success of the center has given us the opportunity to create relationships with 12 other universities through outsourcing to match new research needs with the most specialized investigators. Overall, 90 investigators from 20 agencies contribute to ICT's success."

— Imad Al-Qadi

2016. I have no doubt that in the years to come, ICT will maintain its status as a leading international transportation center and will continue to serve the state of Illinois, the nation, and the world through our cutting-edge research development and implementation.

Please visit our website, ict.illinois.edu, regularly for more information about our research activities, how to get involved, and to view all the final research reports and updated progress reports for our current research projects as well as short videos on ICT and our ATREL research facility.

Sincerely,

Imad L. Al-Qadi, PhD, PE, Dist.M.ASCE
Founder Professor of Engineering, UIUC
Director, ICT and ATREL



ICT FROM PAST TO PRESENT

A HISTORY OF WORLDWIDE CONTRIBUTIONS, GROWTH, AND DIVERSIFICATION

University of Illinois' Highway Research: Paving The Way For More Than 100 Years

The ICT builds on the University of Illinois' (UI) pavement engineering program, which dates back to 1906 when Carol C. (C.C.) Wiley (BS 04 MS 10 and faculty member from 1906-1952) pioneered highway engineering at Illinois. His successors joked that he "came with the automobile." During the past 100 years, as roads have changed from dirt, to gravel, to asphalt and concrete, engineers at UI have made lasting contributions to the world's roadways.

UI's work remains some of the most commonly referenced by pavement engineers. Today's faculty, students, and the ICT build on the UI pavement program's rich history and have firmly established it as the most well-respected in the world.



Westergaard Pioneers Concrete Pavement Design



While completing his doctorate at UI, Harald Westergaard (PhD 1916 and faculty member from 1916-1936) developed the first theoretical basis for the design of concrete pavements. Westergaard's mechanistic models have been used throughout the world to improve concrete analysis and design. His major consulting projects included Hoover Dam and the Panama Canal.

UI Collaborates on National Road Tests and Interstate System

Illinois is home to several early road tests, including the Bates Road Test and the AASHTO Road Test in Ottawa. The results led to great advances in concrete and flexible pavements because, for the first time, trucks of different weights and axel spacings were taken into account. The road tests introduced such concepts as the load equivalency factor and roughness and performance measures. Moreland Herrin (faculty member from 1958-1987) worked as the Assistant Materials Engineer for the AASHTO Road Test.

In the late 1950s, UI, led by Ellis Danner (faculty member from 1946-1973), established the Highway Engineering Technician Training Program, which was a first-of-its-kind summer program in the nation. Run similar to a boot camp, the program trained future highway engineers, and many of the participants helped build the segment of Interstate 74 that runs east of Champaign to Danville, IL. UI's Ernest Barenberg (faculty member from 1960-1996) and Marshall Thompson (BS 60, MS 62, PhD 64 and faculty member from

1965-1996) were integral in developing the mechanistic-empirical design frameworks for pavements, which merged sophisticated modeling with prediction of performance after 20 years of traffic and weathering. This work is reflected in the Eisenhower Interstate System and in many agencies' guidelines for the design and construction of flexible pavement systems. Barenberg and Thompson also conducted revolutionary work to stabilize clay soils with lime. UI's worldwide impact became apparent when other countries began translating the lime stabilization work into their own languages.

UI Builds Its Reputation through Advanced Material Testing and State-of-the-Art Laboratories

Revolutionary work in testing asphalt mixes during the 1970s to quantify their limits and optimal thickness, led by Sam Carpenter (faculty member from 1976-2006), gave transportation agencies a better understanding of their own mixes and how to achieve ideal thickness, which resulted in fewer construction needs.



UI Pavement Faculty, 1979: Standing are Sam Carpenter (L) and Ernie Barenberg (R); Sitting (L to R) are Michael Darter, David Boyce, Moreland Herrin, Marshall Thompson, Berry Dempsey, Lufti Raad

UI's continued success in pavement and materials research has been a direct result of outstanding and innovative laboratory facilities. In 1993, Barry Dempsey (PhD 1969 and faculty member from 1969-1999) facilitated the transportation group's laboratory relocation to the Advanced Transportation Research and Engineering Laboratory (ATREL) facility that sits on 47 acres of the former Chanute Air Force Base in Rantoul, just 15 miles north of the UIUC campus. ATREL includes 67,000 square feet of lab space for pavements, materials, and transportation operations testing and research.

Dempsey served as the lab's first director and used it as a catalyst for the UI to reach new levels in transportation research.

The UI is also well known for its work on airfield pavements. In 1995, Dempsey established the UI's Center of Excellence for Airport Technology (CEAT), first sponsored by the Federal Airport Association. The outcome of this safety and pavement research center has been beneficial to the FAA and trained numerous students who have moved on to jobs in airport engineering. Even as Director of CEAT and ATREL, Dempsey continued developing useful products to solve pavement problems, including the interlayer stress absorbing composite (ISAC) material that carries U.S. and foreign patents and has been used in numerous airport and highway pavement projects. Dempsey also pioneered the development of the Integrated Climate Model (ICM) that has been used extensively in research and design procedures.

UI faculty member Michael Darter (1973-2003) has also been at the center of many developments, including the widely used Pavement Condition Index (PCI) system, which was one of the first tools used to assess the condition of an airport pavement or roadway for future maintenance planning. His work led to the introduction of pavement management systems, which agencies use to inventory, maintain, and repair their pavement systems. He was also the lead investigator on the AASHTO M-E design guide for concrete pavements.

ATLAS Arrives at UI

In 2001, UI faculty specifically designed a loading system to conduct full-scale pavement testing for trucks, planes, and railcars. The Advanced Transportation Loading Assembly (ATLAS) provides the UI with unique testing abilities, applying up to 6,000 repetitions per day and simulating up to 20 years of wear on pavement in just a few weeks.

ICT Solidifies UI as Worldwide Leader in Transportation Research

In 2004, Imad Al-Qadi joined the faculty at UIUC. In 2005, Al-Qadi served as Founding Director for the ICT, which was established with the majority of its funding from the Illinois Department of Transportation (IDOT) and further strengthened the UI-IDOT relationship.

The UI pavement program has long attracted and educated the best students in the world, who then take jobs around the world, further spreading UI's influence and reputation. Building on the rich history of the UI's pavement engineering program, the ICT adds to this legacy by allowing UI students the opportunity to participate in groundbreaking transportation research that serves the state of Illinois, the nation, and the world.



Current and emeritus pavement faculty from left to right: Erol Tutumluer, Bill Buttlar, Jeff Roesler, Ernie Barenburg, Barry Dempsey, Imad Al-Qadi, Sam Carpenter, Moreland Herrin, and Marshall Thompson.

PROGRAM TIMELINE

1906

First Professor of Highway Engineering joins UI.

1914

UI Holds First Highway Engineering Conference in U.S.

1952

UI signs first official agreement with IDOT to collaborate on transportation research. (Previously UI had served as contractor.)

1992

The Advanced Transportation and Engineering Laboratory established on former Chanute Air Force Base.

2001

Faculty help procure largest moveable full-scale pavement testing facility in the country known as Advanced Transportation Loading Assembly (ATLAS).

2005

ICT established with an initial three-year agreement of \$8.8 million with IDOT providing a majority of its \$6.6 million share through federal highway dollars specifically earmarked for research purposes. UI provided the local match of \$2.2 million to get the program underway. Of the initial 12 ICT projects, nine are pavement-related and all are performed by UIUC investigators.

2008

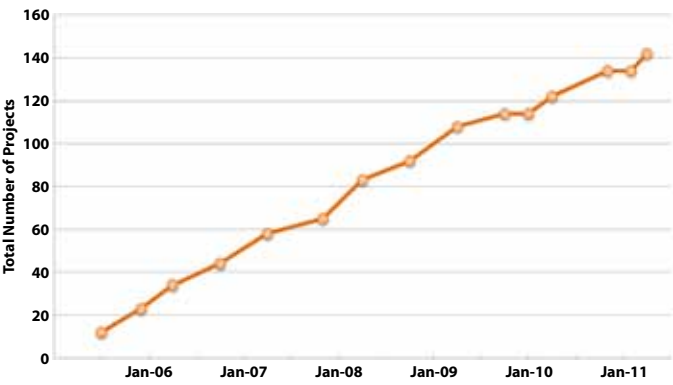
IDOT and ICT sign second three-year agreement providing \$15 million for additional research through 2011. At the time the second agreement is signed, ICT has 68 projects in progress, 14 projects completed, and has greatly expanded the scope of its research (of the 68 projects, only 15 are pavement-related).

June 2011

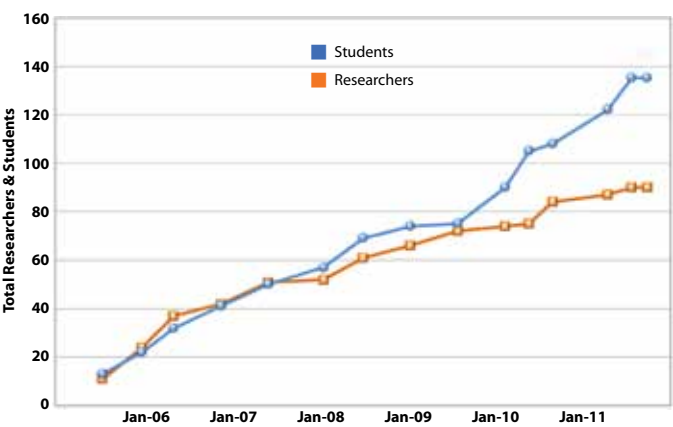
IDOT and ICT have agreed to over \$30 million of funding through 2016. As outlined in the agreements, ICT continues its research with 142 approved projects that show great diversity, both in research topic and investigator outsourcing. ICT collaborates with investigators from 12 universities as well as government agencies and private firms. ICT has completed 75 projects with final reports published and posted to the ICT website and research findings making a true impact in Illinois and beyond.

GROWTH

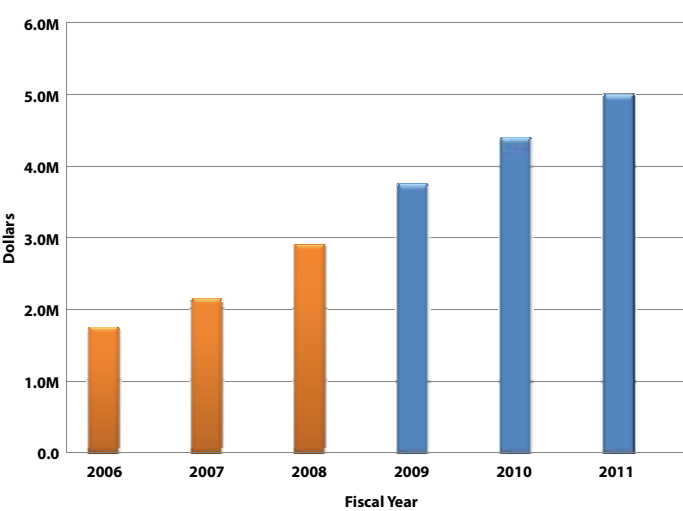
ICT Project Growth



ICT Involvement Growth



ICT Funding Growth

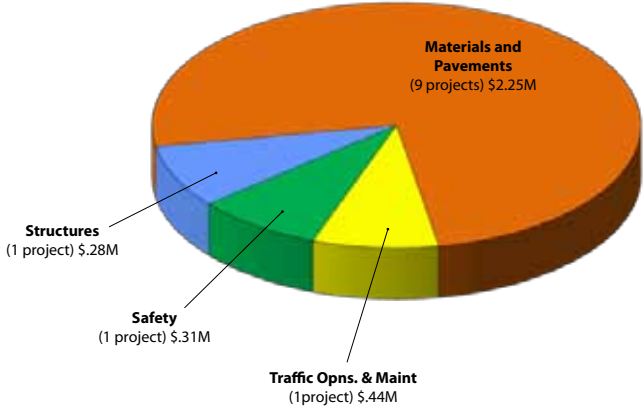


DIVERSITY

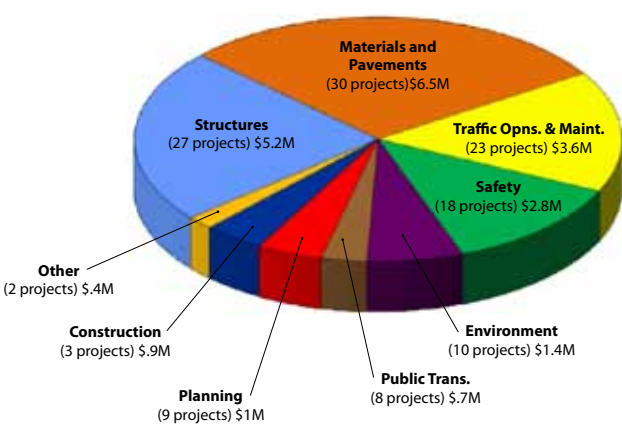
ICT's Diversified Research Portfolio

Since its inception, ICT has greatly expanded the scope of its research to cover additional focus areas, including environment, planning, construction, renewable energy, and public transportation. Although it is still a core focus area, pavement research no longer defines ICT.

ICT in 2005

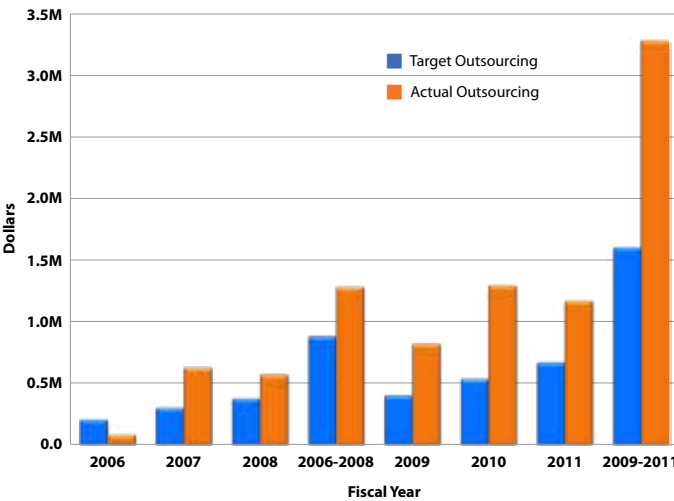


ICT Projects Added 2005–2011



Outsourcing to Non-UI Researchers

A unique feature of ICT is that, even though it is administered by the University of Illinois at Urbana-Champaign, a portion of the funding is outsourced to schools outside of the University of Illinois system. This outsourcing develops cooperative relationships with other universities and exposes more students to transportation research. In recent years, ICT has significantly exceeded its target goals for outsourcing.



Participating Universities and Institutes



ILLINOIS DEPARTMENT OF TRANSPORTATION (IDOT) INVOLVEMENT

In addition to providing funding to the ICT, the Illinois Department of Transportation (IDOT) has an active role in the administrative and research activities of the ICT.

ICT ADMINISTRATIVE COMMITTEE

The ICT administrative committee meets monthly to discuss the status of ongoing ICT projects.

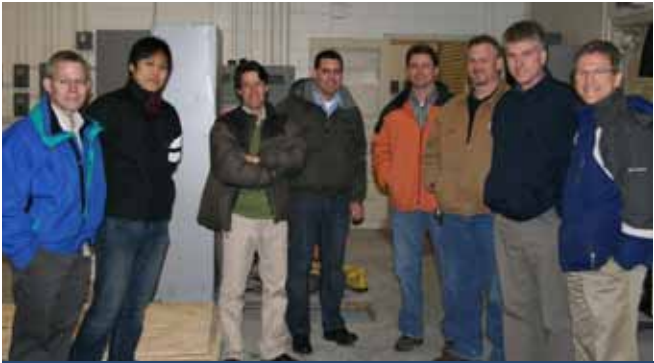
- DAVID LIPPERT**
BUREAU CHIEF, MATERIALS AND PHYSICAL RESEARCH
- AMY SCHUTZBACH**
ENGINEER OF PHYSICAL RESEARCH
- RHONDA LEINBERGER**
CHIEF, LOCAL AGENCY SYSTEMS & SERVICES,
BUREAU OF LOCAL ROADS AND STREETS
- ANDREA RUEDI**
ICT DEPUTY DIRECTOR
- DAVE KING**
ICT RESOURCE AND POLICY ANALYST
- LORI CARPENTER**
ICT COMMUNICATIONS COORDINATOR
- MEGAN SWANSON**
TECHNICAL RESEARCH COORDINATOR



Executive Committee meets on April 26, 2011.
Sitting from L-R: Richard Borus, Jeff Heck, Susan Stitt, Jon-Paul Koehler, Becky Forneris. Standing from L-R: Imad Al-Qadi, Amy Schutzbach, Charles Ingersoll, Susan Shea, Bill Frey, David Lippert, Tony Small, John Webber, Rhonda Leinberger, Brian Pfeifer. Attending but not pictured are Chuck Abraham and Priscilla Tobias.

ICT EXECUTIVE COMMITTEE

- Several IDOT staff members serve on or support the ICT executive committee, which oversees the research program by reviewing and selecting individual research projects. Projects are screened to ensure that the research is innovative, diverse, cost-effective, and serves the needs of both the state of Illinois and the IDOT.
- CHRISTINE REED**
DIRECTOR OF HIGHWAYS
 - BILL FREY**
ACTING COMMITTEE CHAIRMAN, DEPUTY DIRECTOR OF HIGHWAYS
 - JON-PAUL KOHLER**
FHWA REPRESENTATIVE
 - BRIAN PFEIFER**
FHWA REPRESENTATIVE
 - IMAD AL-QADI**
ICT REPRESENTATIVE
- Additionally, the director of each IDOT Division or his/her appointee is invited to attend biannual executive committee meetings.



Technical Review Panel for ICT R27-98, "Evaluation of Concrete Cylinder Match Curing & Effect of Test Cylinder Size," visits the testing area at ATREL after their project meeting.

TAG LEADERS & BMPR REPRESENTATIVES

- Also critical to the ICT research activities are the IDOT staff who serve on the Technical Advisory Groups (TAGs), which review, prioritize, and recommend projects to the ICT Executive Committee. Each TAG includes a representative from the Bureau of Materials and Physical Research (BMPR).
- STRUCTURES/HYDRAULICS/GEOTECHNICAL**
TAG LEADER: TOM DOMAGALSKI
BMPR REPRESENTATIVE: MARK GAWEDZINSKI
 - PAVEMENT DESIGN & MANAGEMENT/MATERIALS**
TAG LEADER: DAVID LIPPERT
BMPR REPRESENTATIVE: MARK GAWEDZINSKI
 - TRAFFIC OPERATIONS & ROADSIDE MAINTENANCE**
TAG LEADER: AARON WEATHERHOLT
BMPR REPRESENTATIVE: MICHAEL BROWNLEE
 - SAFETY ENGINEERING**
TAG LEADER: PRISCILLA TOBIAS
BMPR REPRESENTATIVE: AMY SCHUTZBACH
 - ENVIRONMENT**
TAG LEADER: BARBARA STEVENS
BMPR REPRESENTATIVE: JOE VESPA
 - PUBLIC TRANSPORTATION/MULTI-MODAL**
TAG LEADER: CHUCK ABRAHAM
BMPR REPRESENTATIVE: AMY SCHUTZBACH
 - PLANNING**
TAG LEADER: SUSAN STITT
BMPR REPRESENTATIVE: AMY SCHUTZBACH
 - CONSTRUCTION**
TAG LEADER: TIM KELL
BMPR REPRESENTATIVE: CHARLES WIENRANK

TECHNICAL REVIEW PANELS

Each approved ICT project is assigned a Technical Review Panel (TRP) to oversee and guide the project on behalf of IDOT. The TRP reviews and approves the work plan, provides regular feedback, and reviews and approves the project's final report. The TRP Chair for each project is listed in the Research Appendix of this report. The TRP members for each project are listed in the final reports, which are posted on the ICT website.

ICT Executive Committee Approves 12 New Projects and Increases Funds to Support B.S. and M.S Students (November 2010)

The ICT Executive Committee met at the Hanley Building in Springfield on November 8, 2010, to review several projects suggested for funding. The committee approved 12 new research projects that included establishing native vegetation for IDOT erosion control, improving the effectiveness of night-time traffic control devices, and analyzing travel/activity planning and scheduling behavior of senior citizens in the Chicago metropolitan area.

The committee also decided to set aside additional funds annually to hire B.S. and M.S. degree students as hourly workers on ICT projects. This will help meet the educational missions of ICT and IDOT while allowing IDOT access to a pool of potential hires with experience in pavements and materials.

ICT Executive Committee Approves Eight New Projects (April 2011)

The ICT Executive Committee held its spring meeting on April 26, 2011, in Springfield, Illinois and decided to fund eight new research ideas. Some examples of the varied research topics the Executive Committee approved include: all-weather pavement markings, polymer-modified asphalt mixtures, super-structures of integral abutment bridges, roadway inventory data, real-time information determination requirements, and restoration of wetland mitigation sites.

The newly approved research brings the total approved ICT projects to 142. Several of the newly approved research projects will be outsourced to other universities or private researchers.



ICT STAFF

Behind ICT's innovative research are the staff who work together to deliver a full range of support services to the research team.



ICT staff pictured from left to right: (back) Craig Raymond, Imad Al-Qadi, Bill Buttlar, Jeff Roesler, Jeff Kern, Dave King, Jim Meister, Mark Killion; (front) Andrea Ruedi, Lori Carpenter, Leslie Myrick, Trachia Wilson. Not pictured are: Sam Carpenter, Leslie Elble, and Mary Fries.

IMAD AL-QADI—FOUNDER PROFESSOR OF ENGINEERING & DIRECTOR OF ICT
Imad oversees all ICT research and administration.

SAM CARPENTER—ASSOCIATE DIRECTOR
Sam is a Professor Emeritus of the UIUC Department of Civil and Environmental Engineering and has served as the principal investigator on several projects for IDOT both before and after the inception of ICT.

ANDREA RUEDI—DEPUTY DIRECTOR
Andrea manages the day-to-day operations, technology transfer, and business development activities of the ICT.

BILL BUTTLAR—PROFESSOR & CEE M.S. ONLINE PROGRAM COORDINATOR
Bill oversees distance learning activities.

LORI CARPENTER—COMMUNICATION COORDINATOR
Lori monitors the status of ICT projects, documents TRP meetings, and allows the project teams to focus on research rather than administrative tasks.

LESLIE ELBLE—ASSISTANT TO THE DIRECTOR
Leslie oversees the daily administrative needs of the center and assists with special projects.

JEFF KERN —RESEARCH ENGINEER
Jeff works actively with IDOT, representatives from industry, and student researchers to ensure that the project needs are met.

MARC KILLION—INSTRUMENT MAKER
Marc helps maintain equipment, makes improvements to equipment, and fabricates prototype equipment at ATREL.

DAVE KING—RESEARCH AND POLICY ANALYST
Dave oversees ICT's research funds, the center's overall budget, the project's progress, and the RFP process.

JIM MEISTER—RESEARCH ENGINEER
Jim supports student researchers and ICT investigators with their research at ATREL by making sure they have the right equipment; it is in proper working order; and they have a safe environment for their work.

LESLIE MYRICK—TECHNICAL EDITOR
Leslie coordinates the production of promotional materials, including the quarterly newsletter and the annual report, manages the website content, and edits all the ICT technical reports.

CRAIG RAYMOND—LABORATORY ASSISTANT
Craig prepares samples and performs tests for various ICT projects.

JEFF ROESLER—PROFESSOR AND ASSOCIATE DIRECTOR OF ATREL
Jeff oversees the ATREL facility and its laboratories.

TRACHIA WILSON—OUTREACH COORDINATOR
Trachia coordinates ICT outreach activities, including training courses and conferences.

ICT INVESTIGATORS

ICT's research team includes 90 principal investigators from a diverse array of universities, private consulting firms, and governmental agencies.



MOHAMMAD ALHASSAN
ASSISTANT PROFESSOR
Indiana University – Purdue University
Fort Wayne
alhassam@ipfw.edu

Mechanical properties and durability of plain and fibrous high performance concrete.



