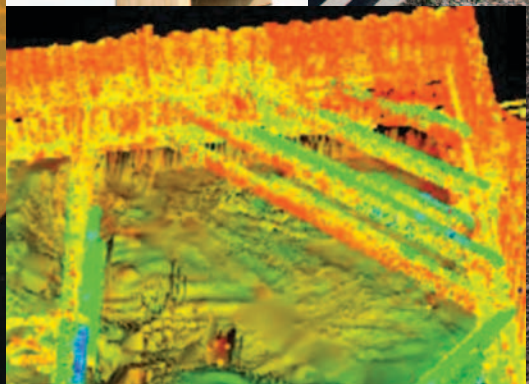
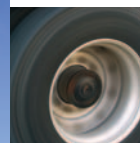




 ILLINOIS

 Illinois Department of Transportation



The Illinois Center for Transportation (ICT) is an innovative research partnership between the Illinois Department of Transportation (IDOT) and the University of Illinois. The ICT builds on the experience of renowned experts in transportation and related fields by providing the appropriate tools and support required for objective research. The ICT facilitates the development and timely implementation of cost-effective technologies that improve safety and reliability, reduce congestion and impact on the environment, optimize the utilization of the state transportation infrastructure, and maximize the return from taxpayer dollars.

1 DIRECTOR'S REPORT

Director Imad Al-Qadi summarizes the positive impacts from ICT's first four years and more than 100 research projects.

3 ICT ADMINISTRATION

Meet the administrative team behind ICT's innovative research that includes Associate Director Sam Carpenter, several ICT staff members, and the ICT Executive Committee and Technical Advisory Groups.

4 THE ICT INVESTIGATORS

Meet the ICT research team that includes 64 investigators from a diverse array of universities, private consulting firms, and governmental agencies.

6 INFRASTRUCTURE AND THE ROLE OF RESEARCH

As the most critical component to our economy, infrastructure requires the research, development, and implementation of innovative and cost-effective technologies.

6 ICT FROM PAST TO PRESENT

Created in 2005, the ICT builds on several decades of collaboration between IDOT and the University of Illinois. Since its inception, the ICT has shown impressive growth and diversified its research portfolio.

7 RESEARCH FUNDS

Statistics on ICT's research funds, including growth, outsourcing, and diversification, are presented graphically.

8 FACILITIES AND RESOURCES

Research at ICT is supported by world class facilities that include the Advanced Transportation Research and Engineering Laboratory (ATREL) on 47 acres of the former Chanute Air Force Base.

10 THE RESEARCH PROCESS

From an idea to the final report: Learn how a good idea turns into real results and how to get involved in ICT's research.

12 IMPACT OF COMPLETED RESEARCH

ICT's completed research is presented by focus area with tangible outcomes highlighted.

23 OUTREACH HIGHLIGHTS

ICT actively publicizes its research through its web site, newsletter, publications, presentations, conferences, short courses, and webinars.

26 RESEARCH PROJECT APPENDIX

The first 106 funded ICT projects are listed by focus area, including the project name, a short description of the research, research outcome, investigator(s), technical review chairperson, and status.

44 COMMONLY USED ACRONYMS

Several commonly used acronyms are defined.

“In the four years the ICT has been in operation, our activities have increased to the point where we are truly a world class research center. Our role is to lead the discovery, development, and implementation of solutions that address the urgent and evolving transportation needs of the state of Illinois, the country, and the world at large.”

—Imad Al-Qadi



The Illinois Center for Transportation (ICT) is a unique research and outreach center located at a crossroads for all modes of transportation, in the state of Illinois, and housed within the #1 ranked civil engineering department in the country, at the University of Illinois.

This background brings both great opportunities and great responsibilities. Thanks in part to the strong and ongoing support of the Illinois Department of Transportation (IDOT) and the Federal Highway Administration (FHWA), the ICT has continued to produce groundbreaking research that directly impacts policies and specifications, resulting in cost savings and positive changes that affect the daily lives of the traveling public and transportation of goods.

Since its inception four years ago, the ICT has grown and diversified its research portfolio from an initial 12 projects to over 100 projects that include innovative approaches to nondestructive testing; bridge and pavement testing, evaluation, and construction techniques; advanced modeling and simulation; transportation safety and security; monitoring infrastructure using advanced instrumentation; energy conservation through recycling; and clean energy generation, just to name a few. Our research involves investigators from a wide variety of backgrounds, including governmental agencies, private sector consultants, and more than 10 universities. This diverse range of involvement provides even more students and future engineers with the tools they need to continue solving tomorrow's transportation challenges.

At ICT, we are extremely proud of the methods we have used to increase safety and maximize the use of taxpayer dollars. This report features numerous completed projects that have directly impacted the transportation system and the well-being of the traveling public.

Research typically takes a significant amount of time, and much of our research does, but ICT also considers itself constantly “on call” to provide

continued on next page

ICT AT A GLANCE

- 106 research projects approved to date
- 43 completed projects
- \$18 million investment from IDOT and FHWA
- 64 researchers contributing
- 50 graduate students funded
- 10 universities participating
- 47-acre facility
- 67,400 square feet of laboratories
- Largest moveable full-scale pavement testing facility in the country
- Housed within in the U.S. #1 nationally ranked civil engineering program*

* according to *U.S. News and World Report* in March 2009

continued from previous page

a quick turnaround when IDOT needs immediate answers. For example, ICT has rapidly responded to issues regarding bridge integrity on Chicago's Dan Ryan Expressway (I-80/294) and the Kingery Expressway, and most recently in DeKalb County. ICT's quick turnaround with these requests helps ensure drivers' safety and also saves the state significant testing and repair costs.

ICT realizes that conducting ground-breaking research is only a part of the equation and understands that outreach is also vital in disseminating the outcome of the research through publication in archived journals; at international conferences, meetings, and institutions; and by posting final reports on the ICT web site. ICT also keeps interested parties informed through quarterly newsletters and by offering short courses and webinars. These activities allow the outcome of our research to be widely used and implemented. It is the intention of ICT to expand its outreach activities even more in the coming years.

It has been a busy and productive four years that have resulted in steady growth and increased involvement, and ICT is pleased to present this summary report of our accomplishments. Please continue to follow ICT's activities on our web site, <http://ict.illinois.edu>, which provides the status of ongoing research, final reports, and activities at our center, and much more. ICT truly is where excellence and transportation meet.

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

ADMINISTRATION

ICT Administrative Team



Dr. Sam Carpenter serves as ICT Associate Director. Dr. Carpenter is a Professor Emeritus of the UIUC Department of Civil & Environmental Engineering.

The ICT administrative team, pictured below, works together to deliver a full range of support services to the research team.



Front Row: Lori Carpenter (Communication Coordinator), Leslie Myrick (Editor), Leslie Elble (Assistant to the Director). Back row: Jeff Kern (Research Engineer), Josh Houston (Systems Engineer), Jim Meister (Research Engineer), Dave King (Resource & Policy Analyst). Not pictured: Mary Fries (Lecturer).

Illinois Department of Transportation (IDOT) Involvement

Staff at the Illinois Department of Transportation (IDOT) have an active role in the administrative and research activities of the ICT through monthly meetings between ICT and IDOT research administration. The following IDOT and FHWA staff members serve on the ICT Executive Committee, which oversees the ICT research program and meets twice a year. The Executive Committee also screens projects to ensure the research is innovative, diverse, cost-effective, and serves the needs of both the State of Illinois and the IDOT.

ICT Executive Committee

CHAIR:

Christine Reed, Director and Chief Engineer, Division of Highways

MEMBERS:

Ellen Schanzle-Haskins, Chief Counsel

Ann Schneider, Director, Office of Finance & Administration

Nick Williams, Director, Office of Governmental Affairs

Dick Smith, Director, Office of Planning & Programming

Kyle Anderson, Director, Office of Operations & Communications

Daniel Kennelly, Director, Office of Quality Compliance & Review

Lawrence Parrish, Acting Director, Office of Business and Workforce Diversity

Susan Shea, Director, Division of Aeronautics

Joseph Clary, Director, Division of Public & Intermodal Transportation

Michael Stout, Director, Division of Traffic Safety

FHWA Representative:
Brian Pfeifer

ICT Representative:
Imad Al-Qadi

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, and who represent the Bureau of Materials and Physical Research (BMPR) in the TAGs.

TAG Chairs and BMPR Representatives

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: Patricia Broers

SAFETY ENGINEERING

TAG Leader: Priscilla Tobias

BMPR Representative: Patricia Broers

ENVIRONMENT

TAG Leader: Barbara Stevens

BMPR Representative: Joe Vespa

PUBLIC TRANSPORTATION/MULTI-MODAL

TAG Leader: Chuck Abraham

BMPR Representative: Patricia Broers

PLANNING

TAG Leader: Vacant

BMPR Representative: Patricia Broers

CONSTRUCTION

TAG Leader: Mike Ripka

BMPR Representative: Charles Wienrank

ICT INVESTIGATORS



Mohammad Alhassan
Purdue University



Samuel Carpenter
Associate Director
of ICT, UIUC



Khaled El-Rayes
UIUC



Anastasios Ioannides
University of Cincinnati



David Lange
UIUC



Imad Al-Qadi
Director of ICT, UIUC



Patrick Chapman
UIUC



Mostafa Elseifi
Louisiana State University
(formerly Bradley University)



Audrey Ishii
U.S. Geological Survey



Liang Liu
UIUC



Bassam Andrawes
UIUC



Samer Dessouky
UT at San Antonio
(formerly UIUC)



Larry Fahnestock
UIUC



Diego Klabjan
Northwestern University
(formerly UIUC)



James Long
UIUC



Rahim Benekohal
Director of
the Traffic Operations Lab
(TOL), UIUC



Jon DeVries
Chicago Institute of Real
Estate, Roosevelt University



Jerome Hajjar
UIUC



Daniel Kuchma
UIUC



James Meister
UIUC



William Buttlar
UIUC



William Dunn
UIUC



James Hall
UIS



James LaFave
UIUC



Timothy Murphy
Murphy Pavement Tech.