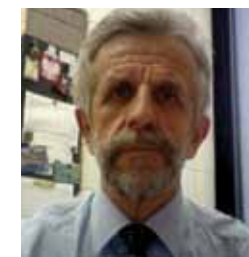
SULEIMAN ASHUR
ASSOCIATE PROFESSOR
College of Engineering,
Technology, and Computer Science
Indiana University – Purdue University
Fort Wayne
ashur@engr.ipfw.edu

Transportation planning and logistics, traffic engineering, GIS, infrastructure rehabilitation and management.



IMAD AL-QADI
PROFESSOR AND DIRECTOR
OF ICT AND ATREL
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
alqadi@illinois.edu

Pavement mechanics, tire-pavement interaction, advanced modeling techniques, full-scale accelerated testing.



GRZEGORZ BANAS
RESEARCH ENGINEER (RETIRED)
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
gbanas@illinois.edu

Bridge design.



BASSEM ANDRAWES
ASSISTANT PROFESSOR
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
andrawes@illinois.edu

Structural dynamics, earthquake engineering, bridge engineering, seismic retrofit of structures.



PETER BELTEMACCHI
ASSOCIATE PROFESSOR
College of Architecture
Illinois Institute of Technology
beltemacchi@iit.edu

Urban design, city and regional planning.



FARHAD ANSARI
PROFESSOR AND HEAD
Department of Civil and
Materials Engineering
University of Illinois at Chicago
fansari@uic.edu

Structural engineering with emphasis in structural health monitoring, smart sensors, and nondestructive testing.



RAHIM BENEKOHAL
PROFESSOR
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign

Traffic flow modeling, traffic flow theory, intelligent transportation systems, and traffic operations and safety.



RICHARD BRUCE
ASSISTANT PROFESSOR
Technology and
Construction Management
Missouri State University
RichardBruce@missouristate.edu

Construction scheduling.



PATRICK CHAPMAN
ADJUNCT ASSOCIATE PROFESSOR
Electrical and Computer Engineering
University of Illinois at Urbana-Champaign
plchapma@illinois.edu

Wind energy.



JOHN DILLENBURG
SENIOR RESEARCH SCIENTIST
Department of Computer Science
University of Illinois at Chicago
dillenbu@uic.edu

Information technology, leadership, research, and development.



MOSTAFA ELSEIFI
ASSISTANT PROFESSOR
Civil and Environmental
Engineering Department
Louisiana State University
(formerly Bradley)
elseifi@lsu.edu

Modeling, analysis, and characterization of flexible pavement and pavement instrumentation.



ABBAS BUTT
PRESIDENT
Engineering and
Research International, Inc.
eri@advancenet.net

Pavement management, evaluation, rehabilitation, and design.



ROGER CHEN
POST DOCTORAL FELLOW
McCormick School of Engineering
and Applied Science
Northwestern University
roger-chen@northwestern.edu

Statistical estimation.



WILLIAM DUNN
RESEARCH PROFESSOR (RETIRED)
Department of Mechanical Engineering
University of Illinois at Urbana-Champaign

Radiation detection.



JAKOB ERIKSSON
ASSISTANT PROFESSOR
Department of Computer Science
University of Illinois at Chicago
Jakob@uic.edu

Real-time public transit monitoring and navigation; networked systems, especially wireless and vehicular networks.



WILLIAM BUTTLAR
PROFESSOR
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
buttlar@illinois.edu

Experimental and analytical characterization of the physical properties of asphalt mixtures, particularly at low temperatures.



RICHARD COOKE
ASSOCIATE PROFESSOR
Agricultural and Biological Engineering
University of Illinois at Urbana-Champaign
rcooke@illinois.edu

Water quality and management.



CARMINE DWYER
SENIOR ENGINEER
Applied Research Associates, Inc.
cdwyer@ara.com

Pavement and asset management, pavement markings, pavement evaluation.



LARRY FAHNESTOCK
ASSISTANT PROFESSOR
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
fhnstck@illinois.edu

Earthquake engineering, innovative structural systems, steel structures, and progressive collapse mitigation.



SAMUEL CARPENTER
PROFESSOR EMERITUS AND
ASSOCIATE DIRECTOR OF ICT
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
scarpent@illinois.edu

Performance characterization and implementation of asphalt mixtures.



SAMER DESSOUKY
ASSISTANT PROFESSOR
Civil Engineering Department
University of Texas at San Antonio
samer.dessouky@utsa.edu

Pavement design and modeling.



SOUHAIL ELHOUAR
ASSOCIATE PROFESSOR
Department of Civil
Engineering and Construction
Bradley University
selhouar@bradley.edu

Structural steel analysis and design, development of advanced design applications, artificial intelligence applications.



DOUGLAS FOUTCH
PROFESSOR EMERITUS
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
dfoutch@illinois.edu

Testing and evaluation of full-scale structures, including bridges and buildings' responses to earthquake loads.

SANTANU CHAKRABORTY
VISITING RESEARCH SCIENTIST
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
santanu@illinois.edu

Stochastic optimization with application to transportation systems and supply chain.



JON DEVRIES
DIRECTOR
Chicago Institute of Real Estate,
Roosevelt University
jdevries@roosevelt.edu

Economic development, office and industrial development, and downtown and neighborhood development.



KHALED EL-RAYES
ASSOCIATE PROFESSOR
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
elrayes@illinois.edu

Construction optimization, decision support systems, information technologies, construction productivity.



RYAN FRIES
ASSISTANT PROFESSOR
Department of Civil Engineering
Southern Illinois University at Edwardsville
rfries@siue.edu

Intelligent transportation systems and incident management.



JEROME HAJJAR
PROFESSOR AND CHAIR
Department of Civil and
Environmental Engineering
Northeastern University (formerly UIUC)
JF.Hajjar@neu.edu

Analysis, design, and field measurement of bridges; earthquake engineering.

LAURA HECKEL
CONSULTANT
Heckel Engineering, Research, and Education, Inc.
HERE_Laura@sbcglobal.net

Pavement engineering.



JEFF KERN
RESEARCH ENGINEER
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
jeffkern@illinois.edu

Research support and field implementation for ICT projects.



ZONGZHI LI
ASSOCIATE PROFESSOR
Department of Civil, Architectural,
and Environmental Engineering
Illinois Institute of Technology
lizz@iit.edu

Multimodal transportation network infrastructure, mobility, safety, security, and vehicle emission performance modeling.



JAMES HALL
ASSOCIATE PROFESSOR
Department of Management
Information Systems
University of Illinois at Springfield
jhall1@uis.edu

Information systems management and implementation, GIS, decision support and e-government.



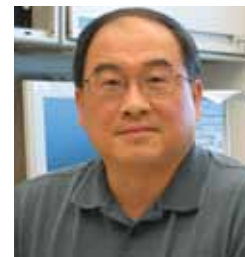
RIYADH HINDI
ASSOCIATE PROFESSOR
Parks College of Engineering,
Aviation, and Technology
Saint Louis University
(formerly Bradley University)
rhindi@slu.edu

Experimental, analytical, and finite element modeling of bridges and structures.



DIEGO KLABJAN
ASSOCIATE PROFESSOR
McCormick School of Engineering
and Applied Science
Northwestern University
d-klabjan@northwestern.edu

Business intelligence and analytics in air transportation, logistics, railway industry, retail, and supply chain management.



CHIANG LIN
PROFESSOR
School of Engineering
Southern Illinois University at Edwardsville
clin@siue.edu

Geotechnical, materials, transportation.



CHRISTOPHER HART
GRADUATE TEACHING ASSISTANT
Department of Civil and Environmental Engineering
University of Illinois at Urbana-Champaign
chart3@illinois.edu

Bridge design and seismic behavior.



ANASTASIOS IOANNIDES
ASSOCIATE PROFESSOR
College of Engineering and Applied Science
University of Cincinnati
Anastasios.ioannides@uc.edu

Response modeling for rigid and flexible pavements, pavement behavior and performance data interpretation.



DANIEL KUCHMA
ASSOCIATE PROFESSOR
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
kuchma@illinois.edu

Design and behavior of reinforced and prestressed concrete structures subject to complex states of stress.



JIE LIN
ASSOCIATE PROFESSOR
Department of Civil and
Materials Engineering
University of Illinois at Chicago
janelin@uic.edu

Sustainable transportation systems, mobile source emissions and air quality modeling, freight planning and modeling.



YOUSSEF HASHASH
PROFESSOR
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
hashash@illinois.edu

Deep excavations, earthquake engineering, numerical modeling, and soil-structure interaction.



AUDREY ISHII
HYDROLOGIST
U.S. Geological Survey
Illinois Water Science Center
alishii@usgs.gov

Hydrologic/hydraulic analysis, surface and subsurface transport numerical simulation, flood frequency and data analysis.



JAMES LAFAVE
ASSOCIATE PROFESSOR
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
jlafave@illinois.edu

Experimental behavior and analytical modeling of structural connections and joints.



LIANG LIU
ASSOCIATE PROFESSOR
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
lliu1@illinois.edu

Construction engineering and management areas.



MARWA HASSAN
ASSISTANT PROFESSOR
Department of Construction
Management and Industrial Engineering
Louisiana State University
(formerly Bradley University)
marwa@lsu.edu

Sustainable construction.



PRASANTA KALITA
PROFESSOR
Agricultural and
Biological Engineering
University of Illinois at Urbana-Champaign
pkalita@illinois.edu

Water quality, environmental protection, water resources, watershed water-quality management, and soil erosion.



DAVID LANGE
PROFESSOR
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
dlange@illinois.edu

Self consolidating concrete, pavements, airport technology, relationships between microstructure and mechanical properties.



JAMES LONG
ASSOCIATE PROFESSOR
Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
jhloug@illinois.edu

Soil-structure interaction, use of load test database for reliability-based design, earthquake engineering.



HANI MAHMASSANI
PROFESSOR

McCormick School of Engineering
and Applied Science
Northwestern University
masmah@northwestern.edu

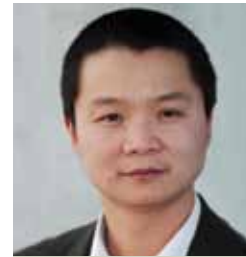
Dynamic traffic system management, network modeling and optimization, dynamics of user behavior and telematics.



PARAMITA MONDAL
ASSISTANT PROFESSOR

Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
pmondal@illinois.edu

Concrete microstructure and the design of innovative and sustainable construction materials.



YU (MARCO) NIE
ASSISTANT PROFESSOR

McCormick School of Engineering
and Applied Science
Northwestern University
y-nie@northwestern.edu

Network optimization, traffic flow theory, and traffic simulation.



JOHN POPOVICS
ASSOCIATE PROFESSOR

Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
johnpop@illinois.edu

Non-destructive testing and evaluation, structural health monitoring, sensing, imaging, construction materials.



ENAD MAHMOUD
ASSISTANT PROFESSOR

Department of Civil Engineering
and Construction
Bradley University
emahmoud@bradley.edu

Asphalt mixes.



RITA MOROCOIMA-BLACK
PLANNING AND COMMUNITY
DEVELOPMENT DIRECTOR

Champaign County Regional
Planning Commission
rmorocoi@co.champaign.il.us

Transportation planning, traffic safety including bicyclists and pedestrians, transportation modeling and traffic studies.



SCOTT OLSON
ASSOCIATE PROFESSOR

Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
olsons@illinois.edu

Liquefaction of level and sloping ground, paleoseismology and paleoliquefaction, soft ground engineering, in situ testing.



JEFFERY ROESLER
PROFESSOR AND ASSOCIATE
DIRECTOR FOR ATREL

Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
jroesler@illinois.edu

Concrete pavement design and analysis, continuously reinforced concrete pavements, characterizing concrete joint behavior.



JAMES MEISTER
RESEARCH ENGINEER

Department of Civil and
Environmental Engineering/ICT
University of Illinois at Urbana-Champaign
jfmeste@illinois.edu

ICT research support at ATREL.



TIMOTHY MURPHY
PRESIDENT

Murphy Pavement Technology
tmurphy@murphypavetech.com

Design and construction of asphalt pavement structures.



TOM O'ROURKE
PROFESSOR EMERITUS

Department of Kinesiology
and Community Health
University of Illinois at Urbana-Champaign
torourke@illinois.edu

Study design and methodology, survey research, sampling, questionnaire design, data collection and analysis.



LAURENCE ROHTER
ADJUNCT PROFESSOR

Civil, Architectural, and
Environmental Engineering
Illinois Institute of Technology
rohter@iit.edu

Surveying, GIS, and transportation.



PAUL METAXATOS
ASSOCIATE DIRECTOR FOR
RESEARCH PROGRAMS AND
RESEARCH ASSISTANT PROFESSOR

University of Illinois at Chicago
pavlos@uic.edu

Transportation modeling, transit planning, intelligent transportation systems planning, data development for freight planning.



KRISTEN NANCE
DIRECTOR OF EXECUTIVE EDUCATION

College of Business Administration
Roosevelt University
knance@roosevelt.edu

Freight distribution activities.



YANFENG OUYANG
ASSOCIATE PROFESSOR

Department of Civil and
Environmental Engineering
University of Illinois at Urbana-Champaign
yfouyang@illinois.edu

Stability and efficiency of transportation systems, transportation and supply network operations, and transportation safety.



KERRIE SCHATTLER
ASSISTANT PROFESSOR

Department of Civil Engineering
and Construction
Bradley University
kschattler@bradley.edu

Traffic and transportation engineering.



KOUROS MOHAMMADIAN
ASSOCIATE PROFESSOR

Department of Civil and
Materials Engineering
University of Illinois at Chicago
kouros@uic.edu

Transportation planning, travel behavior analysis, travel survey and data mining, applied econometrics and choice models.



PETER NELSON
DEAN

College of Engineering
University of Illinois at Chicago
nelson@uic.edu

Artificial intelligence search techniques.



WILLIAM PINE
RESEARCH ENGINEER

Heritage Research Group
bill.pine@heritage-enviro.com

Hot-mix asphalt technologies.



JENNIFER SHARPE
GEOGRAPHER

U.S. Geological Survey
Illinois Water Science Center
jbsarpe@usgs.gov

Ground water and water quality investigations.



Construction surveying, construction soils, and foundations.



Transportation facilities evaluation, design, and research,
including nondestructive testing of pavements.



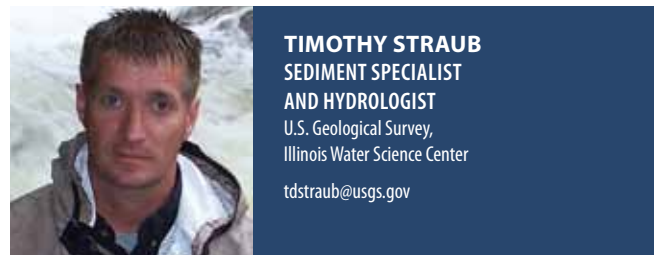
Transportation policy analysis, transportation data quality,
intelligent transportation systems.



Experimental mechanics, fiber reinforced composites,
construction materials, structural dynamics.



Integrating solid super elements in building information
models; laser scanning applications for construction.



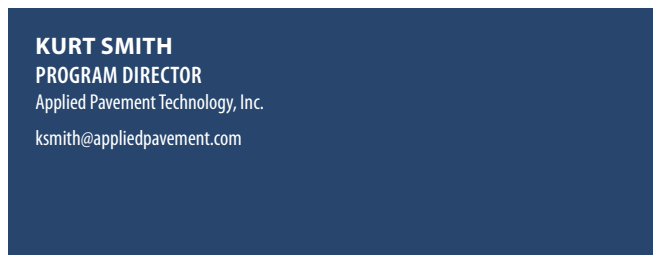
River hydraulics, mechanics, and sediment transport modeling;
bridge Scour Prediction in cohesive soils.



Mechanistic-empirical design procedures for flexible pave-
ments.



Pavement design, evaluation, materials assessment,
and sustainability.



Pavement evaluation, design, and management.



Concrete composition, microstructure, and performance.



Transportation geotechnics, pavement and railroad track subgrade
soils and aggregates, recycled materials, geosynthetics.



Pavement evaluation, design, and management.



Surface water investigations.



Modeling, analysis, control and performance evaluation of
discrete-state/discrete-event systems.



Materials testing, geotechnical engineering, instrumentation.



Traffic operations and safety, pedestrian and bicycle safety,
access management, intelligent transportation systems.



Transportation geotechnics and geosynthetics for the
design, construction, and operation of roadways.



Welfare-to-work, equity, public transportation, stakeholder
participation, asset management, and geo-spatial analysis.



Pavement evaluation, design, and management; forensic
investigations; work zone safety; pavement markings.



Pavement evaluation, design, and management.



ICT FACILITIES AND RESOURCES

ICT is headquartered in a state-of-the-art facility at the Advanced Transportation Research and Engineering Laboratory (ATREL). The ATREL complex is located on 47 acres just 15 miles north of the UIUC Campus. The complex includes 67,400 square feet of laboratories, continuing education classrooms, office space, a technical library, and a computer facility.

To sustain ICT’s leadership in transportation research, ATREL is staffed and equipped to accommodate the investigation of a wide range of projects from basic science and theoretical research to full-scale field testing and evaluation of pavements, bridges, railroad traffic, and transportation systems.

ATREL’s Ever-Growing Capabilities

ATREL is constantly upgrading its capabilities; just a sample of its improvements in the past year include:

- A new dynamic shear rheometer (DSR) device with the capability of “fluids to solids” testing. With a wide range of measurement geometries and accessories, the DSR can perform rheological characterization of asphalt binders and sealants and mechanical characterization of asphalt mixtures and mastic. The equipment provides precise control over a wide range of temperatures



- A laboratory-scale foamed bitumen plant. This equipment can be used to investigate the foaming properties of different bitumen types at different temperatures and with various amounts of water and air to allow an optimum design of foamed bitumen. It is utilized for in-place cold recycling and warm mix design.
- A new large triaxial device for testing ballast.
- Increased oven capacity to handle larger volumes of asphalt work.
- Shear and fracture testing capabilities were added to the Interlaken asphalt testing machine.
- A second device for DC(T) fracture testing.
- IPC triaxial asphalt testing machine.
- Capability for fracture-energy interface bond testing.

ATREL’s Laboratories

Large and small-scale material samples can be tested in several labs at ATREL using state-of-the art equipment, some of which were developed at ATREL. One laboratory area houses several servo-hydraulic and pneumatic systems for soil, granular materials, concrete, as well as HMA testing that includes simple performance, complex modulus, indirect tension, creep, four-point bending fatigue, and disk-shaped compact tension, among others.

Another ATREL lab houses SuperPave™ binder testing equipment, a linear rolling wheel compactor, triaxial shear apparatus, aggregate image analyzers, and the UI-FastCell capable of applying dynamic stresses on a soil cylinder in both vertical and radial directions. Another laboratory area has a 30 gpm hydraulic pump that can be connected to a variety of computer-controlled servo-actuators to simulate wheel loads on full-scale pavement slabs and bridge girders. This frame and soil containment box can test specimens approximately 8 ft. x 16 ft. Previous tests have included reinforced concrete slabs cut from an interstate pavement, static and fatigue of airfield concrete slabs, fiber reinforced concrete slabs, and two-lift concrete slabs.



ATREL has been inspected as per the same standards expected for all IDOT district labs and it was found to meet the specifications; therefore, ATREL has received IDOT approval. Additionally, ATREL participates in the Round Robin Uniformity Study for HMA conducted by IDOT. The biennial study requires each participating lab to perform testing on a known mix.



A new triaxial device for testing ballast arrived at ATREL in April 2011.

The 2010 Round Robin testing included HMA volumetrics, gyratory compaction, TSR, ignition oven, and aggregate gradation. The Round Robin testing provides IDOT with a means to ensure that contractors, consultants, districts, and ATREL are consistent with laboratory procedures and results.

Accelerated Transportation Loading Assembly (ATLAS)

The Accelerated Transportation Loading Assembly (ATLAS) can evaluate full-scale transportation systems subject to real life traffic and environmental loads. The system is capable of simulating aircraft, truck, or rail traffic distributions, testing all types of

pavement systems, and applying load levels exceeding that of highway and airfield limits. ATLAS can be covered by a moveable structure that controls the effects of daily temperature and moisture changes on the pavement section being studied. It also has data acquisition systems for instrument data collection. ATLAS can apply up to 6,000 repetitions per day, and it is equipped with insulated environmental-control aluminum panels designed to provide a constant temperature for the top 2 inches of pavement.



Students help construct a test pavement at ATREL.

Traffic Operations Laboratory

The Traffic Operations Laboratory (TOL) houses equipment to evaluate traffic signal components and fiber optic communications, offices, technology transfer classrooms, testing areas, and a 17-foot high bay area. TOL's extensive collection of traffic signal control hardware, including controllers, detector units, and conflict monitors, provides a valuable resource for hands-on instruction and research.



ICT investigators give Bob Skinner (Transportation Research Board Executive Director) a tour of ATREL. From left to right are: Erol Tutumluer, Imad Al-Qadi, Skinner, and Jeff Roesler.



Engineers from the O'Hare Modernization Program visited ATREL in February 2011.

VISITORS TO ATREL

The transportation community and friends of ICT are always welcome at ATREL. Below are just some of the visitors to ATREL during the past year:

- American Concrete Pavement Association
- Applied Pavement Technology
- Applied Research Associates, Inc.
- Colas Inc.
- Federal Highway Administration
- Heritage Research Group
- Illinois Department of Transportation
- Illinois Tollway
- Malvern
- Murphy Pavement Technologies
- O'Hare Modernization Program
- Pavement Rehabilitation Services (South Africa)
- Research and Innovative Technology Administration (RITA)
- Road Science LLC
- Scott Air Force Base

- Suleyman Demirel University (Turkey)
- Test Quip LLC
- Texas A&M University
- Transportation Research Board
- Transportation Technology Center, Inc.
- U.S. D.O.T. Federal Railroad Administration
- U.S. Transportation Command
- University of Illinois-Springfield
- University of Minho (Portugal)
- University of North Carolina
- University of Parma (Italy)
- University of Washington
- Washington State University
- Wirtgen



ICT welcomed the nation's top transportation research official, Peter H. Appel, to ATREL in August 2010. Appel is the Administrator of the U.S. Department of Transportation's Research and Innovative Technology Administration (RITA).



Comprehensive performance tests on warm-mix asphalt samples were conducted at ATREL during fall 2010.



ATREL hosted social events throughout the year for students, faculty, staff, and their families.



From Idea to Implementation

THE RESEARCH PROCESS

To maximize the variety of research considered and selected, the expertise of its investigators, the efficiency of the research process, and the quality of the research results, ICT operates by the procedures outlined on the next page.

As a testament to its commitment to diversity, ICT consistently outsources to other public and private universities, research institutions, and specialty consulting firms. In fiscal year 2010-2011, ICT outsourced 24% of its funded research.

1. Call for Research Ideas*

Twice annually, the eight Technical Advisory Groups (TAGs) identify specific transportation topics or focus areas as priorities for new ICT research. A TAG is a subcommittee of the ICT Executive Committee with expertise in a specific research area. TAGs are comprised of representatives from IDOT, FHWA, academia, industry, local agencies, and other governmental agencies. These groups review, prioritize, and recommend projects to the ICT Executive Committee. ICT currently has eight standing TAGs – Construction, Environment, Pavement Design and Management/Materials, Planning, Public Transportation/Multi-Modal, Safety, Structures/Hydraulic/Geotechnical, and Traffic Operations and Roadside Maintenance. Other ad hoc TAGs may be added as needed. ICT then posts the TAG suggestions on its website and invites potential researchers and IDOT staff to submit specific research ideas. Although ICT encourages research ideas based on the priorities the TAGs identified, research ideas on any transportation-related topic are considered. Those who wish to suggest a specific research topic can download the Proposed Research Idea Form from the ICT website. The deadlines for these submissions are generally January 31 and June 30.

** Submitters should be aware that not all ideas are selected for funding and that ideas may be shared with others. ICT also reserves the right to select any researcher to carry out a research idea.*

2. Funding of Projects

After the Call for Research Ideas deadlines, the TAGs review the research ideas submitted in their respective subject areas and prioritize them for presentation to the ICT Executive Committee for funding consideration. The Executive Committee is chaired by the IDOT Director of Highways (or the Director's designee) and is comprised of the ICT Director, the Directors of the Offices and Divisions of IDOT, and a representative from the Federal Highway Administration (FHWA). The ICT Executive Committee meets twice annually to review the prioritized recommendations of the eight TAGs and makes the final decision on which research projects are funded.