Scott Olson
UIUC



Dianne Kay Slattery
SIUE



Leslie Struble
UIUC



Yanfeng Ouyang
UIUC



David Soong
U.S. Geological Survey



Marshall Thompson
UIUC



John Popovics
UIUC



Ramavarapu Sreenivas
UIUC



Erol Tutumluer
UIUC



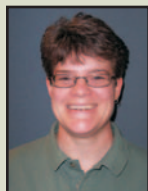
Jeffery Roesler
Associate Director
of ATREL, UIUC



Douglas Steele
ARA



Angela Wolters
APTech



Jennifer Sharpe
U.S. Geological Survey



Timothy Straub
U.S. Geological Survey

Not Pictured

Farhad Ansari
UIC

Suleiman Ashur
Purdue University

Peter Beltemacchi
IIT

Abbas Butt
ERI

Richard Cooke
UIUC

Christopher Hart
UIUC

Marwa Hassan
LSU (formerly Bradley
University)

Laura Heckel
HERE

Prasanta Kalita
UIUC

Michael Koerber
LADCO

Zongzhi Li
IIT

Jie Lin
UIC

Hani Mahmassani
Northwestern University

Paul Metaxatos
UIC

Kouros Mohammadian
UIC

Rita Morocoima-Black
Champaign Co. RPC

Kristin Nance
Marshall Bennett Institute of Real
Estate, Roosevelt University

Peter Nelson
UIC

Scott Peters
Consultant

Laurence Rohter
IIT

Kerry Slattery
SIUE

Kurt Smith
APTech

Piyushimita Thakuriah
UIC

Thomas Van Dam
APTech

William Vavrik
ARA

Ming Wang
UIC

Organization Key:

APTech: Applied Pavement Technology, Inc.

ARA: Applied Research Associates, Inc.

ERI: Engineering & Research International, Inc.

HERE: Heckel Engineering, Research, and Education, Inc.

IIT: Illinois Institute of Technology

LADCO: Lake Michigan Air Directors Consortium

LSU: Louisiana State University

SIUE: Southern Illinois University at Edwardsville

RPC: Regional Planning Commission

UIUC: University of Illinois at Urbana-Champaign

UIC: University of Illinois at Chicago

UIS: University of Illinois at Springfield

UT: University of Texas

ILLINOIS TRANSPORTATION INFRASTRUCTURE AND THE ROLE OF RESEARCH

A significant percentage of the nation's goods and people pass through Illinois every day. As a crossroad for the nation's travel and commerce, Illinois is home to:

- 140,000 miles of highways, streets, and roads (ranks third in the nation for number of highway miles)
- 26,400 bridges
- 115 public use airports (including one of the busiest airports in the world)

This infrastructure is the most critical component to our economy. But while travel and the movement of goods and services continue to increase, infrastructure needs continue to be underfunded. Consequently, the deterioration of roads and bridges and increases in traffic congestion result in lost productivity, harm to the environment, and most importantly, substandard roads and bridge conditions that decrease the safety being provided to our traveling public. Neglect of our transportation infrastructure continues to accelerate this decline, imperiling our safety, stunting the economic growth, and jeopardizing the competitiveness of Illinois and the nation.

Rationale for Research Funding

Although more funding is needed to address these problems, the solutions do not simply involve building more roads, bridges, and runways, but rather researching, developing, and implementing new technologies and cost-effective innovations for the transportation infrastructure network. ICT's research provides IDOT, other agencies, and the nation with the ability to "work smarter" to adequately advance the needs of commerce and to meet travelers' expectations while maximizing their taxpayer dollars.

Looking Towards the Future: Energy Conservation and Sustainability

ICT consistently takes a proactive role in protecting our environment by developing technologies that conserve resources. And a key element in our future research will be energy conservation and sustainability. Ensuring both conservation and sustainability will reduce potential life cycle costs of the transportation infrastructure and will simultaneously provide new methodologies that will increase the opportunities for enhancing the economy and improving the environment.

Statistics were taken from Illinois State Transportation Plan, 2007, a publication of the Illinois Department of Transportation.

ICT FROM PAST TO PRESENT— A HISTORY OF GROWTH AND DIVERSIFICATION

Significant Events

1941: The Illinois Department of Transportation (IDOT) and the University of Illinois establish a cooperative agreement and begin collaborating on their individual strengths and common interests in transportation research.

July 2005: IDOT and the University form an official research partnership, the ICT, which is created 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 allocated for research purposes. The University provides most of the local match of \$2.2 million to get the program underway. Of the initial 12 ICT projects, which are mainly a continuation of the existing cooperative agreement, nine are pavement-related and all are performed by investigators from the University's Champaign-Urbana campus.

July 2008: A second three-year agreement between IDOT and ICT provides \$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.