3. Selection of the Project Technical Review Panel

For each new project, IDOT appoints a Technical Review Panel (TRP) to oversee and guide the research. Chaired by an IDOT employee, members are appointed based upon their expertise to ensure there is sufficient subject expertise and diversity on each panel to assist and guide the ICT researcher(s). Members are selected from IDOT, FHWA, local agencies, industry, other governmental agencies, etc. The TRP chair is generally an IDOT employee. The TRP is responsible for reviewing RFPs (if proposals are solicited outside the University of Illinois system), reviewing and approving the research work plan and budget, providing regular feedback to the researchers about the research, and reviewing and approving the project's deliverables and final report.

4. Investigator Selection

Once a project is funded, ICT determines who serves as the Principal Investigator(s), the lead researcher(s) on an ICT project. ICT can select a Principal Investigator (PI) from one of the University of Illinois' three campuses. Alternatively, ICT can solicit proposals from researchers outside the University of Illinois' campuses.

5. Requests for Proposals

For projects not directly assigned to an investigator, ICT solicits formal research proposals. These requests for Proposals (RFPs) are widely advertised and posted on the ICT website semi-annually. In fiscal year 2010-2011, ICT advertised nine RFPs with a total value in excess of \$1.6 million.

6. Evaluation of Proposals

The appropriate TAG evaluates all submitted proposals and makes a recommendation to ICT for award of the research.

7. Research Process

Once a researcher is selected for a project (either by the ICT or via RFP), he or she is asked to work with the TRP to prepare a work plan and budget. The PIs keep accurate records of the nature of their work performed and data analysis, and they submit quarterly reports on their research progress.

8. Completed Projects

After the researchers complete their project report and are ready to disseminate the findings and conclusions, they work with their TRP and an ICT editor to finalize a project report so that the research findings are presented clearly and the report's formatting is consistent with ICT requirements. ICT considers a project as complete when the final research report is published and posted on the ICT website.*

When a project is complete, ICT publicizes the research findings as appropriate, and IDOT implements the research findings as appropriate. In some instances, IDOT has asked ICT to develop and present short courses to facilitate the transfer of the findings and new technologies to appropriate state and local transportation officials.

** In some limited instances, IDOT may request the findings remain confidential for a period of time or IDOT may determine that the findings/conclusions are so specialized that they do not warrant a public report. In these cases, the findings or conclusions are shared internally within IDOT.*

Publication #	Project #	Title	Authors	Date
PRDIACT-11-079	ICT-610	Safety impacts of highway structure attributes in electric	R. Bancel, Y. Lee, Z. Li	Apr-11
PRDIACT-11-079	ICT-627-62	Proceedings of the Material Quality Testing Work	T. Muehle, L. Tardieu, A. ...	Mar-11

All final reports are posted on the ICT website.



Impact of Research

SUSTAINABILITY/ ENVIRONMENT

ICT takes a proactive role in protecting our environment by developing technologies that conserve resources. Pavements, tires, and even rest areas all contain opportunities for environmentally friendly practices, and ICT’s research is at the forefront of these ideas.

PROJECT # DTFH61-10-D-00042 ICT Researchers to Support New National Sustainable Pavements Program

Pavement experts at the Illinois Center for Transportation, led by Director Imad Al-Qadi, will assist the Federal Highway Administration (FHWA) as it develops a national sustainable pavements program.



ICT Director Imad Al-Qadi facilitates discussion at the kick off meeting for the sustainable pavements project on May 23, 2011.

The project, to begin during summer 2011, will identify sustainability issues with regard to pavements. The FHWA will use the information to help develop its sustainable pavements program to consider asphalt, concrete, granular, and other recyclable materials.

ICT’s work will increase the awareness, visibility, and the body of knowledge of sustainability considerations for our nation’s pavements.

The desired outcome is to increase the awareness, visibility, and the body of knowledge of sustainability considerations in the design, construction, maintenance, and rehabilitation of pavement systems.

Other organizations that are part of this team include Applied Pavement Technology, Inc., the University of California Pavement Research Center, University of Washington, Virginia Tech, University of New Hampshire, The Right Environment, and CH2M Hill. ■

PROJECT # R27-74 ICT Promotes Green-Friendly Practices for Interstate Rest Areas

Illinois Interstate rest areas welcome nearly 40 million visitors annually. They are one of Illinois’ most visible amenities and are on display and used 365 days a year. The facilities are presently

ICT’s work to develop green-friendly practices for rest areas will help the state of Illinois achieve energy savings and advance IDOT’s leadership in preserving the environment.

maintained as well as budgets allow but are in need of upgrades to become more energy efficient and “green friendly.”

To develop a list of “green friendly” best management practices (BMPs) for Illinois Interstate rest areas, ICT investigators Khaled El-Rayes and Liang Liu determined energy cost baselines, assessed existing conditions related to energy use, and evaluated existing and alternative BMPs. The investigators developed BMPs for specific locations, with expected costs and payback information as well as a total statewide cost estimate for full implementation with payback. The final report for Phase I of the study is posted on the ICT website.



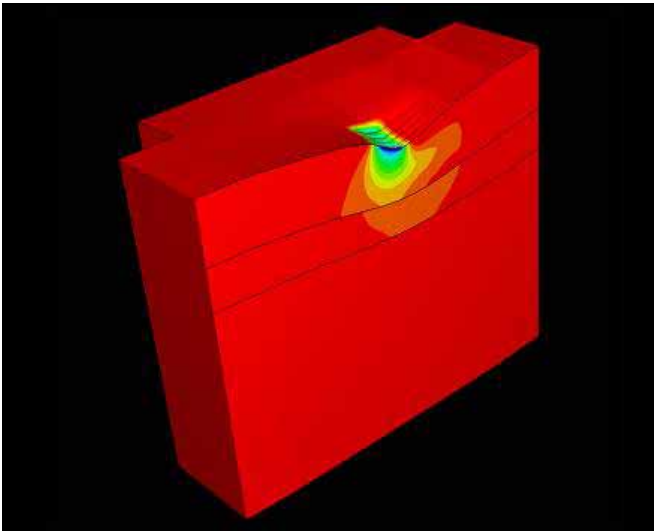
Pride of the Prairie Rest area in Illinois was a subject of the Phase I ICT study on best management practices.

The investigators are now working on Phase II of the study which will investigate, determine, and provide a list of green-friendly BMPs for six additional rest areas that together account for 32% of IDOT’s rest area energy bills. Implementing green-friendly practices in Illinois’ rest areas will lead to significant annual savings for IDOT and will show a commitment by the state of Illinois to be more environmentally conscious. ■

PROJECT # DTFH61-11-C-00025
From 18 Wheels to 10? ICT Awarded \$1.2 Million to Study Wide-Base Tires

Researchers at the Illinois Center for Transportation (ICT) have been selected to lead a \$1.2 million FHWA project to model and validate the use and effects of wide-base tires as an alternative to the conventional dual-tire system on semi-truck trailers. Wide-base tires have the potential to provide numerous benefits to the environment and the trucking industry.

The team will use advanced theoretical modeling that is validated with testing sensorized full-scale pavements to determine the relationship between the tire characteristics, including width, aspect ratio, loading, inflation pressure, and actual tread width, and pavement damage. The team will develop a tool and methodology that allows engineers and agencies to assess the impact of wide-base tires on the pavement network and analyze the



Finite element simulation of wide-base tire imprint using ABAQUS.

economic, safety, and environmental effects of using wide-base tires relative to the impact on pavement performance. As part of an earlier project, the ICT team showed the environmental advantages of wide-base tire implementation. The U.S. Environmental Protection Agency (EPA) Smartway Transport Project promotes the use of wide-base tires as a way to improve fuel economy by reducing weight, aerodynamic drag, and rolling resistance. Other potential benefits they cite include reduced drive-by noise and improved stability.

ICT's previous work on wide-base tires has shown that they actually have similar total pavement impact on the interstate highway pavements as the dual-tire system; although the pattern of damage could be different. But recent advances in tire technology have led to a revised design for wide-base tires that have a better load distribution than dual-tire assembly. Theoretically, the team showed that for thick pavements, the pavements' expected service life could be improved when exposed to wide-base tires when compared to dual-tire assembly.

Principal Investigator and ICT Director Imad Al-Qadi says, "In addition to modeling and pavement instrumentation to measure pavement response to various types of tires, this project covers the sustainability and environmental effects of using the wide-

A decade after the completion of this project, the use of dual-tires on trucks may be something of the past.
—Imad Al-Qadi, Director of ICT and Principal Investigator

base tire. I predict that a decade after the completion of this project, the use of dual-tires on trucks will be something from the past. My students and I have been working on this topic for many years and we are very pleased to win this project that will move this technology forward. This project is a truly international effort and we are very pleased to work with top researchers in this field at the Delft University of Netherlands, UC Davis, CSIR of South Africa, and Florida Department of Transportation as partners. In addition to FHWA, seven states as well as industry are funding this project."



A wide-base tire rolls over a test pavement at ATREL.

Along with the administration of the project, full-scale testing will be conducted at ICT's headquarters (ATREL), UC Davis, and FDOT. Tire stress measurements will be conducted in South Africa; modeling will be developed at UIUC and Delft; and life cycle assessment and impact on the environment will be studied at UC Davis and UIUC. The project is set to begin during summer 2011 and has a three-year timeline. ■

ICT Collaborates with the Illinois Tollway on Environmentally Friendly Warm-Mix Asphalt

ICT researchers, lead by Director Imad Al-Qadi, and the Illinois Tollway have teamed up on a project involving the performance of warm mix asphalt (WMA), which has several environmental benefits compared to the performance of traditional hot-mix asphalt.

In recent years, WMA techniques have been developed to reduce hot-mix asphalt (HMA) production temperatures. WMA is mixed and placed on the road at lower temperatures (as much as 50 to 100 degrees Fahrenheit lower than HMA). Compared to traditional asphalt construction, this reduction in production temperature uses less fossil fuel and produces fewer emissions, therefore, benefiting the environment. WMA may also perform better – a question which Al-Qadi and his team intend to answer. The research team also plans to determine how long WMA needs to cure to develop its ultimate performance strength. Knowing this ideal timeframe will help the agencies decide how soon it can open traffic on their roadways following construction. A past concern was that their roadways were being opened to traffic too soon after construction, and consequently the pavements were being prematurely distressed.

There are two unique aspects about this research. The first is that this research is on Stone Mastic Asphalt (SMA), a specially designed mix that contains fibers and/or additives that enhance its performance for heavy traffic interstate/expressway placement. Several SMA mixes are being analyzed, containing a spe-



Plane loaded with asphalt samples takes off to meet strict performance testing schedule at ATREL.

cific warm-mix technology, recycled pavement materials, rubber, and/or recycled roofing shingles. The second unique aspect is that performance tests are being conducted on field-compacted samples, rather than laboratory samples. This method better simulates the actual curing of WMA and avoids any effects from re-heating the WMA.

A testing program of this level has never been attempted before: samples were tested from compaction time until seven days (and some tests up to three weeks) over specific periods and in



Researchers sample plant-produced asphalt prior to compaction of field performance samples.

accordance with the detailed testing program that includes analyzing material susceptibility to rutting and cracking. To achieve this, the team mobilized six gyratory compactors to the asphalt production facility for each mix investigation. With the samples being compacted anywhere from 130 to 200 miles from ATREL, some samples were flown immediately from a nearby airport to meet the strict performance testing schedule.

Back at ATREL, comprehensive laboratory tests were conducted on the samples upon arrival and over the course of seven days (and some over three weeks). Those tests include complex modulus, flow number, wheel tracking, indirect tensile creep and

A testing program of this level has never been attempted before: some samples were flown immediately from a nearby airport to meet the strict performance testing schedule.

strength, and semi-circular bending fracture. Additionally, this research project aims to verify the early age rutting potential of the innovative warm-mix SMA, using a lightweight deflectometer for in-situ performance testing.

The end result will be a performance evaluation of warm mix SMA at early age, which will allow pavement engineers and/or contractors to determine the minimum traffic opening time; especially for high traffic volume interstates or expressways. The early age performance will be based on stiffness, rut resistance, and life-cycle assessment. As a result of this study, the Illinois Tollway will have the information they need to select the best asphalt mix and maximize its performance for future projects, which will save them time and money while also providing environmental benefits when compared to traditional HMA. ■

PROJECT # R27-54

ICT Establishes Research and Training Center for Erosion Control



Co-PI Prasanta Kalita stands in front of construction for the ICT's erosion control center.

ICT established the Erosion Control Research and Training Center (ECRTC) on the UIUC campus to demonstrate erosion, sediment, and storm water control practices suitable to Illinois conditions. This facility will be used for hands-on training, to demonstrate proper installation and evaluation techniques, and to initiate research to assess the applicability of erosion control and best practices for storm water management for relevant IDOT construction site conditions.

Land development and construction projects often alter the hydrologic responses that result in increased rates and volume of storm water runoff and soil erosion rates. This in turn contributes to increased and frequent flooding, channel erosion, sediment transport and deposition, loss of structures due to high runoff rates, and non point pollution of our streams, lakes, and reservoirs. IDOT strives to excel in road construction technologies, including storm water management and adopting best management practices (BMPs) for erosion control and sediment transport.

The center, equipped with rainfall simulators (sprinklers) and automated water quality samplers, will provide a setting that will simulate a multitude of conditions typically found along Illinois roadways, highways, and urban settings. This facility will provide critical hands-on training in outdoor and indoor classrooms on proper installation, use and evaluation of erosion and sediment control products.

The ECRTC will be used to evaluate the performance of IDOT-identified storm water management and erosion control BMPs in real Illinois conditions and provide IDOT with staff training in a timely and cost-effective manner. In collaboration with UIUC's Department of Agricultural and Biological Engineering, ICT will

The erosion control center allows IDOT to evaluate practices and products in real Illinois conditions. It also allows for hands-on training opportunities for contractors, inspectors, designers, and others interested storm water management best management practices for a sustainable environment. ICT began offering its erosion and sediment control workshop in June 2011.

administer short courses to disseminate the outcome of the center's research. Prasanta Kalita, co-investigator along with Richard Cooke, says, "Our vision is to make the ECRTC one of the best centers in the country where quality research, demonstration, and education will be provided to state, federal, and other groups." ■



Installation of runoff and sediment collection tanks.



Impact of Research

SAFETY

Speed, work zones, and wrong-way traffic are three major contributors to accidents on Illinois highways. To prevent accidents and save lives, the ICT supports research to study driver behaviors related to these and other factors.

PROJECT # R27-90
ICT Study Aims to Reduce Wrong-Way Driving on Freeways

Statistics show that wrong-way driving is a factor in approximately 27% of fatal crashes in Illinois. By investigating these crashes individually, in as much depth as possible, ICT investiga-



tors Huaguo Zhou, Ryan Fries, Brent Vaughn, and Chiang Lin are determining the common contributing factors so they can recommend potential countermeasures. Specifically, the investigators are looking at crash data, crash reports, construction reports for fatal crashes, plan and site information, as well as interviewing the officers and engineers who are most familiar with the location and traffic operation. They are also considering less severe crashes to confirm and contrast patterns.

The investigators collected five-year crash data and reports from the IDOT, Illinois State Police, and Highway Safety Information System. They also designed and conducted a statewide survey to identify experiences, current research, and deployed counter-

Wrong-way driving is a factor in approximately 27% of fatal crashes in Illinois; ICT is investigating these crashes in depth to recommend the most effective countermeasures.

measures. They are currently indentifying contributing factors and have conducted a preliminary statistical analysis based on the data collected.

At completion of the project (set for June 2012), the research results will answer three basic questions: (1) What is the state of practices on safety, design, and operational issues related to wrong-way driving on freeways? (2) What are the wrong-way crash history, pattern, and severity in Illinois? And (3) What are the significant contributing factors affecting severe and less severe wrong-way crashes? The information gained can help reduce these types of driving errors and therefore save lives. ■

PROJECT # R27-66
ICT Helps Illinois Better Allocate Resources for Speed Enforcement

Speed contributes to 39% of traffic-related fatal crashes occurring on Illinois highways. The FHWA has identified Illinois as a Speed Focus State and has encouraged Illinois to develop a speed man-

Speed contributes to 39% of traffic-related fatal crashes on Illinois highways; ICT is identifying the most effective patrol strategies to reduce speeds and consequently fatalities.

agement program. In this era of a struggling economy, reduced resources, and competing needs, leaders within the public and private sector are turning to intelligence-driven assignments to produce the greatest gain with the least amount of investment. Therefore, ICT is identifying the most effective speed enforcement patrol and saturation patrol procedures and methods, including effective enforcement duration and appropriate staffing level needs, so Illinois can more efficiently deploy valuable resources and maximize results.

ICT investigators Hani Mahmassani and Roger Chen are identifying statewide survey locations to test existence and extent of the halo effect and the effectiveness and efficiency of each speed enforcement technique.



Speed photo enforcement vans are one technique to reduce drivers' speeds.



Deployment station inside van.

Their analyses will result in more effective patrol strategies and procedures with the least amount of staff, allowing IDOT and the Illinois State Police to better allocate resources and ultimately reduce speed-related fatalities on Illinois highways.

Specifically, the research results (set for October 2012) will answer: 1) How does presence/absence and duration of speed enforcement affects speed on Illinois highways? 2) What are the best practices for patrol and saturation patrol procedures? 3) How does reduction of speed correlate to the reduction of severe crashes? ■

PROJECT # R27-52
ICT Provides Recommendations to Improve Work Zone Layouts

In Illinois alone, work zone accidents result in an average of 2,100 injuries and 27 fatalities per year. Contrary to popular belief, motorists are more likely to get hurt in work zones than workers. With the end goal of safer work zones for everyone, ICT supports research to study driver behavior and improve the set-up of work zones.

ICT researchers Khaled El-Rayes and Liang Liu analyzed the frequency and severity of traffic-related work zone crashes and investigated the probable causes and contributing factors of these crashes. Next they developed practical recommendations for improved work zone layouts and merge techniques that minimize the probable causes of work zone crashes. As part of the project, they also evaluated the practicality and effectiveness of the strategies proposed by the Illinois Comprehensive Highway Safety Plan to add temporary/portable rumble strips within and prior to work zones.

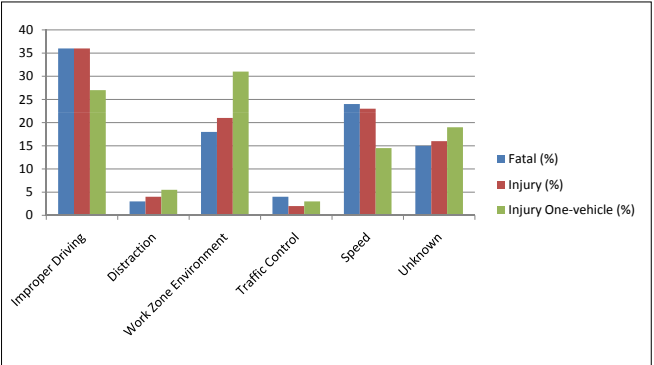
To reduce work zone crashes in Illinois, the ICT has presented IDOT with specific recommendations for improving work zone layouts, merge techniques, and traffic control standards and specifications.

As a result of this project, ICT has presented IDOT with a comprehensive analysis of work zone crashes in Illinois and specific recommendations for improving work zone layouts, merge techniques, and traffic control standards and specifications.

Marshall R. Metcalf, IDOT District 6 Traffic Operations Engineer, explains, "As IDOT works to reduce traffic related work zone crashes and fatalities, these statistically based recommendations will help IDOT to make the best decisions to improve safety. IDOT will apply resources to the areas of greatest potential improvement as a part of a rational approach to continual reduction in crashes and fatalities." ■



Temporary rumble strips were installed so researchers could study how well they generated sound levels to enhance the alertness of drive-by motorists.



Behind improper driving and speed, work zone environment is the next highest contributing cause of work zone crashes. Accordingly, the layout of construction zones needs to be carefully designed and implemented to improve safety.



Impact of Research

PAVEMENT

To help meet the expectations of the travelling public while maximizing the use of their tax dollars, ICT investigates ways to improve pavement design, monitoring, evaluation, performance, and rehabilitation methods. The results lead to lower construction costs, increased maintenance intervals, extended pavement life, and reduced travel delays.

PROJECT # R27-42
ICT Developing Thin, Long-Lasting, High-Friction Surface Layer

Aggregates that provide adequate friction can be expensive and may not be readily available in all locations. Therefore, ICT set out to develop a new surface cross section that utilizes locally available aggregate materials as much as possible.

The investigators are taking a fresh look at the hot-mix asphalt (HMA) cross-section, including the job mix formulae of the composition layers, their engineering characteristics, and cost effectiveness. Test sections of the considered mixes were constructed during November 2010 on Illinois Route 72 from Hoffman Estates to Barrington. The research team conducted raveling, rutting, fracture, dynamic modulus, moisture susceptibility, and friction tests. Lab testing on the field samples began in March 2011 and will continue through summer 2011.

ICT is using innovative materials and construction techniques to provide IDOT with new HMA design alternatives.

Using the data collected, the investigators will perform an engineering benefit analysis and will provide IDOT with new mix designs that are durable, provide sufficient friction, and possibly lower noise. ■



IDOT's friction tester prepares for data collection on test section.



A quartzite sprinkle treatment is added to the test pavement.

PROJECT # R27-81
ICT Uses Full-Scale Testing to Optimize Unpaved Road Design

ICT is using full-scale testing to evaluate Illinois aggregates and verify their performance levels at various thicknesses. The full-scale testing will provide data regarding the aggregates' performance levels and ideal thicknesses linked to their properties and quality considerations.

The test sections of the aggregate materials (previously studied in a laboratory setting) were constructed at ATREL during fall 2010. Six different test cells, each with three different aggregate thicknesses, were loaded with the ATLAS accelerated loading system. The investigators measured permanent deformations that accumulated with ATLAS wheel passes under channelized traffic loading in two transverse locations in each test section. In addition, a total of 10 pressure cells were used to measure subgrade stresses during trafficking. The investigators used ground penetrating radar to measure the transverse rut profiles and

identify amounts of rutting in the subgrade and aggregate cover individually.

Through an innovative use of ground penetrating radar, ICT investigators were able to identify the levels of deformation in various layers of the test pavements.

After fully evaluating the test results, investigators will provide IDOT with recommended revisions to its Subgrade Stability Manual and specifications to potentially reduce expenditures for aggregates by optimizing treatment thickness and minimizing failures. ■



A full-scale test section is constructed at ATREL.



Researchers use ground penetrating radar to detect deformation.

Impact of Research

STRUCTURES

From monitoring specific bridges to developing innovative technologies to improve bridge design, the ICT has an ongoing role in assuring the safety of our nation's bridges.

PROJECT # R27-71

ICT Develops and Implements Sensor to Detect Scour Depth under Bridge Piers

Bridge scour, the erosion of stream material around the bridge foundation, is responsible for many of the bridge failures in the United States. An ICT study led by Farhad Ansari developed a fiber optic scour sensor capable of monitoring and providing quantitative characteristics of both scour depth and flow processes, i.e. rate.



Installation of the scour sensor.

ICT's new scour sensor includes fiber optic bragg grating and is embedded inside a rod cantilevered into the river bed. The project involved development, testing, modeling, and fabrication of the field sensor and field implementation and testing. The results proved that the simple concept of developing a very low cost sensor with only one sensing element is sound.

Because of its accuracy, simplicity, and low cost, ICT's new scour sensor can be widely implemented to improve bridge maintenance.

The simplicity of ICT's new sensor allows for widespread implementation in myriads of scour critical bridges. The new sensor will provide better monitoring of scour and therefore better bridge maintenance. ■



Instrument box at the bridge site for remote acquisition and wireless transfer of data.

PROJECT # R27-70

ICT Revisits Illinois Earthquake Resistance Strategy

ICT investigators are using both experimental and computational research to investigate, validate, calibrate, and adjust (if necessary) high-priority components of the current Illinois Earthquake Resisting System (ERS) strategy. The work will focus on the specific seismic hazard and structural characteristics appropriate for Illinois. IDOT is confident about the robustness of its developed ERS strategy but also realizes that more experiments and sophisticated finite element models would provide valuable information that could lead to improvements.

The basic idea behind the IDOT ERS is that the bridge deck should be isolated during major earthquakes (the bridge deck will stay nearly still while the ground moves the piers and abutments under

it). ICT researchers are performing experiments to simulate the large displacements anticipated for major seismic events, such as a repeat of the 1811-1812 New Madrid earthquakes, to investigate how the bearings will behave (How much force does it take for the deck to start sliding? How much damage does the bearing incur while sliding on piers and abutments?)

ICT researchers are simulating the large displacements anticipated for major seismic events, such as a repeat of the 1811-1812 New Madrid earthquakes, to investigate how the bridge bearings will behave.



IDOT technical review panel members visit the earthquake resistance bridge testing facilities at Newmark Lab on the UIUC campus.

The experimental data is then being used in computational models of full bridges to evaluate the performance of the bridge as a complete system (How does earthquake intensity correspond to forces in the bridge? What maximum displacements can be expected during large seismic events? How much permanent displacement is likely to remain at the bridge deck after an earthquake?)

Using the data obtained from the experiments and computer models, ICT will verify bearing fuse capacities and help to ensure prevention of span loss during a seismic event for appropriately designed bridges. ■



Impact of Research

INNOVATIVE SOLUTIONS

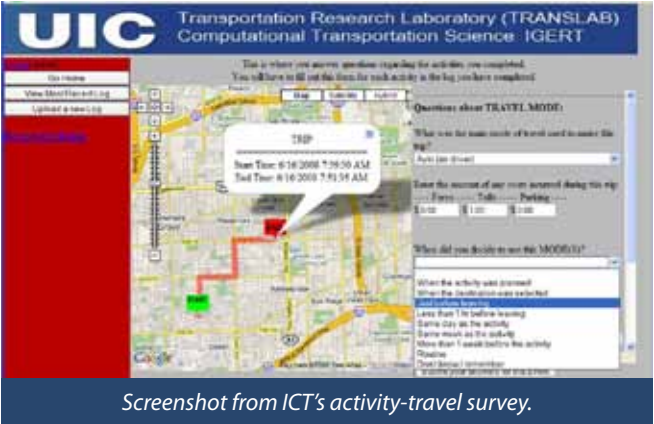
ICT’s work to develop transportation solutions is as varied as it is innovative and includes projects to encourage the use of public transportation and increase trucking commerce in Illinois.

PROJECT # R27-50
ICT Uses GPS Surveying Techniques to Help Chicago’s Mass Transit Agencies Better Serve an Aging Population

ICT investigators used an internet-based, prompted recall activity-travel survey using global positioning system (GPS) devices to collect activity-travel diaries and other necessary information from over 100 households in several northeastern Illinois counties.

ICT’s data sheds light on seniors’ activity-travel behavior and decision-making processes; these findings will be used to better target transit services to seniors.

A previous ICT study shed light on the factors that influence seniors’ choices about transit. For this follow-up study to better understand trip-chaining behaviors, each respondent was asked to carry a portable GPS device for 14 consecutive days and complete activity-travel survey questionnaires. The results provided much insight into both the GPS surveying method and the differences in travel behavior among age groups.



Screenshot from ICT’s activity-travel survey.

ICT determined that age affects some aspects of activity-travel behavior such as planning horizons, trip flexibility, and trip chaining practices. This study’s results will therefore be used to plan more efficient transit services targeting senior travelers and help change their attitudes toward public transportation. ■

PROJECT # R27-51
ICT Study Supports Trucking-Related Commerce in Chicago’s South Suburbs

A recent South Suburban Mayors and Managers Association (SSMMA)’s freight study designated the I-80 East Logistics Corridor as a development opportunity to attract truckers and trucking-related industries. ICT supports SSMMA’s continuing efforts



Truck traffic needs convenient locations to rest and refuel.

to encourage new business and meet the needs of truckers who provide pickups and deliveries to this area.

The ICT researchers categorized problems, developed a locally responsive design guide and engineering handbook, provided detailed site plans and designs to alleviate delivery problems, addressed scattered truck parking problems by identifying parking zones on major roads or small areas on otherwise unusable

ICT developed handbooks and webpages to help truckers navigate freight corridors, alleviate parking problems, and encourage trucking-related commerce in the I-80 area.

adjacent sites, and alleviated truck parking issues by forming agreements with property owners of existing facilities.

The team developed communications, both print and electronic, to help truckers safely and efficiently navigate the southern suburban freight corridors. The new resources include truck parking and rest facility locations, truck route maps, and emergency information. These resources make the south suburbs a choice destination for truckers, especially because other major trucking destinations are 10 to 11 hours away. This effort will ultimately help encourage trucking-dependent and manufacturing industries to stay, expand, or relocate to this area. ■

Impact of Research

TRAFFIC OPERATIONS & ROADSIDE MAINTENANCE

Working traffic signals and properly maintained roads are often taken for granted. So although ICT's work in these areas might go unnoticed, it leads to safer, more efficient, and more enjoyable travel for everyone.

PROJECT # R27-76

ICT Investigates the Cost-Effectiveness of Street Lights



LED roadway lights are set up on South Perimeter Road, near ATREL.

The use of light emitting diodes (LED) as a light source in roadway lighting has the potential to save energy costs and reduce the frequency of maintenance. Many cities nationwide have switched to LED traffic lights from high-pressure sodium lights. ICT is investigating technological advancements in LED roadway lighting to determine applications where IDOT can reduce costs or improve lighting.

ICT has studied typical lighting applications, including interstate,

urban arterial, intersection, bridge, streetscape, underpass, sign, highmast, and tunnel lighting and worked with the Village of Rantoul during August 2010 to set up a test site that included

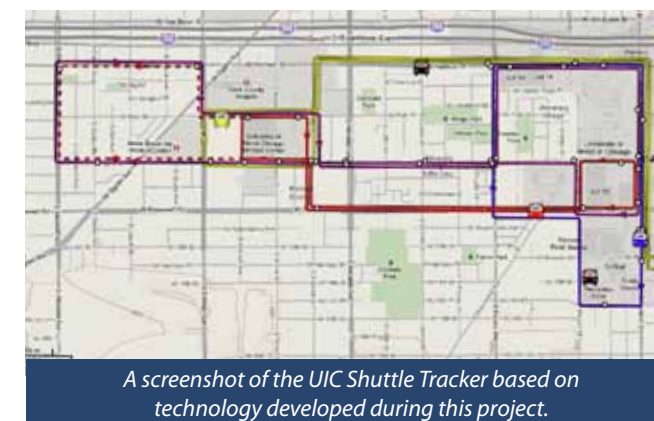
ICT is determining how IDOT can reduce costs and improve lighting.

high pressure sodium luminaries along South Perimeter Road near ATREL. The research team, led by Ray Benekohal, used two ways to measure how efficient the light bulbs are for street travelers: an illumination meter that measures light 6 inches from the road surface that shows how much light is coming from the bulb to the location of the road and a lumination meter that shows how much light is reflected from the road's surface.

In their findings, expected to be released during fall 2011, ICT will determine if LED lights have a longer life span and use less power for street lighting than the high-pressure sodium lights and if the manufacturers' claims for performance are achievable in Illinois conditions. The researchers will compare LED performance to existing light sources and provide economic justification to IDOT for or against the use of LED roadway lighting. ■

PROJECT # R27-91

ICT Deploys Pilot Project to Evaluate Traffic Monitoring Technologies



A screenshot of the UIC Shuttle Tracker based on technology developed during this project.

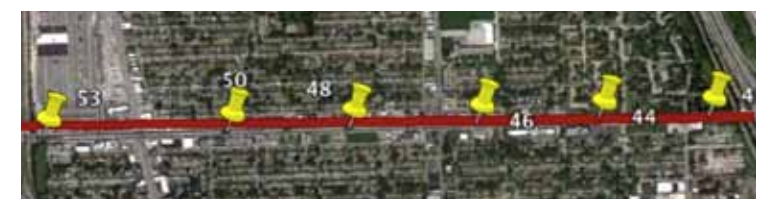
ICT is helping the City of Chicago select traffic management and information technologies for the corridor extending from Midway Airport to the Loop, also known as the Cicero-Midway Smart Corridor. Monitoring this corridor of arterial streets presents several challenges compared to monitoring highways due to the number of miles to be covered, the unlimited access, and the

spacing and impact of traffic signal controls.

To monitor performance and manage traffic, ICT investigator Jakob Eriksson has deployed and compared several different technologies, including a bus tracker based system, named Shuttletracker, WiFi-based travel time estimates, and probe-vehicle based estimates. This prototype project will support integrated corridor management strategies and enhanced information for travelers choosing route, mode, and time of day for travel to/from Midway Airport and the Loop. The long-term goals of this project are to improve corridor performance, improve air quality, reduce fuel consumption, and enhance traveler service and comfort. ■

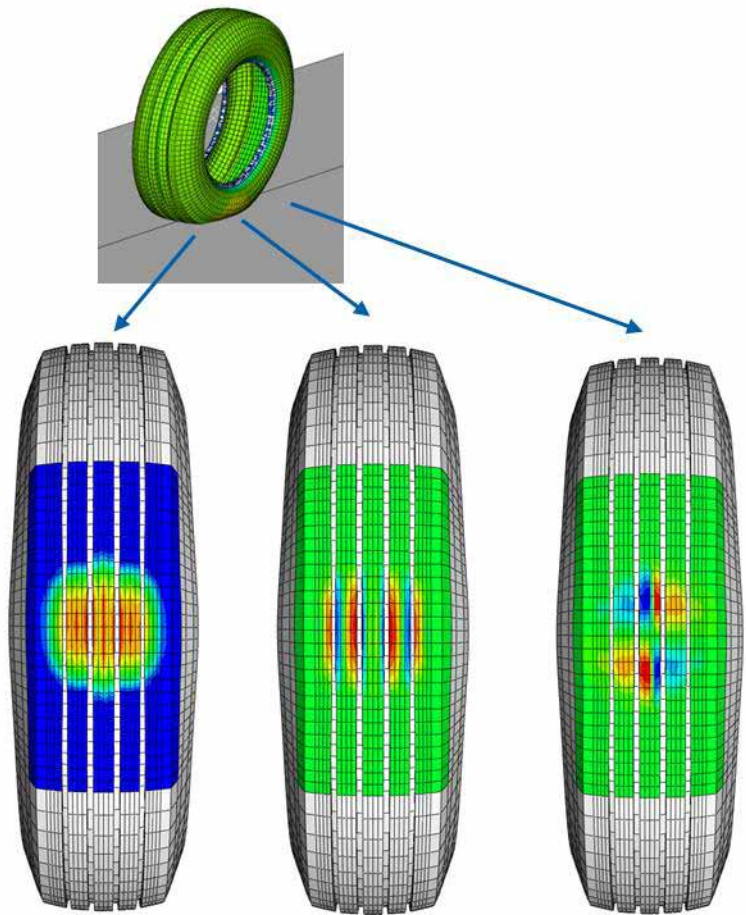


Pole-mounted WiFi monitor prototype.



Spatial distribution of the six-node prototype deployment along Cicero Ave (north = left).

UIC Shuttle Tracker, a next-generation bus tracking system developed as part of this ICT project, is used by 1,000 people every day.



Impact of Research

ADVANCED DEVELOPMENTS

ICT researchers lead the way in using new technologies to improve transportation. Advanced methods, such as 3-D modeling, optimization techniques, and smartphone applications, allow for more accurate data and more cost-effective, efficient, and sustainable travel.

Smartphone = Smart Travel

As smartphones show increased potential to monitor infrastructure and travel, ICT will be at the center of these developments. ICT affiliate Dan Work has developed and tested roles for smartphones in infrastructure monitoring, as part of the Mobile Millennium project in California. Mobile Millennium was developed with support from Caltrans, the U.S. DOT, Nokia, and Navteq, and uses smartphones equipped with a Global Positioning System (GPS) for real-time monitoring of traffic on highways and surface streets in Northern California. It then broadcasts traffic estimates back to the devices.

Because such systems rely on users opting in to contribute, a second component of Work's research is to design privacy aware sampling strategies for mobile devices. He designed Mobile Millennium to prevent user re-identification by an adversary, in col-

Smartphone technologies are being used to monitor traffic, provide travelers with traffic updates, and encourage public transportation.

laboration with researchers at Nokia Research Center in Palo Alto. Towards sustainable mobility, Work strongly believes that mobile internet services can also help commuters shift modes from private vehicles to public transit. He also developed a transit trip planner for mobile devices called Transitr to fill the critical gap



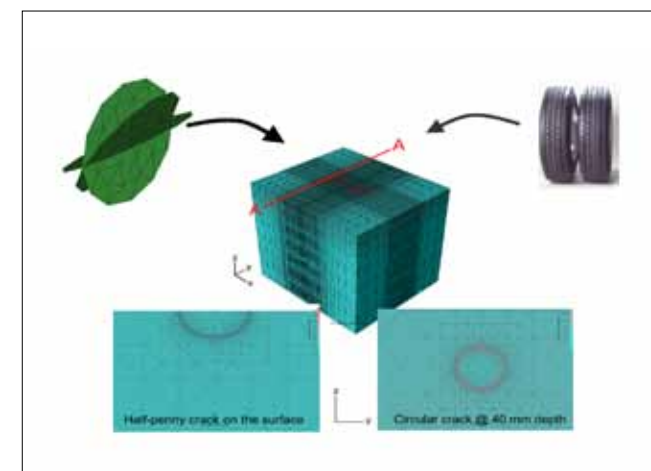
Mobile Millennium traffic client. Traffic is displayed directly on the phone screen, with traffic information (construction, accidents, etc.), and audio traffic reports. For drivers who want to opt in, the phone can also send information to the system (Lagrangian measurements).

between existing real time bus arrival systems which do not include routing, and the traditional static schedule based planners which lack real-time information.

Deployed in San Francisco, Seattle, Portland, and New York, Transitr users submit their origin and destination through a map-based iPhone application, and the server returns personalized route directions for the user. Mobile transit trip planning is an important step towards larger goals of mode shifting towards sustainable transit. ■

ICT Builds Advanced 3-D Models to Predict Pavement Performance

ICT researchers have extensive experiences and capabilities in pavement modeling based on computer simulation. A three-dimensional (3-D) modeling approach allows for consideration of various complex factors, including tire-pavement contact stresses, inelastic behavior of materials (viscoelastic asphalt layers, stress-dependent modulus for granular and subgrade materials), interface bonding conditions, and dynamic tire loading.



3-D pavement model illustrating contact stresses and cracks arbitrarily inserted on or near pavement surface.

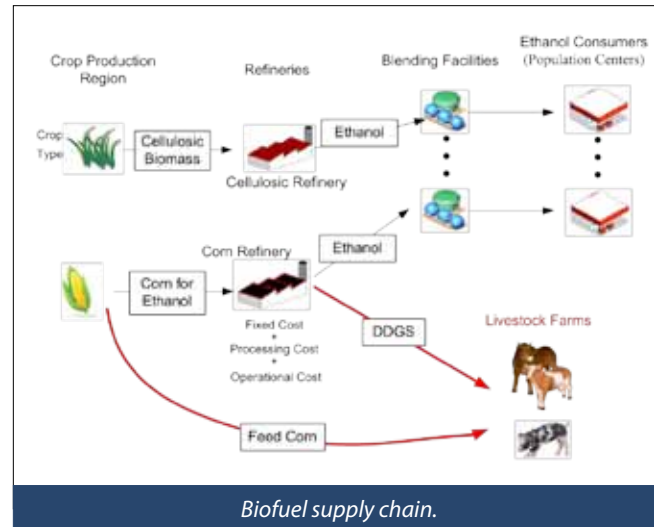
For example, ICT researchers use the 3-D measured contact stresses from tire-pavement interaction to model the pavement loading with moving tires at various loads, tire pressures, and speeds to identify the critical locations where pavement damage typically starts. The modeling results are often validated by full-

ICT's 3-D models predict pavement responses, including stresses, strains, and crack development.

scale testing and provide initial invaluable data for a much larger testing matrix than could be assembled in the field.

Another innovative use for modeling techniques is to better understand the cracking mechanisms in pavements. ICT researchers utilized novel numerical methods such as the Generalized Finite Element Method (GFEM) to realistically model the complex phenomena that control fracture initiation and propagation. They have adapted the GFEM to analyze relatively thick flexible pavement structures to predict near-surface cracking. The 3-D and highly multi-axial nature of the problem is successfully captured by this method, which is ideally designed for 3-D fracture problems for complex geometries and mixed loading conditions. ■

Optimization Techniques Determine Locations and Schedules



As the demand for freight and passenger transportation continues to grow, ICT helps ensure the sustainability and resilience of the transportation systems for current and future generations through optimization techniques. To plan, manage, and control transportation systems, ICT researchers use integrated systems analysis frameworks that incorporate innovative management concepts and advanced mathematical techniques.

For the National Science Foundation, ICT researcher Yanfeng Ouyang and his colleagues address the interdependence, resilience, and sustainability of complex infrastructure systems (e.g., transportation, agricultural, hydrological, ecological, social-economical) in the context of the fast-growing biofuel

production industry. While determining the optimal locations for biofuel refineries, for example, they incorporated agricultural development, roadway infrastructure expansion, shipment routing of feedstock and product, and the resulting traffic congestion impact into the model, so that the welfares of the biofuel industry, the agricultural farmers, and the general public are optimized.

Compared to the current industry practice, the outcome of optimization models reduced the total of travel costs and business rule violation penalties by over 60 percent.

ICT uses optimization techniques to improve transportation planning and operations in many other contexts. For example, Ouyang and his team developed multi-year pavement management programs to help IDOT prioritize rehabilitation activities. They also helped the railroad industry schedule track maintenance projects to keep the serviceability of the railroad network. These maintenance projects (of different types) cost billions of dollars each year, and they must be performed by specific maintenance teams with very complex business rules. A number of advanced network optimization models and efficient solution approaches were developed to minimize the total travel costs of the maintenance teams as well as the impact of maintenance projects on train traffic operations. Compared to the current industry practice, the outcome of their models reduced the total objective value (travel costs and business rule violation penalties) by over 60 percent. ■



In a project for CSX transportation, researchers maximized maintenance work while minimizing cost and impact on train operations.



The ICT website serves as a resource to the transportation community where interested parties can:

- Download all ICT's published final reports.
- Track the progress of ongoing research projects.
- View short videos on ATREL and ICT.
- Sign up for notification lists and the quarterly newsletter.
- View upcoming training and educational schedules.
- Follow news from ICT, ATREL, and the UI transportation program.

The screenshot shows the homepage of the Illinois Center for Transportation (ICT) website. The header includes navigation links: 'About ICT', 'Annual Progress Report', 'Facilities', 'Project Status', and 'Publications'. The main content area is divided into three columns: 'OVERVIEW', 'PROJECTS', and 'NEWS/EVENTS'. The 'OVERVIEW' column lists links such as 'Director's Welcome', 'Virtual Tour of ATREL', 'About ICT', 'Training', 'Facilities/ Resources', 'People', 'Job Opportunities', 'Links', 'ICT Forms/ Guidelines', 'Newsletter', and 'Research Needs/ RFPs'. The 'PROJECTS' column features a 'PROJECT STATUS' section with a 'PROJECT SPOTLIGHT' titled 'ICT Improves Work Zone Layouts', which includes a photo of workers and text about reducing work zone crashes. The 'NEWS/EVENTS' column lists recent news items, including 'Executive Committee Approves Eight New Projects', 'UI's Highway Research: Paving the Way for More than 100 Years', 'TRB Executive Director Visits ATREL, Speaks at Kent Lecture', 'ICT Research Useful for IL Construction Program', 'CEE Offers M.S. Degree Online', and 'ATREL Adds Asphalt Foaming Capabilities'. A 'News Archive' link is also present at the bottom right. A search bar is located at the bottom left of the main content area.

Visit ICT on the web at ict.illinois.edu.



OUTREACH AND EVENTS

ICT maximizes the impact of its research through outreach activities, which include training classes, workshops, and peer exchanges. Additionally, ICT publishes its research in a wide variety of publications and presents its research at numerous national and international conferences and events throughout the year.

PROJECT # R27-64 ICT Educates Responders about Highway Incident Management



Responders from various agencies discuss best practices for responding to highway incidents.

While responding to incidents, police, fire, EMS, and towing personnel encounter a dangerous work environment. ICT developed a new Highway Incident Management Guide that multiple agencies will use to improve their management of highway incidents.

The ICT developed training materials and events to educate responders from all agencies on how to improve their safety, work together more efficiently, and come home safe at the end of the day.

ICT investigators Huaguo Zhou and Ryan Fries developed training materials and training events to educate responders from all agencies on how to improve their safety, work together more efficiently, and come home safe at the end of the day.

The materials and training reinforce important topics such as safe parking, responder cooperation, and incident classification. Fries says, "Keeping Illinois responders safe is a priority to IDOT and ICT, and this training guide is a critical step in the right direction." ■

PROJECT # R27-49 ICT Completes Another Successful Season of Documentation Training

All consultants who perform construction inspection (Phase III) work for IDOT must take and pass the Documentation of Contract Quantities class administered by ICT. In 2010-2011, ICT

The ICT's training and certification classes ensure that quality construction and documentation practices are followed throughout the state.

offered 15 three-day classes that were attended by 542 people. ICT also offered eight re-tests to 131 previously certified consultants to renew their certifications. These classes and retests were held at numerous locations throughout the state.

This training, led by ICT instructor Mary Fries, assures well-educated, prequalified consultants to perform construction inspection in Illinois. This course is also offered to full-time IDOT and local agency personnel, which helps ensure that quality construction and documentation practices are followed throughout the state. ■



Mary Fries instructs a documentation class at ATREL.

PROJECT # R27-89

ICT Hosts Highway Safety Manual Workshop

A substantial development effort by several national transportation agencies (NCHRP, TRB, and AASHTO) led to the publication of the AASHTO Highway Safety Manual (HSM) First Edition. The HSM

ICT's workshop supports successful implementation of the Highway Safety Manual for Illinois and the rest of the nation.

is the first comprehensive document providing a scientific, data-supported decision-making tool for practitioners when considering safety explicitly during their daily work.

On November 17-18, 2010, ICT hosted a peer to peer workshop to facilitate the systematic and effective implementation of the HSM in Illinois. More than 100 participants attended the event, representing 13 lead state DOTs and the private sector. ■



One hundred participants attended ICT's workshop to implement the Highway Safety Manual.

ICT Investigators and Students Present More than 45 Research Topics at Annual Transportation Research Board Meeting



ICT affiliates enjoy a group dinner while attending TRB.

ICT researchers presented at more than 45 sessions at the Transportation Research Board (TRB) Annual Meeting which convened in Washington D.C. on January 23-27, 2011. The ICT/UIUC researchers presented their cutting edge research on diverse topics and participated in various committee meetings and other conference activities.

Approximately 10,000 transportation officials from around the world attended this conference which covers all transportation modes, with more than 3,000 presentations in nearly 600 sessions addressing topics of interest to all attendees that included policy makers, administrators, practitioners, researchers, and representatives of government, industry, and academic institutions. ■

ICT Participates in First Congress of the Transportation and Development Institute



Organizers of the First Congress. Pictured from left to right: Jonathan C. Esslinger, P.E., F.ASCE, CAE, Director, Transportation and Development Institute of ASCE; Imad Al-Qadi, Ph.D., P.E., Dist.M.ASCE, Congress Co-Chair; Robert Stevens, Ph.D., P.E., AICP, ASCE Technical Region Director; Kathy J. Caldwell, P.E., M.ASCE, President, American Society of Civil Engineers; Terry M. Donovan, P.E., M.ASCE, President, Transportation & Development Institute of ASCE; Scott Murrell, P.E., M.ASCE, Congress Co-Chair.

ICT had a strong presence at the First Congress of the Transportation and Development Institute (T&DI) of the American Society of Civil Engineers that convened in Chicago on March 13-16. ICT exhibited at the conference; ICT investigators presented on several topics; ICT Director Imad Al-Qadi served as co-chair; and ICT Investigator Bill Buttlar served as a track co-chair.