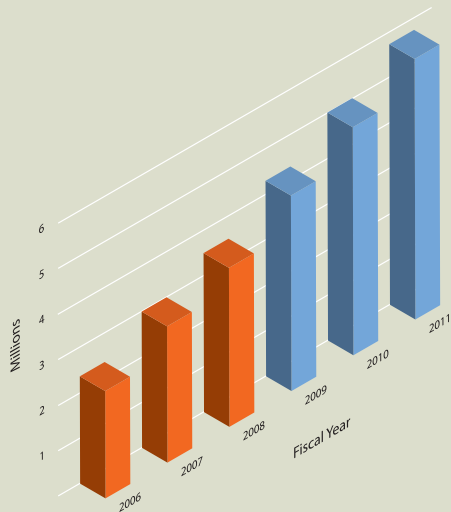
Present: As outlined in the agreements, ICT continues its research with 106 approved projects that show great diversity, both in research topic and investigator outsourcing. ICT has collaborated with investigators from 10 universities as well as government agencies and private firms and has completed 43 projects with final reports published and posted to the ICT web site and research findings making a true impact in Illinois and beyond.



RESEARCH FUNDS

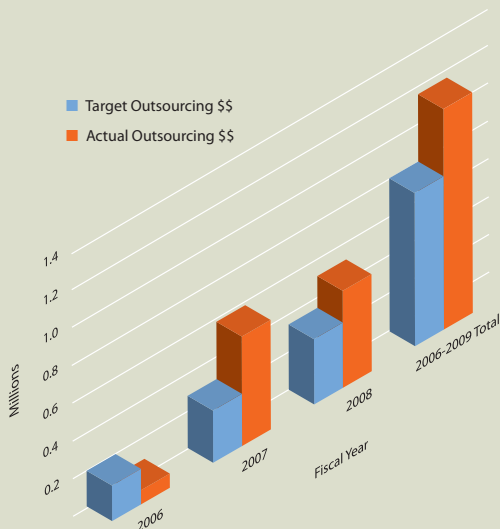
ICT Growth

ICT continues to show remarkable growth with significantly increased IDOT funding each fiscal year.



Outsourcing to Non-UI Researchers

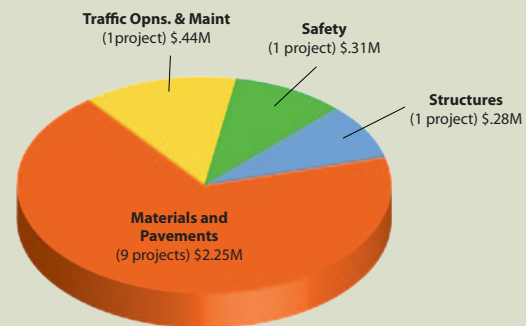
A unique feature of ICT is that, even though it is administered by the University of Illinois at Urbana-Champaign, a portion of the funding is outsourced to schools outside of the University of Illinois system. This outsourcing develops cooperative relationships with other universities and exposes more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



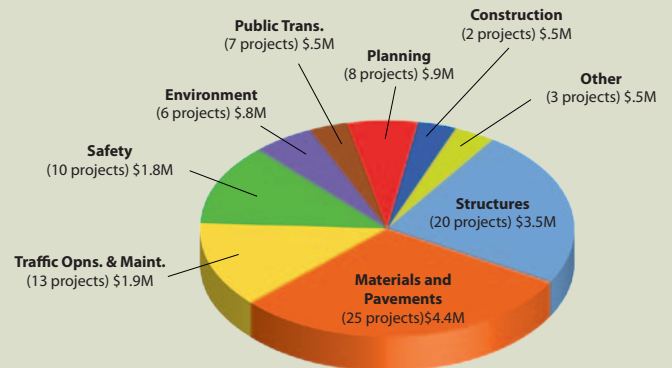
ICT's Diversified Research Portfolio

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 2005–2009



Participating Universities and Institutes

Bradley University

Illinois Institute of Technology

Northwestern University

Purdue University

Roosevelt University

Southern Illinois University at Edwardsville

University of Cincinnati

University of Illinois at Chicago

University of Illinois at Springfield



The ATREL Facility

ICT has access to state-of-the-art facilities at the Advanced Transportation Research and Engineering Laboratory (ATREL). The 67,000 square-foot ATREL facilities are located on 47 acres of the former Chanute Air Force Base in Rantoul, IL, which is 15 miles north of the University of Illinois at Urbana-Champaign campus. ATREL

houses equipment for pavements, materials, and transportation operations research and is home to the largest moveable accelerated pavement test facility in the world (ATLAS).

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 transportation infrastructure evaluation including pavements, bridges, railroad, traffic, and transportation systems. It also houses a technical library and computational capabilities and recently underwent renovations to update and optimize the use of its available space for administration, students, and meeting rooms.