The four-day event brought together 240 attendees to discuss integrated strategies focusing on smart development and efficient multimodal movement of people and goods to support the economic pulse of our nation and the world. The impressive technical program included five concurrent paper/presentation tracks, technical tours that included O'Hare International, and pre-Congress workshops. ■

ICT Sponsors Illinois Bituminous Paving Conference and T.H.E. Conference

The ICT serves as a sponsor for two major conferences on the UIUC campus. The 51st Annual Bituminous Paving Conference convened in December 2010 and had a record attendance of 275.



David Lippert, IDOT Bureau Chief, Materials and Physical Research, welcomes attendees.

The 97th Annual Transportation and Highway Engineering (THE) Conference convened in February 2010 and attracted nearly 1000 attendees. ■



Attendees mingle at the annual Illinois Bituminous Paving Conference.



2010-2011 KENT LECTURE SERIES INCLUDES EXECUTIVE DIRECTOR OF TRB BOB SKINNER

ICT was proud to welcome the Executive Director of the Transportation Research Board (TRB) of the National Academies Robert Skinner to campus and ATREL on April 5, 2011. Mr. Skinner was the guest speaker of the distinguished Kent Lecture series where he discussed "Transportation and Sustainability: Strategies to Reduce Green-House Gas Emissions and Improve Energy Security" to a room full of transportation students, faculty, and other interested attendees.

The Paul F. Kent Distinguished Lecture, initiated in 2007, honors outstanding leadership in the field of transportation engineering. Paul Kent was a 1920 graduate of the University of Illinois in Civil Engineering. As a highway contractor and a materials supplier, he owned and operated two Champaign-based companies, General Paving and Builders Supply. Throughout his professional career he expressed his highest regard and great esteem for the education in civil engineering he received at the University of Illinois.

The Kent Distinguished Lectures are sponsored by the Paul F. Kent Memorial Fund, established in 1977 to support education in transportation engineering. The fund also includes a weekly transpor-

tation seminar series for transportation students and anyone else who wishes to attend. The attendees are always served pizza and soda. The speakers during the past year included:

- Dr. Serji Amirkhanian, Consultant
- Behzad Behnia, UIUC
- Amanda Bordelon, UIUC
- Alex Brand, UIUC
- James Krstulovich, Applied Pavement Technology, Engineering Associate
- Zhen Leng, UIUC
- Deb Mishra, UIUC
- Jorge Pais, University of Minho (Portugal)
- Ricardo Serpell, UIUC
- Sarfraz Ahmed, UIUC
- Dong Wang, UIUC
- Eyad Masad, Texas A&M University
- Stephen Muench, University of Washington
- Balasingam Muhunthan, Washington State University
- Hazan Ozer, UIUC
- Onur Pekcan, UIUC
- Hao Wang, UIUC

PUBLICATIONS AND CONFERENCES

RESEARCH PUBLISHED

A variety of publications and media, including those listed below, feature ICT research:

ACCIDENT ANALYSIS & PREVENTION

ADVANCES IN STRUCTURAL ENGINEERING

ASPHALT CONTRACTOR

BETTER ROADS

CEE MAGAZINE (UIUC ALUMNI PUBLICATION)

CHICAGO TRIBUNE

EARTHQUAKE SPECTRA

ENGINEERING STRUCTURES

ENGINEERING, CONSTRUCTION AND ARCHITECTURAL MANAGEMENT

EUROPEAN JOURNAL OF ENVIRONMENTAL AND CIVIL ENGINEERING

FHWA TRANSPORTATION AND CLIMATE CHANGE NEWSLETTER

HTTP://STREAMSTATS.USGS.GOV/ILSTREAMSTATS/

INGENERIA DICTUC

INTERNATIONAL JOURNAL OF PAVEMENT ENGINEERING

INTERNATIONAL JOURNAL OF ROAD MATERIALS AND PAVEMENT DESIGN

INTERNATIONAL JOURNAL OF TRANSPORTATION RESEARCH

INTERNATIONAL JOURNAL OF TRANSPORTATION SYSTEMS ENGINEERING AND INFORMATION TECHNOLOGY

JOURNAL OF CIVIL ENGINEERING MATERIALS

JOURNAL OF CONSTRUCTION ENGINEERING AND MANAGEMENT

JOURNAL OF ENGINEERING MECHANICS

JOURNAL OF NONDESTRUCTIVE TESTING & EVALUATION

JOURNAL OF PUBLIC TRANSPORTATION

JOURNAL OF SOLIDS AND STRUCTURES

JOURNAL OF TESTING AND EVALUATION

JOURNAL OF THE ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS

JOURNAL OF THE CHINESE CERAMIC SOCIETY

JOURNAL OF THE MECHANICS AND PHYSICS OF SOLIDS

JOURNAL OF TRANSPORTATION ENGINEERING

RANTOUL PRESS

SIUE'S RESEARCH AND CREATIVE ACTIVITIES

THE JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA

THE NEWS-GAZETTE

TRAFFIC TECHNOLOGY INTERNATIONAL

TRANSPORTATION RESEARCH RECORD: JOURNAL OF THE TRANSPORTATION RESEARCH BOARD

WCIA-TV

RESEARCH PRESENTED

ICT affiliates were invited to present their research at numerous events throughout the year, including:

16TH ANNUAL GREAT LAKES GEOTECHNICAL AND GEOENVIRONMENTAL CONFERENCE

59TH ANNUAL ILLINOIS TRAFFIC ENGINEERING AND SAFETY CONFERENCE

90TH ANNUAL MEETING OF THE TRANSPORTATION RESEARCH BOARD

97TH ANNUAL TRANSPORTATION AND HIGHWAY ENGINEERING (T.H.E) CONFERENCE

2011 GREEN COUNCIL ANNUAL MEETING OF THE ILLINOIS ROAD & TRANSPORTATION BUILDERS ASSOCIATION

2011 TRANSPORT CHICAGO

ASCE AIRFIELD AND HIGHWAY PAVEMENTS CONFERENCE

AASHTO RESEARCH ADVISORY COMMITTEE ANNUAL MEETING

AMERICAN ROAD AND TRANSPORTATION BUILDERS' TRANSPORTATION CONSTRUCTION MANAGEMENT TCM-2 CONFERENCE

ANNUAL MEETING OF THE AMERICAN ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS

COLLEGE OF ENGINEERING INDUSTRY ADVISORY BOARD

EIGHTH ANNUAL MIDWEST BRIDGE SYMPOSIUM

FHWA WARM MIX EXPERT TECHNICAL GROUP MEETING

FIRST CONGRESS OF THE TRANSPORTATION AND DEVELOPMENT INSTITUTE OF THE ASCE

FIRST GSI-ASIA GEOSYNTHETICS CONFERENCE

GEOSHANGHAI 2010

GREATER IOWA ASPHALT CONFERENCE

HIGH TIRE PRESSURE TESTS WORKSHOP, TOULOUSE, FRANCE

ILLINOIS BITUMINOUS PAVING CONFERENCE

ILLINOIS TOLLWAY AUTHORITY BOARD OF DIRECTORS MEETING

INTERNATIONAL WORKSHOP ON ENERGY AND ENVIRONMENT IN DEVELOPMENT OF SUSTAINABLE ASPHALT PAVEMENTS

NINTH INTERNATIONAL CONGRESS ON ADVANCES IN CIVIL ENGINEERING

UNIVERSITY OF ILLINOIS AT CHICAGO DISTINGUISHED LECTURE

UNIVERSITY OF PUERTO RICO-MAYAGUEZ

UNIVERSITY OF TEXAS A&M DISTINGUISHED SEMINAR SERIES

AWARDS & HONORS

ICT congratulates its investigators, staff, and student researchers on the following awards and honors received during fiscal year 2010-2011.



IBRAHIM ABUAWAD AND KIVANC AVRENLI, both ICT student researchers, were part of a team from the University of Illinois at Urbana-Champaign that placed second at the 2010 Midwestern Traffic Bowl Competition, sponsored by the Institute of Traffic Engineers.

UI's Traffic Bowl Team celebrates by the Mississippi River after the competition.



SARFRAZ AHMED, former ICT student researcher, has started as Assistant Professor at the National University of Sciences and Technology in Pakistan. Ahmed was a constant fixture in front of the fracture testing machine at ATREL.



Al-Qadi receives congratulations from George Ghareeb, the President of the ASCE's Central Illinois section



BASSEM ANDRAWES, ICT project investigator, received the National Science Foundation Faculty Early Career Development Award. Andrawes will receive \$400,000 over the next five years to develop and study a new technology that uses smart materials to reinforce lifeline concrete structures with the aim of mitigating damage from strong earthquakes.



JONGUEN BAEK, ICT researcher, has started as Research Professor at the Department of Civil and Environmental Engineering at Sejong University in Korea.



AMANDA BORDELON, former ICT student researcher, passed her qualifying exam for her PhD work on, "Flowable Fibrous Concrete for Thin Concrete Inlay Pavements" and has accepted a position at the University of Utah at Salt Lake City.



FRANCISCO EVANGELISTA JUNIOR, ICT student researcher, received an award from the Graduate Research Award Program on Public-Sector Aviation Issues. This award program is sponsored by the U.S. DOT, FAA, and administered by the Airport Cooperative Research Program of the Transportation Research Board.

The title of his proposed research is "Prediction of Potential Cracking Failure Modes in Airfield Rigid Pavements Due to New Generation Aircraft and Environmental Effects."



EVGUENI T. FILIPOV, ICT student researcher, has been selected to receive a National Science Foundation (NSF) Graduate Research Fellowship. NSF Fellows are anticipated to become experts who can contribute significantly to research, teaching, and innovations in science and engineering. Filipov

was also recently awarded the 2010-2011 Structural Engineers Foundation Scholarship.

Filipov, left, with his student colleges on ICT's earthquake resistance project.



RYAN FRIES, ICT project investigator, was student-nominated for the Chi-Epsilon James M. Robbins Award Excellence in Teaching Award.

Fries (first from left) stands with other collaborators for ICT's incident management training.



ALI HAJBABAIE, ICT student researcher, received the Best Student Paper Award at the American Society of Civil Engineers (ASCE) First Transportation and Development Institute Congress. The title of his paper was “Common or Variable Cycle Length Policy for a More Efficient Network Performance.”

Hajbabaie receives award at ASCE conference.



JAIME HERNANDEZ, ICT student researcher, received the 2011 Society of Hispanic Professional Engineers Chicago Scholarship Award.



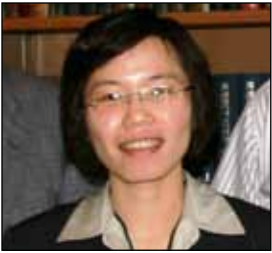
PRASANTA KALITA, ICT project investigator, received the Senior Faculty Award for Excellence from the University of Illinois College of ACES. He also received the Engineering Council Award for Excellence in Advising and the Rose Award for Teaching Excellence from the College of Engineering.



XIAOPENG LI, ICT student researcher, was selected to receive a 2010 Dwight David Eisenhower Graduate Fellowship from the FHWA. Li was also recognized with a “Best Doctoral Dissertation Presentation Award” at the 90th Annual Meeting of the Transportation Research Board in Washington, DC, January 2011 for his presentation, “Reliable Facility Location Design and Traffic Sensor Deployment under Probabilistic Disruptions.”



ZONGZHI LI, ICT project investigator, won the Arthur M. Wellington Prize from the American Society of Civil Engineers.



JIE LIN, ICT project investigator, received third place for “Modeling Commercial Vehicle Daily Tour Chaining” at the TRB-SHRP2 Freight Modeling and Data Symposium in Washington D.C. in September 2010.



LIANG LIU, ICT project investigator, received the University of Illinois at Urbana-Champaign’s Undergraduate Advising Award. He also won the ASCE-UIUC Chapter Outstanding Teaching Award 2010 and the Engineering Council Award for Excellence in Advising in 2011.



JIM MEISTER, ICT research engineer, was awarded the Annual Civil and Environmental Engineering Staff Award for Excellence at the University of Illinois at Champaign-Urbana.



SCOTT OLSON, ICT project investigator, was selected to take part in the National Academy of Engineering’s second Frontiers of Engineering Education symposium. The three-day event assembled 53 of the nation’s most innovative young engineering educators to share ideas, learn from research and best practice in education, and leave with a charter to bring about improvement in their home institutions. Olson was also the first recipient of the University of Illinois at Urbana-Champaign’s CEE Undergraduate Advising and Mentoring Award.



YANFENG OUYANG, ICT project investigator, was promoted to the rank of Associate Professor with indefinite tenure at the University of Illinois at Urbana-Champaign.



HASAN OZER, ICT student researcher, passed his qualifying exam for his PhD work on “Development of Domain Integral and Generalized Finite Element Methods for Three-dimensional Analysis of Near-surface Cracking in Flexible Pavements” and has started at UIUC as a Research Assistant Professor.

Ozer testing recycled asphalt pavement at ATREL.



JEFFREY ROESLER, ICT project investigator, was promoted to the rank of Full Professor at the University of Illinois at Urbana-Champaign.



TIMOTHY STARK, ICT project investigator, won the R.S. Ladd D18 Standards Development Award for Standard Designation D7608: Standard Test Method for Torsional Ring Shear Test to Determine Drained Fully Softened Shear Strength and Nonlinear Strength Envelope of Cohesive Soils from the American Society for Testing and Materials in 2011.



EROL TUTUMLUER, ICT project lead, has been named the first Director of International Programs for the University of Illinois at Urbana-Champaign’s Department of Civil and Environmental Engineering.



HAO WANG, former student researcher, passed his qualifying exam for his PhD work on “Analysis of Tire-pavement Interaction and Pavement Responses using a Decoupled Modeling Approach” and has accepted a faculty position at Rutgers.
Wang poses with his committee after passing his PhD exam.



HUAGUO ZHAO, ICT project investigator, received the 2010 Outstanding Research Award from the Southern Illinois at Edwardsville School of Engineering.

NUMEROUS ICT RESEARCHERS have been named to 2010 List of Teachers Ranked as excellent by their students. This list is compiled after each semester, and is based on the evaluation forms filled out by students. Faculty members receiving this honor include: Imad Al-Qadi, Bassem Andrawes, William Buttlar, Carlos Armando Duarte, Khaled El-Rayes, Larry Fahnestock, Youssef Hashash, Dan Kuchma, James LaFave, Liang Liu, James Long, John Popvics, and Timothy Stark.

ICT Study Selected As Regional High Value Research Project

An ICT project is included in the American Association of State Highway and Transportation Officials (AASHTO) Research Advisory Committee (RAC) Value of Research task force’s public relations brochure on high value research. The brochure was prepared for the AASHTO Standing Committee on Research, for whom RAC serves as an advisory body, and for state DOT CEOs.

Each state was asked to submit their high value research efforts to their RAC Region Chair for consideration for inclusion in the brochure. Each region then voted on their top four projects. Balloting among the nine states in Region 3 (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Ohio, and Wisconsin) resulted in the ICT study, “Speed Photo-Enforcement in Illinois Work Zones,” being selected as one of the top regional high value research projects.

The Principal Investigator for “Speed Photo Enforcement in Illinois Work Zones” was Dr. Rahim Benekohal of the University of Illinois at Urbana-Champaign. The objective of the project was to determine the effectiveness of speed photo-radar enforcement in work zones as compared to traditional enforcement methods such as police presence and speed indicator signs.

Speed photo-radar enforcement was found to be most effective at reducing speeds for both cars and trucks. As a result, Illinois has implemented speed photo-radar enforcement statewide in work zones using specially trained state police officers to deploy vans equipped with speed photo-radar enforcement equipment, review and approve violations for citation issuance, and appear in court for adjudication of all approved work zone citations.



Lori Carpenter (ICT), Amy Schutzbach (IDOT), Patty Broers (IDOT), and Brian Pfeifer (FHWA) represented the ICT at the AASHTO RAC meeting in Kansas City during July 2010.

RESEARCH PROJECT APPENDIX

SAFETY ENGINEERING

PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
R56 Speed Photo Enforcement	The effects of using speed-radar photo enforcement (SPE) systems on traffic flow characteristics and safety in work zones were evaluated using criteria such as: speed reduction, speed variation/uniformity, speeding violations issued, and other very similar criteria. The effects of SPE on average speed of vehicles and percentage of speeding drivers were compared to the effects of police presence, signs displaying the driver's speed, and combinations of these treatments. Outcome: Determined the net effects of using SPE to improve work zone safety.	Rahim Benekohal	Juan Medina, Ming-Heng Wang, Ali Hajbabaie, & Madhav Chitturi	Priscilla Tobias	Completed
R27-SP1 Median Cable Scanning Tour	The investigators for this project participated in a scanning tour of Ohio, Oklahoma, and Texas to study these states' use of high-tension cable barriers. After gathering information on system characteristics and performance, the investigators then evaluated alternative high-tension cable barrier systems and products for use in Illinois. The final report identified barrier-based approaches to reduce the number and severity of freeway median crossover crashes in Illinois. Outcome: High-tension cable barriers were implemented in Illinois.	Rahim Benekohal	Juan Medina	David Lippert	Completed
R27-2 Nighttime Construction: Evaluation of Lighting Glare for Highway Construction in IL	This project evaluated lighting glare during nighttime highway construction in Illinois and developed practical tools and objective lighting design criteria for nighttime construction operations. Outcome: Provided IDOT with a scientific and objective approach for specifying the required lighting standards in nighttime highway construction projects.	Khaled El-Rayes & Liang Liu with Mostafa Elseifi & Marwa Hassan (Bradley University)	Joe Wakim, Ibrahim Odeh, & Omar El-Anwar	Dennis Huckaba	Completed
R27-SP14 Texas-AASHTO Retroreflective Sign Sheeting Specifications	When IDOT was appointed chair of an American Association of State Highway and Transportation Officials (AASHTO) effort to develop a specification that will simplify and improve how sign sheeting materials will be specified for state DOTs, an ICT representative attended a sign sheeting research demonstration in College Station, Texas in May 2009. ICT then provided input into the specifications and documented the demonstration. Outcome: Newly proposed sign sheeting specifications for AASHTO and IDOT.	Liang Liu		Kelly Morse	Completed
R27-18 Crash Data Analysis & Engineering Solutions for Local Agencies	This project evaluated other states' safety service programs for local agencies and developed a plan to establish a successful Illinois program, created a searchable database of local roads crashes, analyzed crash data, developed reports useful to local agencies, and provided crash analysis to local agencies. Outcome: Developed tools to allow Illinois local agencies to plan safety based highway improvements.	Yanfeng Ouyang with Zongzhi Li (IIT)	Jang-Hyeon Jo	Kevin Burke	Completed
R27-20 Develop Safety Performance Functions for Illinois	Using descriptive and advanced statistical techniques, this study will provide IDOT with analytical tools to identify and manage a program of site-specific and systematic improvements with the end goal of reducing fatalities and severe injuries from motor vehicle crashes. The project deliverables include a prototype software and a user's guide. Outcome: Developed SPF models that will be used to screen for candidate locations in Illinois for safety improvements.	Yanfeng Ouyang	Robert Tegge & Jang-Hyeon Jo	Dave Piper	Completed
R27-21 Alternative Intersections - Roundabout Evaluation and Design	Roundabouts, an alternative intersection design, have been used in several other states, and IDOT is interested in promoting their use at appropriate locations to improve safety. This study identified ten intersections in Illinois that have the potential to reduce fatalites and injuries using a roundabout design, evaluated existing roundabout design software, and obtained feedback from IDOT district and central offices about roundabouts. Outcome: Developed design/selection guidelines for roundabouts in Illinois.	Rahim Benekohal	Varun Atluri	Sean Coyle	Completed

PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
R27-40 Safety Impacts of Shoulder Attributes in Illinois	This study analyzED the extent to which the presence/absence and width of paved shoulders contribute to vehicle crashes by severity and type; assessed the safety effectiveness of shoulder paving; indentified, mapped, located, and defined the potential for safety improvements for individual highway segments; and ranked and prioritized highway segments with high potential for safety improvements for rural two-lane and multilane highways in Illinois in the most cost-effective manner. Outcome: Ranked and prioritized highway segments for shoulder paving and updated current guidelines and practices for IDOT shoulder paving.	Zongzhi Li (IIT)	Ketankumar Patel, Sirisha Bhimireddy, Jonathan Tam, Radhika Bamzai, & Yongdoo Lee	Dave Piper	Completed
R27-52 Studying & Minimizing Traffic-Related Work Zone Crashes in Illinois	The objectives of this project include analyzing the frequency and severity of traffic-related work zone crashes in Illinois, conducting a comprehensive analysis to investigate the probable causes and contributing factors of work zone crashes in Illinois, and evaluating the practicality and effectiveness of the Illinois Comprehensive Highway Safety Plan proposed strategy of adding temporary/portable rumble strips within and prior to work zones. Outcome: Developing practical recommendations for improved work zone layouts and merge techniques that minimize the probable causes of work zone crashes in Illinois.	Khaled El-Rayes & Liang Liu	Tarek El- Ghamrawy & Ibrahim Odeh	Marshall Metcalf	Active
R27-66 Effectiveness of Innovative Speed Enforcement Techniques in Illinois	This study will identify the most effective speed enforcement patrol and saturation patrol procedures and methods, including effective enforcement duration and appropriate staffing level needs in order to more efficiently deploy valuable resources and maximize results. The analyses will result in a better understanding of the impact of the presence/absence and duration of speed enforcement on Illinois highways and how the reduction of speed correlates to the reduction of severe crashes. The findings will allow IDOT and the Illinois State Police to better allocate their resources and ultimately reduce speed-related accidents on Illinois highways. Outcome: Developing best practices for patrol and saturation patrol procedures.	Hani Mahmassani & Roger Chen (Northwestern)	Alireza Talebpour	Priscilla Tobias & Scott Abbott (ISP)	Active
R27-67 National Safety Performance Function (SPF) Summit	Safety Performance Functions (SPF) are analytical tools developed in a previous ICT project. They are used to identify and manage a system-wide program of site-specific and systematic improvements to develop strategies to prevent and reduce fatalities and severe injuries resulting from motor vehicle crashes. The objective of this project is to convene a national SPF summit to discuss various ongoing and emerging activities and issues regarding the development and implementation of SPFs in order to support system-wide screening for locations with potential for mprovements. Such a summit will also assist practitioners with the implementation of the proposed AASHTO Highway Safety Manual Key. Outcome: Introduced the concept of SPFs to a wider audience and facilitated the exchange of ideas and best practices related to SPFs.	Yanfeng Ouyang	Yun Bai, Xiapeng Li, Mohammad Nourbakhsh, Fan Peng, & Mary Nokes	Priscilla Tobias	Completed
R27-89 Illinois Highway Safety Manual Workshop	On November 17-18, 2010, ICT hosted a peer to peer workshop to facilitate the systematic and effective implementation of the Highway Safety Manual (HSM) in Illinois. The HSM is the first comprehensive document providing a scientific, data-supported decision-making tool for practitioners when considering safety explicitly during their daily work. Outcome: The HSM workshop facilitated the manual's implementation in Illinois and other states.	Yanfeng Ouyang & Santanu Chakraborty		Priscilla Tobias	Active
R27-90 Investigation of Contributing Factors RE: Wrong-Way Driving on Freeways	The objective of this project is to identify trends with wrong-way crashes (geometric designs, certain locations, age groups, etc.) and then to identify systematic and policy changes that will address the trends indentified. Outcome: Determining contributing factors to wrong way driving on freeways and ways to reduce these errors and related crashes.	Huaguo Zhou, Ryan Fries, Brent Vaughn, & Chiang Lin (SIUE)	Jiguang Zhao, Mostafa Reisi Gahrooei, & Gang Xu	Dave Piper	Active
R27-97 Evaluation of Flashing Yellow Arrows (FYA) for Protected/ Permissive Left Turn (PPLT) Control	This research will evaluate the effectiveness of flashing yellow arrows (FYA) at protected/permissive left turn signals in terms of safety and operations. The information gained will help IDOT quantify the safety and operational benefits of upgrading to FYA displays. Outcome: Improving intersection safety for Illinois motorists.	Kerrie Schlattler	Jessica Lund, Utkarsh Pandey, & Ashley Rietgraf	Randall Laninga	Active

*Principal Investigators are UIUC affiliated unless otherwise noted ; general projects will list the ICT Director as PI.