Large- and small-scale material samples can be tested in several laboratory areas at ATREL using state-of-the-art equipment, some of which were developed at ATREL. One laboratory area houses several servo-hydraulic systems for soil, granular materials, concrete, and hot-mix asphalt (HMA) testing including simple performance, complex modulus, indirect tension,



creep, four-point bending fatigue, disk-shaped compact tension, to name a few. In addition, ATREL houses SuperPave™ binder testing equipment (including recently developed hot-poured sealant 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 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. Another test frame for testing fully supported slabs up to 16 feet long and 8 feet wide is available and has been used to test reinforced concrete beams cut from interstate pavements and also to simulate fatigue in





airfield concrete slabs. The ATREL facility is also home to a van-mounted, state-of-the-art ground penetrating radar (GPR) device with a wide range of antennae for accurate measurements of a pavement's layer thicknesses, bridge deck assessment, railroad track evaluation, and internal flaw detec-

tion. In addition to other nondestructive testing equipment, the facility has readily available data acquisition systems for collecting static and dynamic data from instrumented pavement sections.

The Traffic Operations Laboratory (TOL) houses equipment to evaluate traffic signal components and fiber optic communications, offices, 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.

The Accelerated Transportation Loading ASsembly (ATLAS) can evaluate full-scale transportation systems subject to real

life traffic and environmental loading. 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 is housed in a moveable sprung structure that also controls the effects of daily temperature and moisture changes on the pavement section being studied. ATLAS also has data acquisition systems for instrument data collection. ATLAS can apply up to 10,000 repetitions per day and it was recently equipped with insulated aluminum panels that are designed to provide a constant temperature for the top 2 inches of pavement.

Additionally, ICT has access to specialized equipment on the University's campus, including the transportation structures laboratory, materials research laboratories, and the supercomputers housed at the National Center for Supercomputing Applications (NCSA) that can support large transportation network and sophisticated materials modeling efforts.



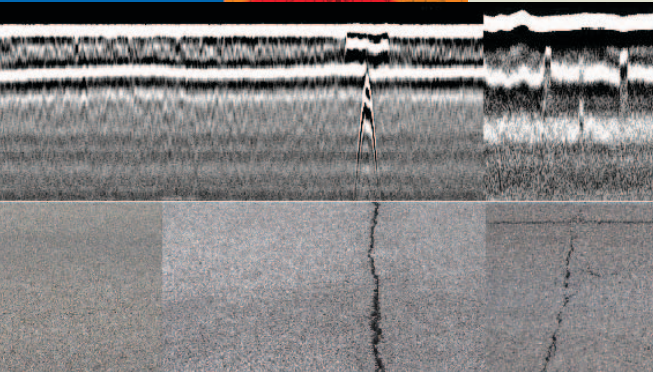
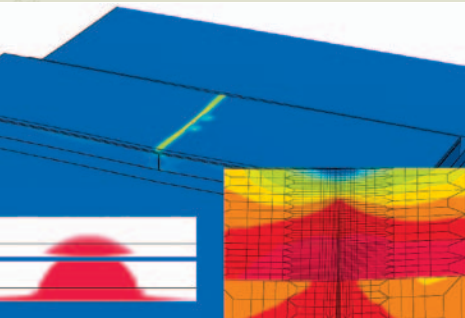
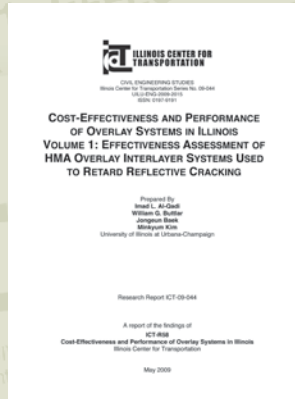
...FROM IDEA TO FINAL REPORT

The ICT prides itself on diversity, both of its research portfolio and in the affiliations of its investigators. Although the center is based at the University of Illinois, ICT research is conducted in collaboration with experts at many other universities, research agencies, and private consulting firms.

The ICT Intergovernmental Agreement with IDOT requires that approximately 11% of contract amounts be contracted outside the University of Illinois at Urbana-Champaign to other public or private universities, research institutions, and specialty consultant firms.

As a testament to its commitment to diversity, ICT consistently exceeds this outsourcing requirement, and in Fiscal Year 08-09, ICT outsourced approximately 20% of its funded research.

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.



1. Call for Research Ideas

Twice annually, the eight ICT Technical Advisory Groups (TAGs) identify specific transportation topics or focus areas as priorities for new ICT research. ICT then posts the TAG suggestions on its web site 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 web site. The deadlines for these submissions are generally January 31 and June 30.

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 recommendations. The ICT Executive Committee meets twice annually, and during these meetings, the committee reviews the project priorities of the eight TAGs. The Executive Committee makes the final decision on which research projects are funded.

3. Investigator Selection

Once a project is funded, ICT determines who serves as the Principal Investigator(s). 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.

4. Requests for Proposals

For projects not directly assigned to an investigator, ICT solicits formal research proposals, and the corresponding TAG selects a PI who can develop the best research approach. These Requests for Proposals (RFPs) are widely advertised and posted on the ICT web site semi-annually. In fiscal year 2008-2009, ICT advertised ten RFPs with a total value in excess of \$1.8 million.