SAFETY ENGINEERING CONT.

PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS	PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
R27-111 Effects of Intersection Right-Turn Lane Design and Skew on Safety and Operations	The research will include (1) a detailed crash-based evaluation of six test intersections; and (2) observational studies to assess operational characteristics and driver performance at selected test intersections. Outcome: Quantifying the safety, operational and economic benefits of these right-turn lane treatments to determine if they are effective countermeasures that should be implemented in candidate locations in the future.	Kerrie Schlattler		Sean Coyle	New	R27-19 Pier Scour Prediction in Cohesive Soils: Use of EFA-SRICOS Method in IL	To asses scour in cohesive sediments, a new methodology, The Scour Rate in Cohesive Soils-Erosion Function Apparatus (SRICOS-EFA) has been developed and is being evaluated along with the current methodology used in Illinois for non-cohesive sediments (primarily sand), HEC-18. The SRICOS-EFA method is being tested for estimating scour depth of cohesive soils to potentially validate its use for Illinois streams. The project will then compare the SRICOS-EFA method to the HEC-18 scour estimates. Outcome: Validated and calibrated scour assessment methodology for Illinois streams.	Timothy Straub (US Geological Survey)	Michael Drog & Joseph Parker	Matt O'Connor	Completed
STRUCTURES/HYDRAULICS/GEOTECHNICAL						R27-24 Evaluation/ Modification of IDOT Foundation Piling Design & Construction Policy	The objective of this study was to assess IDOT's and other methods for estimating pile capacity, to improve IDOT's methods if possible, and to determine resistance factors appropriate for the methods. This study reports pile load test data along with pile driving information and subsurface information, and uses this information to investigate and quantify the accuracy and precision with which five different static methods and five different dynamic formulae predict capacity. Three databases were assembled and used to quantify the ability of these methods to predict capacity. Outcome: Developed an improved method for estimating pile length and capacity.	James Long	Josh Hendrix & Alma Baratta	William Kramer	Completed
R54 Precast Deck Beam Lifting Loops	To address a lack of published guidance on the design of lifting loops for shallow members, this study reviewed current practices and tested a range of lifting loop arrangements. Outcome: Developed a standard for the fabrication, embedment, anchorage, and use of lifting loops in precast deck beams, with an emphasis on shallow precast members that are 11 and 17 inches deep.	Daniel Kuchma & Christopher Hart	Jason Motsinger & Bryan Fehrenbacher	Kevin Riechers	Completed	R27-25 Modification of IDOT Integral Abutment Design Limitations & Details	Because the former guidelines and limitations that apply to intergral abutment bridges (IABs) had several gaps and grey areas, IDOT requested further investigation. The objective of this project was to develop and document rational guidelines and limitations for IABs as well as construction and monitoring plans for instrumenting existing and/or planned IABs. A more rational design approach will allow pile and soil modifications to meet the demands of an IAB for conditions in which they currently may not be considered. Outcome: Developed a new design approach for IABs in Illinois.	Scott Olson & James Long	James Hanson & Dzuigas Renekis	William Kramer	Completed
R27-SP2 Chicago Bridge Deck & Bridge Piers	This project, which required a quick turnaround, evaluated damaged bridge columns at two locations in the City of Chicago. After a highway bridge girder suddenly collapsed on the Chicago Kingery Expressway, the columns were evaluated for internal structural damage and the reinforcement steel condition was identified. For the Dan Ryan Expressway (I-90/94) bridge decks, a non-destructive evaluation was conducted using ground penetrating radar to measure the reinforcement cover depth. Outcome: Rapid response saved additional testing and repair costs and reduced construction delays and costly construction downtime. Timely and accurate measurements of the Dan Ryan Expressway bridge resulted in IDOT changing its rehabilitation technique, which saved millions of dollars in repair costs.	Imad Al-Qadi & John Popovics	Wie Xie & Gonzolo Centrangelo	David Lippert	Completed	R27-26 Free-Cutting Brass Breakaway Couplings	The objective of this project is to evaluate the design of a free-cutting brass breakaway coupling device for use in supporting light poles. Free-cutting brass breakaway coupling devices could be used to replace the currently used aluminum or steel couplings and potentially save IDOT significant resources. The evaluation will consist of a finite element analysis of brass couplings to predict distribution of stresses and experimental testing of single and four-couplings assemblies to evaluate energy absorbing capacity. Outcome: Quantifying the energy absorbing capacity of different shapes of single, and multiple brass couplings and developing a prototype shape for brass couplings to use in full-scale crash testing.	Daniel Kuchma	Sang-Ho Kim & Heui Hwang Lee	Christopher Hahin	Active
R27-SP7 Non-Destructive Evaluation of Reinforced Concrete Structure	As part of this project, low-volume, older bridges in Illinois were evaluated to ensure their structural integrity. Because most of the damage to these bridges is likely to be near the bottom or internal, the bridges were evaluated using innovative nondestructive testing technology. Outcome: Developed procedure for evaluating older bridges in Illinois with non-destructive technology.	Imad Al-Qadi & John Popovics	Sara Alzate Diaz	David Lippert	Completed	R27-35 Simple Cost Effective Scour Sensor	The objective of this project was to develop a simple sensor for detection of scour depth under the bridge piers and abutments. The sensor principle is based on optical fiber transduction of scour. The research involved development, testing, and fabrication of the prototype sensor assembly, laboratory prototype testing, modeling, fabrication of field sensor, and field implementation. Outcome: Developed a fiber optic scour sensor capable of monitoring and providing quantitative characteristics of both scour depth and flow processes, i.e. rate that will allow for better monitoring of scour and therefore better bridge maintenance.	Farhad Ansari (UIC)	Amirhossein Iranmanesh	Dave Copenbarger	Completed
R27-SP12 DeKalb County Bridge Collapse Investigation	This project consisted of a forensic investigation of the collapse of Bridge No. SN 019-5010 in DeKalb County, Illinois on August 19, 2008. Comprehensive experimental and analytical studies were conducted to determine the primary cause of failure. Outcome: Determined that structural overload, leading to fracturing of the timber piles in combined compression and flexure, was the likely reason for the bridge failure.	Bassem Andrawes, Jerome Hajjar, & Scott Olson	Daniel Borello, James Hansen, & Jason Buenker	Jim Klein	Completed	R27-36 Transfer/ Development Length of Prestressing Tendons in AASHTO I-Girders Using S-C Concrete	The increasing interest among Illinois precasters in using self-consolidated concrete (SCC) in bridge girders motivated this synthesis study, which reviewed and combined information from literature discussing the impact of using SCC on the transfer and development lengths of prestressing tendons in AASHTO bridge girders. The study utilized the results of previous research to evaluate the effect of using SCC on the transfer and development lengths of prestressing tendons, evaluate how SCC compares with conventional concrete, and investigate the feasibility of using SCC in AASHTO bridge girders without the need for changing current design provisions recommended by the ACI and AASHTO. Outcome: Provided IDOT with recommendations regarding the application of SCC in prestressed bridge girders.	Bassem Andrawes	Moochul Shin	Thomas Domagalski	Completed
R27-6 Illinois StreamStats	This project developed and serviced Illinois-StreamStats, an automated Internet Map Server (IMS) which produces discharge determinations at rural sites. Illinois-StreamStats is interfaced with the National Flood Frequency program to generate peak flood discharges at various frequencies. The web-based program is easily accessible and offers consistent and reliable solutions to the equations and methodology contained within the 2004 United States Geological Survey (USGS) report. Outcome: Developed web program that reduced the time and resources, and consequently costs, required to size bridge and culvert waterway openings and to prepare other water resources studies.	David Soong, Audrey Ishii, & Jennifer Sharpe (US Geological Survey)	Alisa Halm, King Shan Kwok, & Christopher Hamblen	Matt O'Connor	Completed						
R27-9 I-39 Kishwaukee Bridge Monitoring	A distributed intelligent bridge monitoring system was developed for the Kishwaukee Bridge to provide continuous health information. The long-term monitoring effort has yielded a variety of data which spans several years, including measurements such as bridge deck acceleration, temperature changes, crack opening displacement data from local deformation gages, modal frequencies, shear strain at known crack locations, and daily truck traffic. Outcome: Determined possible structural changes and guided retrofit strategies for compromised bridge components, ensuring the bridge's integrity and stability into the future.	Ming Wang (UIC)	Jinsuk Yim	Todd Ahrens	Completed						

STRUCTURES/HYDRAULICS/GEOTECHNICAL CONT.

PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS	PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
R27-55 Instrumentation & Monitoring of “Extreme” Integral Abutment Bridges in Illinois	This project builds on a previous ICT project to improve the economy and applicability of integral abutment bridges (IABs) in Illinois. The researchers will select, instrument, and monitor one or more IABs to verify current design assumptions, validate the numerical analyses from the previous project, measure actual soil/foundation/abutment performance, and monitor the long-term behavior of these systems. Outcome: Revised Bridge Manual to expand the use of integral abutment bridges, improve design methods and construction procedures, and verify performance of these structures in Illinois.	Scott Olson & James Long	Jason Buenker	William Kramer	Active	R27-82 Strengthening of Bridge Wood Pilings Retrofits for Moment Resistance	The primary objective of this research is to develop enhanced repair / retrofitting techniques for bridges supported on wood pilings through the application of fiber reinforced polymer (FRP) composites and other suitable materials. Outcome: Savings in the significant costs associated with chemically treating or replacing deteriorated bridge wood piles; increasing the longevity of wood piling bridges which would reduce the demand for new bridge construction; increasing the public safety, and avoiding future bridge catastrophic failures.	Bassem Andrawes	Jay Bose	Dan Tobias	Active
R27-56 Transfer & Development Lengths in Prestressed Self-Consolidating Concrete Bridge Box & I-Girders	This research will assess and experimentally evaluate the effect of using self-consolidating concrete (SCC) on the transfer and development lengths of prestressing tendons in prestressed box and I-girders which are commonly used in Illinois bridges and compare it with the ACI and AASHTO code requirements. Outcome: Completing essential step towards adopting the technology of SCC in the state of Illinois.	Bassem Andrawes	Andrew Pozolo	Thomas Domagalski	Active	R27-88 Bridge Decks: Mitigation of Cracking & Increased Durability	This project includes testing and analytical research to refocus Illinois’ efforts to build bridge decks that exhibit less cracking over time in conjunction with increased durability. Outcome: Developing a systematic technique for re-implementing high-performance concrete into Illinois’ bridge decks.	Paramita Mondal & Doug Foutch with Riyadh Hindi (Bradley University)		Dan Tobias	Active
R27-57 Superiority & Constructability of Fibrous Additives for Bridge Deck Overlays	This study will evaluate the advantages fibrous additives can add to the performance of bridge deck concrete overlays, which can in turn lead to substantial life-cycle cost savings, an aesthetic product, good riding quality, and enhancement in the overall structural behavior and performance of bridges. Outcome: Documenting recommendations and guidelines on the design and construction of high performance, durable, and crack resistant overlay mixtures with fiborous additives.	Mohammad Alhasan & Suleiman Ashur (Purdue)	James Welch, Nicholas Fenton, Steve Aime, & Brad Smith	Gary Kowalski	Active	R27-98 Evaluation of Concrete Cylinder Match Curing & Evaluation of 4"x8" Cylinders	This research will determine if match curing that uses a mold or a chamber is acceptable, the required specifications, and an accurate measure of strength at various ages for precast prestressed products. The research will evaluate the use of 4”x8” concrete test cylinders as a substitute for the standard 6”x12” cylinders and will determine if a correlation between a 4”x8” and 6”x12” cylinder is needed. Outcome: Establishing performance standards for match curing of concrete test cylinders to reduce production time and costs.	John Popovics	Suyun Ham	Doug Dirks & Dan Tobias	Active
R27-69 Improved Design for Driven Piles Based on a Pile Load Test Program in Illinois	This project initiates pile testing to improve pile foundation designs. The Pile Driving Analyzer (PDA), CAPWAP program, and static load testing will be used to increase the maximum nominal required bearing designers can specify to reduce the number and/or weight of piles; decrease the difference between estimated and driving pile lengths to reduce cutoffs and splice lengths by development of local bias factors; increase reliance on pile setup to increase the factored resistance available to designers; reduce risk of pile driving damage during construction; and increase resistance factor (decrease factor of safety) based on increased data and confidence from load tests in and near Illinois. Outcome: Developing more efficient, cost-effective pile foundation designs.	James Long	Andrew Anderson & Dave Hall	William Kramer	Active	R27-99 Improvement for Determining the Axial Capacity of Drilled Shafts in Shale in Illinois	This research will identify, quantify, and implement methods to better design drilled shaft foundations in shale in Illinois. Outcome: More efficient design and decreased cost for drilled shafts found in shale.	Tim Stark & James Long		William Kramer	Active
R27-70 Calibration & Refinement of Illinois’ Earthquake Resisting System Bridge Design Methodology	This project will use both experimental and computational research to investigate, validate, calibrate, and adjust (if necessary) high-priority components of the current Illinois Earthquake Resisting System strategy. The work will focus on the specific seismic hazard and structural characteristics appropriate for Illinois. A new strategy will lead to a more rational and consistent bridge design approach that can best balance necessary structural safety with design methodologies, construction practices, and construction costs appropriate for the state of Illinois. Outcome: Developing refined seismic design criteria specific to the needs of Illinois.	James LaFave, Jerome Hajjar, Larry Fahnestock, & Doug Fautch	Joshua Steelman & Evgueni Filipor	Daniel Tobias	Active	R27-105 Improvement of IDOT Bridge Scour Estimation Method at Sites with Cohesive Soils Using SRICOS Zmax - Phase II	A previous ICT project (R27-19) showed that the IDOT cohesive soil reduction-factor method may not always provide the best estimate of scour prediction and that using SRICOS Zmax may improve this prediction. This study will test 15 additional sites and compare these SRICOS Zmax predictions with measured scour data. Outcome: Improved scour assessment methodology for Illinois streams.	Timothy Straub (US Geological Survey)		Neil Vanbebber	Active
R27-71 Field Implementation and Evaluation of the Simple Cost-Effective Scour Sensor	The objective of this project was to implement and evaluate a scour sensor that was developed in a previous ICT project. The investigators performed comprehensive field testing on a multi-span bridge with several piers and examined various design parameters in terms of sensor dimensions, scour depths, resolution, and numerical calibration schemes. The optimum sensor parameters were selected based on these parameters. The research focused on installation of several sensors at different pier locations and interface software for simultaneous detection of scour. Outcome: Developed design and installation details and performed field implementation and instrumentation for the scour sensor.	Fahrad Ansari (UIC)	Ali Zarafshan & Amirhossein Iranmanesh	Dave Copenbarger	Completed	R27-106 Formability of New High Performance Grade 50 Structural Steel	This new steel offers high toughness, atmospheric corrosion resistance, weldability, and machinability. Outcome: Determining the formability of new steel for use as the base material for structural tubing.	To Be Determined by RFP Process		Chris Hahin	New
R27-80 Fatigue Testing of Brass Breakaway Couplings	This project will determine the fracture characteristics of the free-cutting brass breakaway couplings in either a pendulum or full-scale crash test at an FHWA-certified crash test facility in order to place these couplings in actual service and to evaluate their fatigue life under stress. Outcome: Potential cost savings due to use of and new source for brass breakaway couplings.	Grzegorz Banas & Fred Lawrence	Joseph Rudd	Chris Hahin	Active	R27-107 ILoad Testing of Rapid Deployment Plate and Tube Short-Span Bridge for County Roads	This research will involve building a structure with rapid deployment plate and tube and testing it to verify the design assumptions used in its development. Outcome: Validating rapid-deployment plate and tube bridges.	To Be Determined by RFP Process		Chris Hahin & Tom Winkleman	New
						R27-115 Analysis of Superstructures of Integral Abutment Bridges	This purpose of this project is to create more robust integral abutment bridge superstructures by improving the understanding of the effects of skew, gravity, and thermal loading on the integral abutment bridges. Outcome: Stronger and more optimized integral bridge superstructure designs.	To Be Determined by RFP Process		Mark Shaffer	New
						R27-116 Investigation of Methods and Approaches for Collection and Recording of Roadway Inventory Data	The objective is to evaluate the available techniques and methodologies for collecting and storing roadway asset data needed to fully support IDOT’s implementation of the recently published Highway Safety Manual. Outcome: Improved safety of roads through the implementation of safety performance functions available.	To Be Determined by RFP Process		Dave Piper	New
						R27-117 National State Safety Engineers and Traffic Engineers Peer to Peer Workshop	This workshop will focus on the implementation of a variety of safety engineering and traffic operations countermeasures and initiatives including the new federal rules. Outcome: Cost-effective approach to learning from other states so Illinois can improve on implementation of strategies and initiatives.	To Be Determined		Priscilla Tobias & Aaron Weatherholt	New

						PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
CONSTRUCTION						R39-2 Nondestructive Pavement Evaluation Using ILLI-PAVE Based Artificial Neural Network Models	The objective of this project was to develop advanced pavement structural analysis models for more accurate solutions with fast computation schemes. Soft computing and modeling approaches, specifically the Artificial Neural Network (ANN) and Genetic Algorithm (GA) techniques, were implemented to develop forward and backcalculation type pavement analysis models based on the validated nonlinear ILLI-PAVE finite element solutions of the most commonly found/constructed flexible pavements in the s tate of Illinois. Outcome: Created a pavement evaluation toolbox that can be used for rapidly and more accurately backcalculating field or in-service pavement layer properties and thicknesses; predicting critical stress, strain, and deformation responses of these in-service pavements in real time from the measured falling weight deflectometer deflection data; and incorporating predicted pavement responses directly into IDOT’s mechanistic pavement analysis and design.	Erol Tutumluer & Marshall Thompson	Onur Pekcan	Charles Wienrank	Completed
R27-30 Evaluation of 3-D Laser Scanning for Construction Applications	This project evaluated the feasibility of using laser technology to monitor IDOT highway construction activities and transportation structures. Data obtained using laser scanning technology was compared to data obtained using traditional methods. Outcome: Validated a cost-effective and accurate laser technology, which can impact the efficiency and cost control of future construction projects.	Dianne Slattery & Kerry Slattery (SIUE)	Brandon Egelhoff, Joe Vickey, & Brian Schuh	Ted Nemsky	Completed						
R27-49 Documentation of Contract Quanitites Training	Beginning in 2009, the ICT took over the administration of the Documenta-tion of Contract Quantities class. Documentation certification is required for all consultants to become prequalified with IDOT to perform construction inspection (Phase III) work. Students in this class learn to document contract quantities in compliance with state and federal standards. The class covers project diary entries, quantity book preparation, the cross-reference system, extra work reports, and the measurement and calculation of pay items for pay quantities occurring in road and bridge plans. Outcome: Well-trained, prequalified consultants to perform construction inspection in Illinois.	Imad Al-Qadi	Mary Fries	Mike Renner	Active						
R27-86 An Expert Systems Approach to Highway Construction Scheduling	This project will develop a software product that leads engineers through the schedule logic design process by means of a graphical user interface that “visualizes” construction operations as they progress over time. Outcome: Improving the accuracy of the engineer’s estimate of contract time required for highway construction projects.	Dianne Slattery, Kerry Slattery, and Richard Bruce (Missouri State)		Mike Ripka	Active						
PAVEMENT DESIGN & MANAGEMENT/MATERIALS						R44 Self-Consolidating Concrete	The objective of this project was to better understand how self-consolidating concrete (SCC) performs in fresh and hardened states and to provide protocols and criteria for specifications and test procedures for SCC mixtures and construction practices. The investigators based their investigation on the extensive reconstruction of I-74 through Peoria, IL, which used SCC for over 20 miles of retaining wall structures. Outcome: Developed six new test methods for measurement of SCC performance.	David Lange & Leslie Struble		James Krstulovich	Completed
						R53 Concrete Distress Identification	This project included two distinct studies related to concrete distress. The first identified the cause of distress observed in relatively new pavement in Valmeyer, IL, and the second was to assess the alkali-silica reactivity (ASR) of chert. Outcome: Provided valuable input for pavement design and mainte-nance procedures due to a better understanding of ASR deterioration.	Leslie Struble		Brian Pfeifer	Completed
R28-1/ R27-60 Mechanistic-Empirical (M-E) Design, Implementation & Monitoring for Flexible Pavements	This project provides technical support to IDOT concerning the mechanistic-empirical (M-E) design, implementation, and monitoring of flexible pave-ments. Although UIUC researchers developed M-E-based flexible pavement design concepts and procedures for IDOT in previous projects (IHR-510 and IHR-527), which have been implemented, IDOT continues to support a variety of M-E design, implementation, and monitoring activities. Outcome: Developing improved M-E flexible pavement design proce-dures for the IDOT Bureau of Design and Environment and the Bureau of Local Roads & Streets.	Marshall Thompson & Imad Al-Qadi		David Lippert & Charles Wienrank	Active						
R28-2 Binder/ Mixture Testing and Analysis	As mechanistic designs rely more on dynamic modulus predictions, the generation of rheological binder data (G*) and rheological mixture data (E*) becomes more crucial. This project provided support for data reduction, interpretation, and included limited testing. Dynamic Shear Rheometer data for IDOT binders was analyzed to develop indications of the expected dynamic modulus, E*. Outcome: Developed a method to support rheological mixture selections for different binder grades.	Samuel Carpenter		Amy Schutzbach	Completed						
R39-1 Validation of Extended Life HMA Pavement Design	This research provided test data for dynamic modulus and fatigue for 21 current IDOT mixes in accordance with the AASHTO 2002 data requirements for pavement design. The fatigue testing validated fatigue algorithms and illustrated the existence and magnitude of a fatigue endurance limit. Full Depth HMA sections were constructed, instrumented, and response tested with the falling weight deflectometer and the ATLAS. Nine binder mixes were tested for rich bottom binder fatigue characterization. Outcome: Validated material behavior for an improved design procedure for extended life HMA pavements.	Samuel Carpenter & Marshall Thompson	Shannon Beranek & Chris Dunbar	Amy Schutzbach	Completed	R57 Evaluation & Implementation of Improved CRCP & JPCP Design	This study refined IDOT’s jointed plain concrete pavement (JPCP) design and developed a continuously reinforced concrete pavement (CRCP) design pro-cess based on M-E principles and recent findings, including the release of the new M-EPDG. The new developments in the proposed design process include fatigue damage accumulations at the critical top and bottom location in the CRCP slab, equations for calculating the equivalent damage ratio for several shoulder types and crack stiffness values, application of a strength reduction factor to the concrete stress ratio calculated at the surface of the CRCP, and a new logistic-type punchout prediction model. Outcome: Developed input for two IDOT design guides: 1) mechanistic-empirical continuously reinforced concrete pavement and 2) jointed plain concrete pavement.	Jeffery Roesler	Matthew Beyer, Amanda Bordelon, Jake Hiller, & Dong Wang	Amy Schutzbach	Completed

PAVEMENT DESIGN & MANAGEMENT/MATERIALS CONT.

PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS	PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
R58 Cost-Effectiveness & Performance of Overlay Systems / Crack Control Methods in IL	This project used theoretical approaches, laboratory experiments, and field evaluations to evaluate different rehabilitation methodologies and gain a better understanding of crack initiation, propagation, and control mechanisms. Cracks were quantified in the field by using image analysis and ground penetrating radar (GPR) surveys. The researchers also conducted advanced laboratory material characterization and developed finite element models to simulate crack initiation and propagation as well as to simulate various interlayer systems. The cost-effectiveness of interlayer systems through life-cycle cost analysis (LCCA) was also investigated. Outcome: Introduced a method to better identify reflective cracking in the field using digital imaging and GPR signal analysis and developed a decision-making procedure for selecting a cost-effective interlayer system in the state of Illinois when HMA overlay is used for pavement rehabilitation.	William Buttlar & Imad Al-Qadi	Jongeun Baek & Minkyum Kim	Joe Vespa	Completed	R27-SP17 Warm Mix Asphalt Study	The objective of this project is to evaluate the performance characteristics of asphalt mixtures produced with new technologies and materials and provide a method of comparison between the mixtures. Outcome: Providing IDOT with decision tools to implement warm mix asphalt mixtures, recycled asphalt shingles, and alternative friction aggregates.	Imad Al-Qadi, Jeff Kern, & Jim Meister		Tom Zehr	Active
R59 Evaluation of Pavement Damage Due to New Tire Designs	This project quantified pavement responses due to various tire designs, including the wide-base tire, through advanced modeling and accelerated pavement testing. Wide base tires have the potential to provide numerous benefits to the trucking industry, including increased fuel efficiency and hauling capacity and lessened gas emission and cost. However, a source of concern has been that they may cause increased damage to highway pavements. This research showed that wide-base tires actually have similar total pavement impact on the interstate highway pavements as the dual-tire system; although the pattern of damage could be different. By addressing potential concerns, this research demonstrated that wide-base tires have the potential to benefit the nation's trucking industry and the environment. Outcome: Improved asphalt thickness selection by characterizing pavement response due to different tire designs and a quantification of expected savings from wide-base tires, through hauling more goods and lowering the impact on the environment, showing expected savings to be in the billions of dollars.	Imad Al-Qadi	Hao Wang	Mark Gawedzinski	Completed	R27-1 Characterization of IL Aggregates for Subgrade Replacement and Subbase	This project examines the characteristics of Illinois aggregates to determine relationships between different aggregate properties and IBR/ IBV and the sensitivity of the aggregate IBR/IBV to changes in moisture content. The strength, stiffness, and deformation behavior of various types and qualities of aggregate commonly used in Illinois will be characterized for an improved prediction of cover thickness requirements and field performances. The findings, which could reduce treatment thickness and help avoid aggregate failures, will be incorporated into the Subgrade Stability Manual to allow consideration of aggregate characteristics when determining thickness. Outcome: Recommended revisions to IDOT's Subgrade Stability Manual and Specifications will reduce expenditures for aggregate in subgrade applications.	Erol Tutumluer with Abbas Butt (ERI)	Debakanta Mishra	Riyad Wahab	Completed
R27-SP3, SP5, SP9, SP13 Profile Equipment Verification (PEV) - FY06 - FY09	This program certified that contractors' profilograph machines, which measure the smoothness of pavements, met IDOT standards. Clean, marked test lanes with an initial baseline profile for comparison were set up as a test track at the Rantoul Airport. Then, contractors' machines were tested on the track, and the results were forwarded to IDOT. All contractors wanting to work with the state needed to have their machine tested on this track. Outcome: Implemented a program to guarantee the accuracy of pavement smoothness ratings for state of Illinois work.	Imad Al-Qadi, Samer Dessouky, & James Meister		David Lippert & LaDonna Rowden	Completed	R27-3 Design & Concrete Material Requirements for Ultra-Thin Whitetopping Procedures	Ultra-thin whitetopping (UTW) is a pavement rehabilitation strategy where a thin layer of concrete is placed on top of an existing hot-mix asphalt pavement. This research provided IDOT with a UTW thickness design method and guidelines for UTW design, concrete material selection, and construction practices. Outcome: Developed structural design and construction guidelines for UTW and appropriate concrete material requirements to achieve a design of the intended service life and disseminated these guidelines to local agencies.	Jeffery Roesler with Anastasios Ioannides (University of Cincinnati)	Amanda Bordelon, Matthew Beyer, & Dong Wang	James Krstulovich	Completed
R27-SP6 2008 RILEM Conference on Cracking in Pavements	The ICT planned and served as the major sponsor for the Sixth RILEM International Conference on Cracking in Pavements on June 15-19, 2008, in Chicago, Illinois. The conference drew nearly 200 attendees from 29 countries and included the presentation of 89 papers from more than 20 countries. Outcome: Facilitated the development and discussion of ground-breaking research regarding pavement cracking and introduced the ICT to the international pavement community.	Imad Al-Qadi		David Lippert	Completed	R27-8 Hot Mix Asphalt (HMA) Sampling	This project promoted an understanding of successful methods and practices currently used to sample HMA during production and placement. During the project, sufficient data was collected to allow IDOT's personnel to recommend the optimum technique for HMA sampling in future projects. Outcome: Improved quality control/quality assurance regulations for Illinois HMA sampling.	Mostafa Elseifi (Bradley University)		Jim Trepanier	Completed
R27-SP11 Analysis of I-57 Recycled CRCP Cores	Cores that were extracted from the Continuous Reinforced Concrete Pavement (CRCP) inlay by IDOT were analyzed for the presence of deleterious alkali-silica reactivity (ASR) to make an accurate assessment of the performance of this recycled concrete pavement. Outcome: Independent analysis helped IDOT determine if there was deleterious ASR or an inadequate air void system in the recycled concrete experimental CRCP section on I-57.	Jeffery Roesler	Greg Huntley	Mark Gawedzinski	Completed	R27-11 Determination of Usable Residual Asphalt Binder in RAP	Illinois has been using reclaimed asphalt pavements (RAP) in hot-mix asphalt (HMA) pavements since 1980, but the optimal design of these pavements has continually been questioned. Therefore, this project investigated the use of RAP with up to 50% of the total original material. The research focused on understanding the interaction between the new and recycled asphalt components using state-of-the-art technologies, including scanning electron microscopy, to quantify the effectiveness of using RAP in HMA. Outcome: Developed a scientifically proven approach to optimize the use of RAP in new pavements.	Imad Al-Qadi & Samuel Carpenter with Mostafa Elseifi (Bradley University)	Geoff Roberts, Hasan Ozer, Qazi Aurangazeb, & Greg Huntley	Jim Trepanier	Completed
R27-SP16 Evaluation of Horizontal Directional Drilling (HDD)	This project studies the effects of horizontal directional drilling (HDD) for utilities under pavement to aid the state of Illinois in writing policies and procedures for administering HDD permit requests. Outcome: Documenting recommendations for HDD that consider the overall safety, aesthetic quality, costs, and difficulty of construction and maintenance of both utilities and roadways.	Youssef Hashash		Terri Petersen	Active	R27-12 Cold In-Place & Full Depth Recycling with Asphalt Products (CI & FDRwAP)	This research evaluated and contributed to the facilitation and implementation of currently available Cold-In-Place Recycling and Full Depth Recycling with Asphalt Products (CIR&FDRwAP) technology. An "information/data" survey was conducted; ten selected CIR&FDRwAP projects were documented and evaluated; mixture properties (modulus, strength, fatigue) were established; thickness design options were evaluated; mixture design approaches were evaluated; and construction aspects were considered. Outcome: Developed guidelines for CIR&FDRwAP and recommended it as a standard procedure instead of an "experimental feature."	Marshall Thompson & Samuel Carpenter	Luis Garcia	Kevin Burke	Completed

PAVEMENT DESIGN & MANAGEMENT/MATERIALS CONT.

PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS	PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
R27-27 Expansive Characteristics of Recycled Materials Used as Pavement Base Materials	Current IDOT specifications do not allow the use of reclaimed asphalt pavement (RAP) in the pavement substructure layers. The implications of this exclusion are being studied by first identifying the expansive nature of RAP sources statewide and secondly by establishing guidelines for blending recycled and virgin aggregates for the pavement substructure use. The effects that RAP materials may have on pavement performance will also be researched. Outcome: Developed a test method for the expansion of RAP aggregate and determined the maximum acceptable level of expansion for different RAP aggregate types, properties, and blending proportions with virgin aggregates.	Erol Tutumluer & John Popovics	Derya Deniz	Sheila Beshears	Completed	R27-62 Material Quality Testing Risk Assessment & Multi-State Peer Exchange	The objective of this peer exchange was to benchmark Illinois material testing in relation to other states and to determine needed courses of action to limit risk of material quality related failures in a declining staff environment. Illinois can benefit from learning how other states focus their limited staff to keep risks, such as obtaining poor materials and insuring proper materials are being supplied, in check and how their internal testing programs have been modified/reduced/eliminated/maintained/expanded to be in line with the risk of failure of the item. Outcome: Determined if Illinois can reduce its level of testing for material acceptance or if the risk warrants continued testing and reestablishment of key testing capability/staffing.	Timothy Murphy (Murphy Pavement Technology)	Lisa Taccola	David Lippert	Completed
R27-28 8 th International Conference on Bearing Capacity of Roads, Railways & Airfields (2009)	The ICT sponsored the Eighth International Bearing Capacity of Roads, Railways & Airfields (BCR2A) Conference on the UIUC campus. The main objective of the BCR2A Conference was to promote efficient design, construction, and maintenance of the transportation infrastructure by addressing issues related to the bearing capacity of roads, railways, and airfields.	Erol Tutumluer		David Lippert	Completed	R27-63 Evaluation of the Long-Term Durability of Joints Cut Using Early-Entry Saws on Rigid Pavements	This project established the current national state-of-the-practice regarding the use of early entry sawing for concrete pavements and discuss how it differs from IDOT's current conventional wet sawing technique. Differences in freeze-thaw durability and resistance to deicers between conventionally sawed joints and early entry sawed joints were determined. The expected joint durability of no-seal joints when cut using early entry techniques was evaluated compared to IDOT's standard practice for saw cuts. The joint performance as a function of cut depth and time was also considered. Outcome: Developed definitive recommendations on whether the early entry sawing technique is viable for IDOT work.	Thomas Van Dam & Kurt Smith (APTech)	James Krustulovich	Mark Gawedzinski	Completed
R27-37 Impact of High RAP Content on Pavement Structural Performance	Agencies in Illinois are attempting to use up to 50% recycled or reclaimed asphalt pavement (RAP) in HMA to realize economic savings. However, the structural behavior and durability differences resulting from such a recycling operation have not been addressed. This project will examine the effect of high RAP contents on mixture structural and durability properties. The structural and durability properties will be determined for varying RAP percentages to illustrate any detrimental effect of high RAP percentages and/or varied binder grades. Outcome: Re-evaluation of current recommendations for RAP percentages and binder grade.	Samuel Carpenter & Imad Al-Qadi	Geoff Roberts, Hasan Ozer, & Qazi Aurangazeb	Jim Trepanier	Active	R27-77 Evaluating Pavement Markings on Portland Cement Concrete & Various Asphalt Surfaces	This research will evaluate the pavement marking system compatibility with different hot-mix asphalt (HMA) mixtures. Outcome: Determined matrix of compatibility of marking systems with different HMA mixtures.	Carmine Dwyer & Bill Vavrik (ARA)		Kelly Morse	Active
R27-38 Development of an Improved Specification for Maximum Plastic Concrete Temperatures	This project is investigating the effects of high plastic concrete temperature on the performance and properties of concrete. After determining the temperature specifications used by other states and best practices with regard to warm temperatures and concrete properties, laboratory tests will be conducted to examine particular effects of high plastic concrete temperature on performance and properties of concrete. A better understanding of the effects of higher temperatures on fresh and hardened concrete properties will be gained. Outcome: Developing improved specifications and procedures to assure quality of concrete placed at higher temperatures in Illinois.	John Popovics & Jeffery Roesler	Carrie Peterson & Andres Salas	Derek Parish	Active	R27-78 Evaluating the Effects of Various Asphalt Binder Additives/ Modifiers of Moisture Sensitivity in HMA	This research will evaluate the various methods IDOT has used to improve moisture resistance of hot mix asphalt (HMA) pavements, including polymer modification, liquid anti-strip (A-S) additive, polyphosphoric acid (PPA) modified polymer and hydrated lime slurry. Outcome: Documented performance of asphalt binder additives/modifiers on HMA pavements.	Imad Al-Qadi & Sam Carpenter	Ibrahim Abuawad	Jim Trepanier	Active
R27-41 Performance of I-57 Recycled Concrete Pavement	The state of Illinois first used recycled concrete aggregate (RCA) 20 years ago to rehabilitate a section of I-57. This project summarized and documented this pavement section's performance and compared it to similarly aged and trafficked continuously reinforced concrete pavements (CRCP) in Illinois. The project's tasks included: a structural evaluation of I-57 CRCP using distress surveys collected by IDOT, a functional evaluation of I-57 CRCP using friction and IRI data collected by IDOT, and an evaluation to check for the presence of alkali-silica reaction (ASR) or any other deleterious reaction. Outcome: Validated the future use of recycled concrete aggregate in Illinois while documenting considerations for implementation.	Jeffery Roesler	Greg Huntley	Mark Gawedzinski	Completed	R27-79 Designing, Producing & Constructing Fine-Graded Hot Mix Asphalt (HMA) on IL Roadways	This project will characterize the properties of fine-graded (F-G) mixes in order to provide a fair comparison with course-graded (C-G) mixes, which have been used historically in Illinois and are currently specified (indirectly) by gradation band limits, especially for N90 and N105 mixes. Outcome: Improved understanding of F-G mixes and their capabilities for potential cost benefits.	William Buttlar, Tim Murphy, & Bill Pine	Ibrahim Abuawad, Eschan Dave, & Tor Chiawat	Laura Shanley & Matt Mueller	Active
R27-42 Thin Long-Lasting High Friction Surface Layer	The intention of this study is to develop a new surface cross section that utilizes locally available aggregate materials as much as possible. This requires a fresh look at hot-mix asphalt (HMA) cross-section, including the job mix formulae of the composition layers, their engineering characteristics, and cost effectiveness. The surface layer is expected to be efficient and effective regarding noise, durability, friction, and life cycle cost. Outcome: Developing a cost-effective surface mix design that is durable and provides sufficient friction and possibly lower noise.	Imad Al-Qadi & Sam Carpenter	Shih-Hsien Yang, Songsu Song, & Jongeun Baek	Tom Zehr	Active	R27-81 Field Performance Evaluations of IL Aggregates for Subgrade Replacement & Subbase - Phase II	This project will verify the laboratory testing results from the previous ICT study titled, "Characterization of Illinois Aggregates for Subgrade Replacement and Subbase" using full-scale testing with ATLAS. Outcome: More economical use of the aggregates in Illinois by either reducing thickness or avoiding aggregate failures.	Erol Tutumluer	Deb Mishra	Greg Heckel	Active
R27-42 Thin Long-Lasting High Friction Surface Layer	The intention of this study is to develop a new surface cross section that utilizes locally available aggregate materials as much as possible. This requires a fresh look at hot-mix asphalt (HMA) cross-section, including the job mix formulae of the composition layers, their engineering characteristics, and cost effectiveness. The surface layer is expected to be efficient and effective regarding noise, durability, friction, and life cycle cost. Outcome: Developing a cost-effective surface mix design that is durable and provides sufficient friction and possibly lower noise.	Imad Al-Qadi & Sam Carpenter	Shih-Hsien Yang, Songsu Song, & Jongeun Baek	Tom Zehr	Active	R27-100 Best Practices for Implementation of Tack Coat TRP Recommendations	This project will focus on the optimum application rate of tack coat in the field from the outcome of ICT project R55. The tasks include: developing the best practice, potentially modifying equipment to allow tack coat application without construction delays, minimizing tracking problems in the field, and examining the feasibility of binder application. Outcome: Developing guidelines for efficient and effective application of optimum tack coat.	Imad Al-Qadi with Bill Pine (Heritage Research Group) and Enad Mahmoud	Khaled Issam Hasiba, Alejandro Salinas Cortina, & Zhen Leng	Derek Parish	Active
R27-61 Mechanistic-Empirical Design Implementation & Monitoring for Rigid Pavements	This project will assist IDOT in moving the proposed continuously reinforced concrete pavement (CRCP) and jointed plain concrete pavement (JPCP) framework into the Bureau of Design and Environment (BDE) Manual. The investigators will also review concrete patching requirements. IDOT has the option to add additional research tasks as the project continues. Outcome: Refined design framework for implementation into IDOT's BDE Manual and as-needed research related to IDOT's current practices.	Jeffery Roesler	Amanda Bordelon, Jim Meister, Alex Brand, & Dong Wang	Charles Wienrank	Active	R27-112 Testing of Portland Cement (Current ASTM C 150) with Limestone and Process Addition (ASTM C 465)	The objective of this research project is to duplicate the strength and durability properties of current IDOT concrete mixtures when the allowable Portland cement replacement reaches 11%. Outcome: Validating the rate of strength gain, ultimate strength, and durability characteristics of concrete mixtures that contain ASTM C 465 Portland Cement.	To Be Determined		John Huang	New

PAVEMENT DESIGN & MANAGEMENT/MATERIALS CONT.

PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS	PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
R27-121 Performance of Polymer-Modified HMA and WMA Mixtures with RAP and RAS	This project will evaluate field and laboratory performance of HMA and WMA mixtures with reclaimed asphalt pavements (RAP) and recycled asphalt shingles (RAS). The project aims to add various percentages of RAP and RAS into HMA and WMA mixtures with polymer modified and standard binders. Outcome: Guidelines for using RAP, RAS, and WMA additives into asphalt concrete pavements to produce more durable and sustainable pavements.	Imad Al-Qadi		David Lippert	New	R27-32 Rolling Lane Closures	This project studied the factors that affect driver behavior around moving work zones. Specifically, the researchers studied pertinent safety parameters that include traveling speed, number and spacing of trucks, buffer distances, and visibility of work crews. The research also included full-scale field experiments in collaboration with the Illinois State Toll Highway Authority and determined energy absorption to predict typical roll-ahead distances of protection vehicles when they are impacted by vehicles of varying sizes and speeds. Outcome: Developed recommendations for increasing the safety and effectiveness of moving lane closures.	Douglas Steele & William Vavrik (ARA)		Aaron Weatherholt	Completed
TRAFFIC OPERATIONS & ROADSIDE MAINTENANCE											
R43 Traffic Operations Lab - Signal Systems Testing	This research evaluated multiple commercial video detection systems (VDS) at signalized intersections under a variety of traffic, weather, and illumination conditions. The comprehensive side-by-side evaluations addressed the limitations of previous studies, which only evaluated VDS one at a time for a limited range of test scenarios. Outcome: Developed recommendations and specifications for use of video detections systems in Illinois.	Rahim Benekohal	Ali Hajbabaie, Juan Medina, Hani Ramezani, & Kivanc Avrenli	Yogesh Gautam	Completed	R27-33 Queue and Users' Cost in Highway Work Zones	This study developed methods for estimating speed, capacity, delay, queuing, and user's costs for interstate highway work zones where queuing and congestion occurs which helped IDOT to meet the requirements of Work Zone Safety and Mobility Policy that went into effect in fall 2007. Outcome: Assured IDOT's compliance with the Work Zone Safety and Mobility Policy.	Rahim Benekohal	Hani Ramezani & Kivanc Avrenli	Marshall Metcalf	Completed
R27-SP4 Highway Maintenance Manpower Needs Study	Contrary to two previous studies, which provided fixed static manpower requirements, this project proposed using historical data within computer software so that decision makers can appropriately modify parameters or update historical data. A very important feature is the ability to use the system on a rolling horizon basis, i.e., to obtain the modified manpower requirements at any future point in time. In addition, a what-if analysis was included. Outcome: Developed an improved computer- based decision support system for manpower planning in each highway maintenance field section.	Yanfeng Ouyang & Diego Klabjan		Joe Hill	Completed	R27-58 Evaluation of Wireless Detection Systems at RR Crossings & Signalized Intersections	This study evaluated the performance of a wireless vehicle detection system (Sensys brand) on measures such as missed calls, false calls, stuck on calls, and dropped calls. Two intersections were used for the evaluation, one of which is close to a railroad grade crossing. The sensor's potential as a backup to inductive loops that control the exit gates operation in a four quad-gate railroad crossing was also assessed. This technology has the potential to improve traffic operation and safety at railroad grade crossings and signalized intersections, reduce train-vehicle crashes at railroad crossings, and increase on-time train operation. Outcome: Documented performance ratings for this wireless vehicle detection system for railroad grade crossing locations and signalized intersection for potential use in Illinois.	Rahim Benekohal	Ali Hajbabaie, Bradly McNair, Juan Medina, & Hani Ramezani	Yogesh Gautam	Completed
R27-SP10 Online Training Course Prototype	This research investigated and prototyped online course delivery methods for IDOT to train flaggers. Outcome: Analyzed the costs, benefits, and feasibility of delivering electronic and online training to meet IDOT needs.	James Hall (UIS)	Sharon McCurdy Smith, Deborah Antoine, & Ralph Shank	Kevin Burke	Completed	R27-59 Evaluation of Performance of Solar Powered Flashing Beacons	This study evaluated the performance of solar-powered flashing beacons in a variety of lighting conditions, modes of flashing operation, and as the battery charge level decreases in a controlled lab environment. Their compliance with established requirements for flashing beacons was also evaluated. This technology has the potential to improve traffic safety and operation at intersections, reduce crashes at sites where portable flashing beacons are used, and reduce crashes at stop controlled intersections. Outcome: Documented performance of flashing beacons for potential use in Illinois.	Rahim Benekohal	Ali Hajbabaie & Juan Medina	Yogesh Gautam	Completed
R27-4 Radiation Detection Pilot Program	This project evaluated state-of-the-art radiation detection equipment to determine whether this equipment can meet the needs of IDOT and the Illinois State Police. Testing and evaluation was performed under controlled conditions at Argonne National Laboratory as well as in the field. Outcome: Recommended radiation detection equipment and techniques for use by IDOT and the Illinois State Police at weigh stations, rest areas, and overpasses.	William Dunn		David Johnson	Completed	R27-64 Development of a Highway Incident Management Operational & Training Guide	The goal of this project is to develop a comprehensive highway Incident Management Operational and Training Guide that can be used by multiple agencies to enhance the safety of incident responders and motorists alike; improve the overall operations of highways and interstate corridors; and improve communication, coordination, and cooperation among all incident-responding agencies. Outcome: Developing an operational and training guide for all incident responders and related training and informational materials.	Huaguo Zhou & Ryan Fries (SIUE)	Zhaofeng Tian & Michael Williamson	Geno Koehler	Active
R27-SP15 Snowplow Simulator Training Study	This research evaluated the effectiveness and cost efficiency of simulation training of IDOT snowplow operators. If deemed practically effective and cost effective, the simulator training could enhance safety, reduce traffic accidents and property damage, and increase driver efficiency through decreased maintenance costs and a reduction in fuel consumption. Outcome: Helped IDOT determine if simulation training is worth the expenditure to train snowplow operators.	Thomas O'Rourke		Dave Johnson	Completed	R27-72 Rolling Lane Closures -- Phase II	This project took the data and results from the previous ICT project on rolling lane closures and presented it to practitioners from around the state of Illinois to get additional feedback from these subject matter experts. This research resulted in a better understanding of driver behavior around temporary work zones and the factors that significantly affect this behavior. It documented industry best practices that can be included in IDOT and other industry standards. The combination of all results will lead to safer working conditions for traffic control personnel and contractor work crews, as well as benefits for the traveling public. Outcome: Developed specific recommendations to enhance existing standards for moving lane closures.	Douglas Steele & William Vavrik (ARA)		Aaron Weatherholt	Completed
R27-22 Regional Trans. Data Mgmt. and Archiving System	IDOT and other operating agencies covering the transportation system throughout the northeast corner of Illinois have realized it is suboptimal to have several standalone transportation information systems not communicating to each other. The investigators have identified several implementation alternatives and analyzed each one thoroughly. Outcome: Providing clear guidance to regional agencies on building a single centralized transportation information system.	Yanfeng Ouyang	Sharan Dhanaraju	John Benda	Completed	R27-75 Clearview Font in Traffic Signs: Assessing IDOT Experiences & Needs	This project will inventory the use of Clearview font on traffic signs in Illinois and the issues involved with converting existing signs to Clearview font. Outcome: Inventory of Illinois signs and plan for converting signs to Clearview font, which improves legibility, and consequently, safety.	Hani Mahmassani (Northwestern)		Julia Fox	Active
R27-31 Wind Powered Electrical Systems for Highway Facilities	The viability of using wind power to provide electricity for rest areas and weigh stations along Illinois highways was investigated. For each proposed wind-energy site, available wind resources (in kilowatt-hours per year) were determined. The study also determined location suitability, upfront cost of building and maintaining wind turbines, and potential cost savings from using wind turbines. Outcome: Developed site-by-site recommendations along with an economic analysis for using wind turbines that could reduce IDOT's energy costs while protecting the environment.	Patrick Chapman	Piotr Wiczkowski	David Johnson	Completed						

TRAFFIC OPERATIONS & ROADSIDE MAINTENANCE CONT.

PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS	PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
R27-76 LED Roadway Lighting Evaluation & Field Testing	This study will investigate technological advancements in LED roadway lighting to determine applications where IDOT can reduce costs or improve lighting. Outcome: Quantified benefits and costs of using LED for roadway lighting and recommendations for where to use in Illinois.	Ray Benekohal	Kivanc Avrenli, Hani Ranezani, & Juan Medina	Mark Seppelt	Active	R27-120 Evaluating All-Weather Pavement Markings and Lab Methods to Simulate In-Field Exposure	This research will evaluate the performance of various all-weather markings and evaluate test methods that may simulate degration mechanisms in the field. Outcome: Recommended best performing markings for IDOT roadways.	To Be Determined by RFP Process		Kelly Morse	New
R27-91 Evaluation of Traffic Flow Monitoring Technologies: Cicero-Midway Smart Corridor Case Study	This research evaluates and compares a number of existing and potential technologies through pilot deployments in the Cicero-Midway Smart Corridor. Outcome: Determining the accuracy and relative merits of traffic monitoring and travel time prediction technologies for arterial surface streets.	Jakob Eriksson (UIC)		Jeff Galas	Active	PUBLIC TRANSPORTATION/MULTI-MODAL					
R27-94 Performance Evaluation of Snow & Ice Plows	This project will develop a performance evaluation procedure for snow and ice plow performance, perform field tests on several snow plows and blades, and develop finite element models to synthesize a comprehensive performance database to simulate the plowing process for each blade at the tested speed and compare the simulation results with the test data. Outcome: Developing a comprehensive performance database that IDOT can use to select snow blades.	Souhail Elhouar & Enad Mahmoud		Tim Peters	Active	R27-SP8 Wireless Internet on Trains	This study investigated competing technologies that can bring the vision of providing internet access to passengers on trains closer to reality. The study was a result of the “Broadband Access on Passenger Rail Law” passed by the Illinois Legislature that requires IDOT to develop a plan for ensuring high-speed data access in all passenger rail systems in Illinois at fair and reasonable prices. Experiments were conducted on a 34 mile stretch of the UPN line in the Greater Chicago area. A report submitted to IDOT reviews the results of the experiments, establishes the technical feasibility of providing internet access at a reasonable infrastructural cost, and outlines non-technical issues that need to be considered before this vision can gain acceptance in the marketplace. Outcome: Presented conclusions to General Assembly and Governor on December 31, 2007; information remains on file for the state’s future consideration.	Ramavarapu Sreenivas		Mark Kinkade	Completed
R27-95 Field Evaluation of Smart Sensor Vehicle Detectors at Intersections & RR Crossings	This research will evaluate the performance of a vehicle detection system at railroad grade crossing locations and signalized intersections. Outcome: Improving traffic operation and safety at railroad grade crossings and at signalized intersections through accurate detection.	Ray Benekohal	Ali Hajbabaie, Juan Medina, & Hani Ramezani	Yogi Gautam & Stan Milewski (ICC)	Active	R27-5 Bus-On-Shoulders Study	This study researched the feasibility of Bus on Shoulder (BOS) operations for the northeastern Illinois region as part of congestion management. It included a review of the operational aspects of shoulder use and stakeholder concerns. Outcome: Identified the major points to be resolved in order to successfully implement BOS operations and recommended a planning process that addresses the major areas of concern.	Piyushimita Thakuriah & Paul Metaxatos (UIC)		Charles Abraham	Completed
R27-96 Pedestrian/ Bicyclist Warning Devices & Signs at Hwy.-Rail & Pathway-Rail Grade Crossings	This research will identify and evaluate the effectiveness of existing technology in use at passive and active highway-rail and pathway-rail grade crossings. Outcome: Fewer incidents between trains and non-motorized users at highway-rail and pathway-rail crossings.	Paul Metaxatos and P.S. Sriraj (UIC)	Sarah Jane Sherburn & Michael Alvino	Kyle Armstrong	Active	R27-15 Regional Warehouse Trip Production	This research surveyed truck traffic and production at large warehouses in Northeast Illinois, which has become an intermodal “epicenter.”The final report illustrated the array of distribution activities, supportive truck movements, and meaningful ratios of truck traffic related to business and building profile factors. These factors allow for estimating the truck movement and growth relative to new distribution space being added in the Chicago area. Outcome: Provided data and analysis on characteristics of regional distribution centers that will help agencies determine the demand freight transportation has on infrastructure, forecast travel activity, and anticipate additional transportation assets.	Jon B. DeVries & Kristin Nance (Roosevelt University)		Charles Abraham	Completed
R27-108 Improving the Effectiveness of Nighttime Temporary Traffic Control Warning Devices	Motorists tend to be confused by an overabundance of lighting. This study will provide guidance to IDOT staff, contractor staff as well as emergency responders to use lights properly to reduce motorist confusion. Outcome: Improved safety during nighttime events where traffic control devices and/or emergency vehicle lights are used.	To Be Determined by RFP Process		Steve Brink	New	R27-16 Truck Parking Facilities Program Design	This study examined the current state of truck parking and rest area facilities in the northeast Illinois region to determine if and how problems from truck parking affect freight transportation infrastructure, safety, and the region’s economy and environment. The research indentified the causes and consequences of the “nuisance” parking in residential, retail, or manufacturing areas. Outcome: Outlined potential solutions for the most common truck parking problems.	Laurence Rohter & Peter Beltemacchi (IIT)		Charles Abraham	Completed
R27-109 Effects of Flaggers and Spotters in Directing Work Zone Traffic for Illinois Multi-lane Highways	Sometimes a flagger actually causes problems by being overly enthusiastic. The possible duties of flaggers may need altered to more accurately reflect traffic needs. The results of the research will be implemented through traffic control standards and specifications as well as the work site protection manual. Outcome: Improved safety and efficiency of multilane highway traffic in work zones.	To Be Determined by RFP Process		Steve Lynch (CH2M HILL) & John Brenda (Tollway)	New	R27-17 Effectiveness of Transit Strategies Targeting Elderly People	This project explored the reasons seniors are reluctant to use public transit and the usefulness of strategies that can improve their perception of the public transit system. The results will help transportation researchers provide seniors with innovative transportation alternatives that help them maintain their independence while also assuring the safety and comfort of other travelers. Outcome: Developed strategies to encourage effective transportation solutions for the aging population.	Kouros Mohammadian & Piyushimita Thakuriah (UIC)	Taha Hossein Rashidi, Dina Muller, & Hussam Alkhatib	Charles Abraham	Completed
R27-110 Training and Implementing Findings of Queue and Users’ Costs in Highway Work Zones - Phase II	This research will improve the districts’ understanding and usefulness of a previous ICT study (R27-33) and allow districts to make better use of the data and tools available. Outcome: Computer software and associated training to use in estimating queue and users’ costs in highway work zones.	Ray Benekohal		Steve Lynch (CH2M HILL)	New						
R27-96 Pedestrian/ Bicyclist Warning Devices & Signs at Hwy.-Rail & Pathway-Rail Grade Crossings	The purpose of this project is to develop web-based training materials and supporting computer tools to accompany the one-day classroom training developed in Phase I (R27-64). Outcome: A cost-effective way for incident response agencies to train their employees and maintain a skilled workforce.	Paul Metaxatos and P.S. Sriraj (UIC)		Geno Koehler	New						
R27-119 Real-Time Information Determination Requirements for Illinois per New Federal Rules (75 CFR 68422)	Recent legislation requires that IDOT must provide real-time traveler information along all limited access roadway facilities. Specific benchmarks must be implemented before November 2014. This research will assist IDOT in establishing their real-time information program. Outcome: Timely guidance so that IDOT can meet the deadline cost-effectively.	To Be Determined by RFP Process		To Be Determined	New						

PUBLIC TRANSPORTATION/MULTI-MODAL CONT.

PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS	PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
R27-50 Trip Chaining Behavior of Senior Travelers & Applications to Public Transportation Planning	This project builds on a recently completed ICT project, Effectiveness of Transit Strategies Targeting Elderly People. A portion of respondents recruited in the previous project will be surveyed again; and GPS-based trajectories of seniors’ travel patterns and trip chaining behavior will be utilized followed by an activity/travel recall interview with the goal of understanding their underlying travel/activity scheduling process. The main objective of this study is to survey travel/activity scheduling behavior of senior citizens in the Chicago region to better understand their trip chaining behavior. Outcome: Facilitating more efficient transit services that target senior travelers, positively change their attitude toward public transportation, and help transportation and transit agencies promote effective transportation solutions for an aging population.	Kouros Mohammadian (UIC)	Joshua Auld, Martina Frignani, & Chad Williams	Charles Abraham	Active	R27-34 Pavement Program Planning Process Based on Benefit-Cost Analysis	This project studied successful pavement management programs to understand the state of the practice. Effective (yet simple) mathematical models were developed to support pavement program planning practices. A spreadsheet-based computer program will be developed to serve as a decision-making support tool that facilitates the planning process. Outcome: Developed an advanced pavement program planning procedure based on life-cycle benefit-cost analysis.	Yanfeng Ouyang	Fan Peng	Jeffrey South	Completed
R27-51 Guidelines, Site Selection, and Design for Implementing Truck Parking/Rest Facilities in Chicago’s South Suburbs	This project will provide input to support local agencies in their continuing efforts to meet the needs of truckers who provide pickups and deliveries to local manufacturers and other regional commercial operators. The research team will categorize problems; develop a locally responsive design guide and engineering handbook; provide detailed site plans/designs to alleviate delivery problems, including operational issues; address scattered truck parking problems by identifying parking zones on major roads or developing small parking areas on otherwise unusable adjacent sites; and alleviate truck parking by forming agreements with property owners of existing facilities. Outcome: Developing handbooks and materials to support and encourage trucking-related commerce in the area of I-80/eastern Will County while helping to alleviate truck parking problems.	Peter Beltemacchi & Laurence Rohter (IIT)	Rong Helen Zhou, Scott Beslow, Hollie Lohman, Jeff Fain, & Tom Montgomery	Charles Abraham	Active	R27-39 Context Sensitive Solutions Online Training Course Development	IDOT has already adopted the principles of Context Sensitive Solutions (CSS), an interdisciplinary approach that seeks effective, multimodal transportation solutions by working with stakeholders to develop, build, and maintain cost-effective transportation facilities which fit into and reflect the project’s surroundings – its “context”, in the planning, design, construction, and operation of its projects for new construction, reconstruction, or major expansion of existing transportation facilities. Although formal training already exists for IDOT staff and external planners and design professionals, general CSS information also needs to be provided to public stakeholders to promote understanding and full engagement in the CSS process. Outcome: Developed an internet-based tutorial training course to provide information on CSS policies and procedures to affected citizens, elected officials, local agencies, interest groups, and other stakeholders of IDOT.	James Hall (UIS)	Sharon McCurdy Smith, Deborah Antoine, & Ralph Shank	Susan Stitt	Completed
R27-113 Modeling Seniors Activity - Travel Data - Phase II	This is a follow-up study to R27-50 which will use the existing dataset to develop several key models for analyzing travel/activity planning and scheduling behavior of senior citizens in the Chicago metropolitan area. Outcome: Improved efficiency of transit services for senior travelers and help change their attitude towards the use of public transit.	Kouros Mohammadian (UIC)		Amy Welk	New	R27-43 Utah LTAP GIS Software Replication/ Training in IL	To meet the federal government’s requirements for minimum nighttime retroreflectivity in the Manual on Uniform Traffic Control Devices (MUTCD), ICT worked with the Utah LTAP Center that has created extensive infrastructure management GIS software for use by local agencies in Utah. Several of the modules were suitable for Illinois use immediately, while some enhancements were needed. Working with Utah LTAP staff, the necessary minor modifications were made to existing modules, a roadside hardware module was developed, and a training plan was developed. Outcome: Customized infrastructure management GIS software for use in Illinois and developed a training plan.	Yanfeng Ouyang		Kevin Burke	Completed
PLANNING/OTHER						R27-48 Travel Demand Modeling for Small & Medium Size MPOs in Illinois	This research will establish the framework necessary for the development, maintenance, and application of small and medium size Metropolitan Planning Organization (MPO) urban travel demand models in several communities in Illinois, which will constitute the foundation for a statewide travel demand model. These models will help small and medium size communities assess transportation system performance, analyze deficiencies, and develop long range plans. Outcome: Facilitating the creation of a statewide travel demand model.	Paul Metaxatos (UIC) & Rita Morocoima-Black (Champaign Co. RPC)		Susan Stitt	Active
R27-14 Commercial Vehicle Info. Systems & Networks (CVISN)	This project developed a Commercial Vehicle Information Exchange Window to exchange motor carrier safety information with other federal and state agencies involved with motor carrier regulation. The project also developed system requirements for a Commercial Vehicle Information System and Networks (CVISN) to exchange motor vehicle information amongst the Department of Transportation, the Secretary of State, and the Department of Revenue. Other project deliverables served to improve vehicle regulations, including a roadside information viewing mechanism; a system for oversize/ overweight vehicle permitting, tracking, and mapping; and an input system for the Illinois Department of Revenue’s International Fuel Tax Agreement (IFTA) program. Outcome: The use of CVISN improves highway safety, streamlines regulation of the trucking industry, and enhances motor carrier efficiency and productivity.	Peter Nelson & John Dillenburg (UIC)	John Hayward	Chuck Sikaras	Completed	R27-73 Distance Technology Transfer Course Content Development	Decreasing staff and increasing travel costs have limited IDOT’s ability to deliver technical training in a timely and accessible manner. This project will develop course content for distance learning in an online environment for several key, high-benefit IDOT technology transfer training courses and short courses. The project team will fully develop and deploy online at least one IDOT technology transfer course in the early stages of the project so IDOT can assess functionality and applicability to other technology transfer programs . The first fully deployed course will serve as a prototype in addressing technical and implementation issues. Outcome: Implementing accessible and flexible distance training which enables individuals to take courses anytime and anywhere through the Internet and/or other electronic media.	James Hall (UIS) & William Buttlar	Deborah Antoine, Sharon McCurdy Smith, Josh Houston, and Meg Griffin	Kevin Burke	Active
R27-23 Performance of HMA Overlays in Illinois	This study examined a variety of factors that affect the service life of overlays. Specifically, the following attributes were examined: construction year period, location, condition before overlay placement, presence of D-cracking on rigid pavement sections before overlay, underlying concrete type, estimated overlay number, and overlay type. Outcome: Documented the impact of the evaluated variables on the performance of HMA overlays based on service life result and developed an extensive database that IDOT can use to further analyze the effects of various attributes on the performance of HMA overlays.	Angela Wolters & Kurt Smith (APTech)		Jeffrey South	Completed	R27-83 Goods Movement Study in IL: Applications to Freight Transportation & Logistics	This study will conduct a new disaggregate national level survey with a focus on Illinois that will facilitate analysis of freight shippers in Illinois and the Midwest region and their interactions with the rest of the country. Outcome: Providing a new and highly disaggregate freight dataset that is needed for modeling more realistic decision making processes for more efficient freight movement.	Kouros Mohammadian (UIC)	Amir Samimi, Josh Auld, & Mahmoud Javanmardi	Michael Garcia	Active

PLANNING/OTHER CONT.

PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS	PROJECT CODE & TITLE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
R27-84 Develop Travel Reliability Inventory for Highway Networks	This project will develop necessary procedures and computer tools to systematically document travel reliability information for highway networks. This information will be used to help personal travelers, freight carriers, and emergency responders better prepare for unexpected delays and to monitor and evaluate the performance of highway networks. Outcome: Developing a software tool to analyze and visualize traffic data and generate travel reliability inventories.	Peter Nelson & John Dillenburg (UIC) & Yu Nie (Northwestern)		Jeff Galas	Active	R27-54 Storm Water Pollution, Erosion & Sediment Control Products Demonstration & Training Center	This project will establish a research and training center at the University of Illinois that will demonstrate erosion, sediment, and storm water control practices suitable to Illinois conditions. The center will be used for hands-on training, to demonstrate proper installation and evaluation techniques, and to initiate research to assess the applicability of erosion control and storm water management best management practices for relevant IDOT site conditions. Outcome: Providing IDOT the ability to evaluate and demonstrate, under controlled conditions, proposed erosion control products and methodologies.	Prasanta Kalita & Richard Cooke	Robin Bhattarai & Joseph Monicals	Thomas Ripka	Active
R27-87 Implementing Pavement Management Systems for Local Agencies	This project will provide input to support local agencies as they select a pavement management system (PMS). The team will document the process agencies follow to implement a PMS; this process includes agency staffing, existing pavement inventory, type of condition rating, vendor support, pavement management system capabilities, and pricing. A selection matrix will be developed to determine the key functions/attributes the agency needs to successfully implement a PMS. Outcome: Providing guidelines for local agencies to implement a PMS so they can enjoy cost savings and better performing pavement over time.	Angela Wolters & Kathryn Zimmerman (APTech) with Kerrie Schattler (Bradley University)		Kevin Burke	Active	R27-68 Midwest Transportation Air Quality Summit	This project supports a regional workshop on transportation and air quality issues in the Midwest to be attended by representatives of state DOTs, state air pollution control agencies, metropolitan planning organizations, and federal agencies. The goal is to bring together stakeholders from the transportation and air quality communities to discuss current and upcoming environmental challenges. Timely and relevant research will be presented, and an open dialogue and collaborative problem solving with a wide range of perspectives will be encouraged. Outcome: Providing support to states as they work to comply with federal air quality standards for ozone and particulate matter, reduce the impacts of hazardous air pollutants, and address climate change.	Michael Koerber (LADCO)		Walt Zyznieuski	Completed
ENVIRONMENT						R27-74 “Green Friendly” Best Management Practices (BMP) for Interstate Rest Areas	This project investigated, determined, and provided a list of “Green Friendly” Best Management Practices for use at the interstate rest areas. Outcome: Recommended practices to save energy (dollars) and be environmentally aware.	Khaled El-Rayes & Liang Liu	Moatassem Abdallah & Ibrahim Odeh	Craig Mitckes	Completed
R27-7 Update the Illinois Carbon Monoxide Screen for Intersection Modeling (COSIM)	In 2007, regulatory changes in the Illinois Vehicle Inspection and Maintenance Program prompted the Illinois Environmental Protection Agency (IEPA) to recommend that IDOT update the CO Screen for Intersection Modeling (COSIM) with new emission factor tables using the MOBILE6.2 model. Based on that recommendation, this study was implemented to update the COSIM model. As part of the update, IDOT also requested that the methodology used in creating the original criteria be reevaluated and possibly revised based on the findings of the evaluation. Outcome: Updated COSIM User’s Manual, which is now titled “Illinois COSIM Version 3.0 Carbon Monoxide Screen for Intersection Modeling Air Quality Manual.”	Scott Peters (Private Consultant)		Walt Zyznieuski	Completed	R27-93 Transportation Conformity Particulate Matter Hot-Spot Air Quality Modeling	This research will model various vehicle traffic volumes and percent diesel trucks to predict pollutant concentrations and compare these concentrations with national air quality standards. Outcome: Helping IDOT determine which proposed construction projects pose threats to air quality to keep Illinois in compliance with national standards.	Jie Lin	Suriyapriya Vallamsundar	Walt Zyznieuski	Active
R27-10 Documenting Air Toxics in NEPA Documents: A Midwest Peer Exchange	To address the many uncertainties with FHWA’s Interim Guidance for documenting mobile source air toxics (MSAT) released February 3, 2006, IDOT convened a meeting of six Midwestern states (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin) to discuss the technical and practical issues and uncertainties arising from the new MSAT guidance and to exchange ideas and experiences in documenting MSATs. This meeting was held on October 5-6, 2006, at Allerton Park, Monticello, Illinois. Twenty-one participants from the six state DOTs, FHWA, U.S. EPA Region 5 Office, Illinois EPA, and UIC attended the meeting. Outcome: Documented challenges in practice, research needs, and practical guidelines for use by Illinois and other state DOTs.	Jie Lin (UIC)		Walt Zyznieuski	Completed	R27-102 Installation and Performance Testing of Ditch Checks and Inlet Protection Structures	The objectives of this project are to evaluate the performance of ditch checks in different slope conditions, install and evaluate the performance of inlet protection structures, help IDOT in refining the list of approved sediment control products, and provide demonstration and training to IDOT on the installation and effectiveness of inlet protection measures. Outcome: Developing specifications, design guidance, and construction details for the use of sediment-controlling products under typical Illinois weather conditions.	Prasanta Kalita		Joseph Vespa	Active
R27-29 Particulate Material (PM) 2.5 & PM10 Hot Spot Analysis: Midwest Peer Exchange	On October 23-24, 2007, subject matter experts on particulate matter (PM) gathered at Allerton Park in Monticello, Illinois to exchange ideas and experiences about estimating future localized pollutant concentrations and comparing those concentrations to the National Ambient Air Quality Standards (NAAQS) set by the U.S. EPA. The attendees included staff from five Midwestern state DOTs, metropolitan planning organizations, the U.S.EPA, the Illinois EPA, University faculty, and the FHWA. The attendees identified hot-spot (areas of possible violation) requirements and discussed PM modeling uncertainties, monitoring of PM, and how to document the analyses in reports. Outcome: Documented challenges in practice, research needs, and practical guidelines for particulate matter for use by all state DOTs.	Jie Lin (UIC)		Walt Zyznieuski	Completed	R27-103 “Green Friendly” Best Management Practices (BMPs) for Interstate Rest Areas - Phase II	This project will investigate, determine, and provide a list of BMPs for six additional rest areas that have the highest energy consumption in Illinois. Outcome: Recommended practices to save energy (dollars) for specific rest areas in Illinois.	Khaled El-Rayes & Liang Liu	Moatassem Abdallah	Craig Mitckes	Active
						R27-104 Native Vegetation Establishment for IDOT Erosion Control BMPs	This research will look at developing improved seed mixes and provide an approach to investigate seeding establishment under new and alternative erosion control best management practices. Native seed mixes will be developed and their performance compared to current seed mixes under a variety of conditions. Outcome: Reduced costs, erosion, and sedimentation.	Prasanta Kalita		Matt Sunderland	Active
						R27-114 Restoration Progress and Flood Disturbance at IDOT Wetland Mitigation Sites	This project will determine the influence of flood hydrology on plant community development and the achievement of performance standards at wetland mitigation sites using legacy data from the IDOT wetlands program. Outcome: Improved planning and maintenance strategies for wetland mitigation projects and identification of performance standards for wetland mitigation in floodplain areas.	To Be Determined		Thomas Brooks	New

COMMONLY USED ACRONYMS

- AASHTO**
American Association of State Highway
and Transportation Officials
- ACI**
American Concrete Institute
- ASCE**
American Society of Civil Engineers
- ATLAS**
Accelerated Testing Loading Assembly
- ATREL**
Advanced Transportation and Research Engineering Laboratory
- CEE**
Civil and Environmental Engineering
- DOT**
Department of Transportation
- EPA**
Environmental Protection Agency
- FHWA**
Federal Highway Administration
- HMA**
Hot-mix asphalt
- ICC**
Illinois Commerce Commission
- ICHR**
Illinois Cooperative Highway Research (Program)

- IDOT**
Illinois Department of Transportation
- PI**
Principal Investigator
- RFP**
Request for Proposal
- RITA**
Research and Innovative Technology Administration
- RPC**
Regional Planning Commission
- TAG**
Technical Advisory Group
- TRB**
Transportation Research Board
- TRP**
Technical Review Panel
- UI**
University of Illinois
- UIC**
University of Illinois at Chicago
- UIS**
University of Illinois at Springfield
- UIUC**
University of Illinois at Urbana-Champaign



Below: Installation of all epoxy reinforcement bars and tie bars in the superstructure on Airport Road in Peoria County.
Photo courtesy of IDOT District 4 contractors R. A. Cullinan & Son, a division of UCM, Inc., and Central Illinois Rebar Installers, Inc.



Above: Traffic control provided during structure replacement on IL 15 near the Edwards County line.
Photo courtesy of IDOT District 7 contractor E.T. Simonds Construction Company.



University of Illinois at
Urbana-Champaign

Advanced Transportation Research
and Engineering Laboratory
1611 Titan Drive
Rantoul, IL 61866

p (217) 893-0705
f (217) 893-0601

ict.illinois.edu