5. Evaluation of Proposals

The appropriate TAG (or subcommittee from the TAG) evaluates all proposals and makes a recommendation to ICT for award of the research.

6. Selection of the Project Technical Review Panel

For each new project, IDOT appoints a Technical Review Panel (TRP) to oversee and guide the research. Members can be IDOT employees, FHWA representatives, local government represen-

tatives, private contractors, or private citizens. The TRP chair is generally an IDOT employee.

7. Research Process

Once a researcher is selected for a project (either selected 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 investigator(s) complete their research and are ready to disseminate the findings and conclusions, the PI works with their TRP and an ICT editor to finalize his or her 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 web site.*

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 rare 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 special cases, the findings or conclusions are usually disseminated to the specific IDOT personnel that would be affected or interested.

Technical Advisory Group (TAG): The TAG is a subcommittee of the Executive Committee with expertise in a specific research area. These groups review, prioritize, and *recommend* projects to the ICT Executive Committee. ICT currently has eight standing TAGs, and other ad hoc TAGs can be added as needed.

Executive Committee: 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). This committee reviews and *selects* research projects.

Principal Investigator (PI): The lead researcher on an ICT project.

Technical Review Panel (TRP): A committee specifically created to oversee and guide an ICT research project on behalf of IDOT. 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). The TRP is responsible for reviewing and approving the research work plan, providing regular feedback to the researchers about the research, and reviewing and approving the project's final report.

IMPACT OF COMPLETED RESEARCH

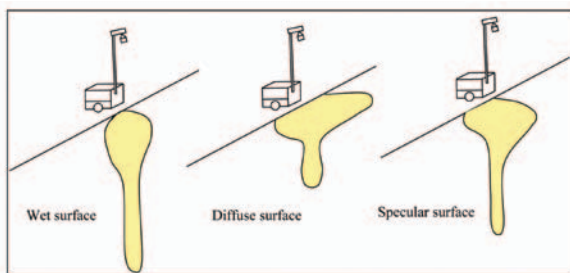
This section presents a summary and, most importantly, the impact of completed ICT research projects.

Please note that this section highlights only a selected number of the diverse and groundbreaking research ICT has completed. For a comprehensive list of complete and ongoing projects, turn to the end of this report.

The showcased projects on the following pages are organized into the research areas that correspond to IDOT Technical Advisory Groups.

Nighttime Lighting Glare

Background: In addition to lessening construction delays for many daytime drivers, nighttime construction is a good alternative for many other reasons. First of all, having fewer travelers on the road can reduce the potential for work zone accidents. Other benefits of nighttime construction can include decreased pollution from stopped vehicles and lower temperatures for construction workers. However, nighttime construction comes with its own set of risks and problems. Poor utilization and placement of the lighting equipment that illuminates the work zone can cause glare that is dangerous to both drivers and workers. When drivers travel into a brightly lighted construction zone at night, their eyes may have trouble adjusting. Additionally, the bright lights can also impair the construction workers' vision.



Luminous patch produced on different pavement surfaces.

Research: With the goal of making nighttime construction zones safer, ICT researchers have analyzed and compared the levels of glare and lighting performance generated by typical as well as innovative lighting arrangements and have identified the factors that affect glare measurement in nighttime work zones. The investigators visited and studied multiple nighttime highway construction zones and conducted their own lighting experiments in a simulated construction zone at ATREL. The team tested a total of 25 different lighting arrangements that were similar to the ones set up in the actual work zones they had visited previously. Finally, the team developed practical models to measure and control the levels of glare experienced by drive-by motorists as they pass nighttime work zones. The research team made several practical recommendations to reduce and control glare in nighttime construction zones which included guidelines for the height of the light sources and the aiming and rotation angles for light towers. Most importantly, as a result of their observations and experiments, the researchers developed a model for quantifying nighttime glare, which they named "Glare Measurement Model (G2M)". This model will

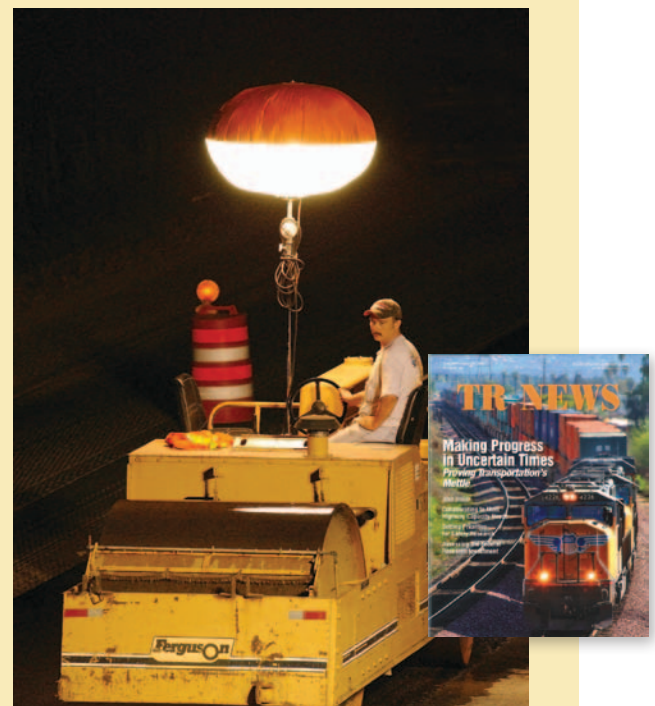
be used by engineers and contractors when they set up nighttime work zones. With nighttime construction zones becoming more and more common because of the aforementioned benefits, the results of this research project will promote safer work zones and reduced commute time for drivers.

Impact: The new G2M model, developed as part of this study, can be used to measure and quantify glare during nighttime construction. The research also provided IDOT with recommendations on which lighting devices to use and how to set up lighting equipment. The end results are safer work zones for everyone and potentially increased productivity due to improved working conditions.

PIs: Khaled El-Rayes and Liang Liu

See Research Appendix for Additional Completed SAFETY ENGINEERING Research.

NOTABLE



ICT's Nighttime Lighting Glare project was highlighted in the January/February 2009 Research Pays Off column in *TR News*, a publication of the Transportation Research Board of the National Academies. The research was also published in two ASCE journals: *Journal of Construction Engineering and Management* and *Journal of Transportation Engineering*.

DeKalb County Bridge Collapse Investigation

Background: On August 19, 2008, a bridge that crosses over the south branch of the Kishwaukee River in DeKalb County (Bridge No. SN 019-5010) suddenly collapsed. Luckily, no one was on the bridge; no one even witnessed the collapse. This bridge was constructed in 1976 with three 42-foot concrete deck beams supported by concrete pile (column) caps with timber foundation piles. The timber piles were approximately 28 foot long with 17 feet extending below the riverbed. The original bridge plans specified an allowable pile capacity of 24 tons. The bridge served local agricultural traffic, including grain trucks.



Research: Through initial observation and a geotechnical investigation, ICT investigators were able to rule out the possibility of collapse due to soil failure or superstructure (deck beams or pile caps) and determine the piles as the initiator of collapse. Therefore, the investigators retrieved six pile samples and conducted compression testing, which revealed the piles could withstand a much heavier capacity than their design capacity but that two specimens tested with a modest eccentricity (resembling the case when traffic loads are applied on one bridge span) showed a 60 percent reduction in the piles' capacity

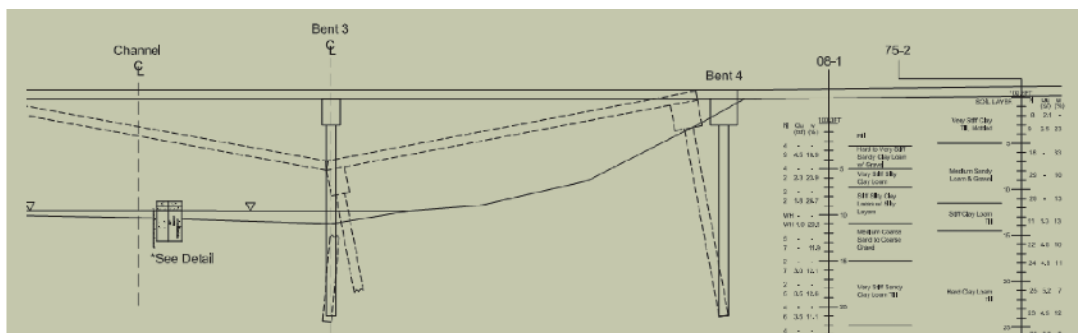


ity compared to that of concentrically (resembling the case when traffic loads are applied on two adjacent bridge spans) loaded specimens. Therefore, these tests illustrated that the piles' capacity was sensitive to eccentric loading, which could occur when only a single span of the bridge is loaded. The investigators also created an analytical model, which

revealed results that supported the experimental testing. The analysis results showed that the bridge was capable of withstanding an Illinois legal load (72,000 lbs) if all eight piles are supporting the load. However, it was concluded that a moderately overloaded vehicle would be sufficient to initiate collapse of the structure. The investigators recommended that the effect of eccentrically applied load be considered when determining the capacity of bridges supported on timber piles, especially when the superstructure is simply supported.

Impact: ICT provided DeKalb County with the information necessary to determine the likely cause of, and potentially the responsibility for, the collapse of the structure. As a result of this study, IDOT now recommends that local agencies not allow overweight permit loads on structures supported by timber pile piers, within certain parameters and characteristics, without a full analysis. Additionally, IDOT will incorporate procedures from the investigation's final report, such as the effects of eccentric loading on timber piles, into its future timber pile capacity analyses.

PIs: Bassam Andrawes, Jerome Hajjar, and Scott Olson



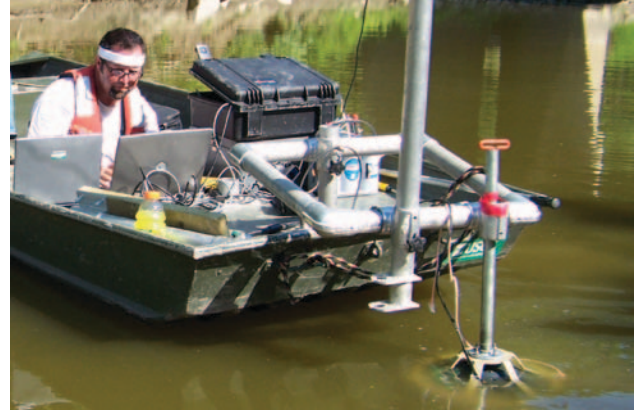
Simple Cost-Effective Scour Sensor



Background: Scour is considered one of the major causes of highway bridge failures in the United States. It is especially prevalent during floods and periods of rapid river flow activities. During floods, erosion of the foundation materials below the bridge piers causes structural instability. This process is dynamic, where erosion

takes place near the peak flow rates, and deposition of sediments occur during the descending stages of the flood. If scour is not identified in time, the structural integrity of the foundation progressively deteriorates and leads to severe damage and collapse of the bridge.

Research: This project developed a fiber optic scour sensor capable of monitoring and providing quantitative characteristics of both scour depth and flow processes, i.e. rate. The proposed fiber optic scour sensor includes a single Fiber Optic Bragg Grating (FBG) sensor embedded inside a rod cantile-



vered into the river bed. The work involved proof of concept experiments, establishment of a calibration methodology, finite element numerical modeling, design and fabrication of field sensors, as well as implementation of field calibrations and field tests.

Impact: Unlike electrical signals, optical signals can safely operate in underwater applications, and they are capable of serial multiplexing. For example, one fiber optic interrogator could handle up to about eight scour sensors at the same time. This sensor will allow for better monitoring of scour and therefore better bridge maintenance and safety. A new ICT project is underway to further evaluate and implement this sensor.

PI: Farhad Ansari

NOTABLE



Prior to the DeKalb County bridge investigation, the ICT has rapidly responded to other IDOT requests related to bridge integrity, including detecting internal structural damage when a bridge girder suddenly collapsed on the suburban Chicago Kingery Expressway (shown above) and conducting a non-destructive evaluation of the Dan Ryan (I-90/94) bridge decks using ground penetrating radar.

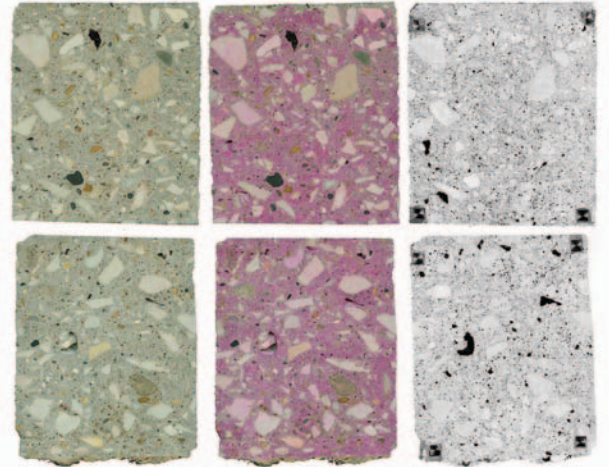
Performance of I-57 Recycled Concrete Pavement and Analysis of I-57 Recycled CRCP Cores



Background: IDOT first used recycled concrete in 1986 to rehabilitate an existing stretch of continuously reinforced concrete pavement (CRCP) on I-57 in Illinois. This I-57 CRCP inlay is the only IDOT project that has used recycled concrete aggregate (RCA) in the concrete surface mixture.

Currently, this CRCP inlay is over 20 years old, has an annual daily traffic of 17,000, and is beginning to show some signs of deterioration.

Research: ICT investigators summarized and documented the 20-year structural and functional performance of the I-57 CRCP inlay that used recycled concrete as the primary coarse and fine aggregate. They extracted and analyzed cores for the presence of deleterious alkali-silica reactivity (ASR) to make an accurate assessment of the performance of this recycled concrete pavement. Then, its performance was compared with the performance of similarly aged and trafficked CRCP in the state of Illinois using a structural and functional evaluation and data collected by IDOT (distress surveys, friction and IRI data). The comparisons showed that the use of RCA did not affect the CRCP's performance. Therefore, based on the performance of



As part of this study, the concrete cores pictured above were analyzed for ASR by Karl Peterson of Michigan Tech.

this section, the investigators recommend that crushed concrete as an aggregate in the surface concrete layer should be considered for future concrete pavement projects as long as the recycled concrete material passes the freeze-thaw requirements, accommodations are made for greater drying shrinkage and slightly lower tensile strength, and the concrete is checked for the possibility of ASR.

Impact: The validation of recycled concrete aggregate for use in Illinois has positive implications for IDOT's budget and the environment.

PI: Jeff Roesler

NOTABLE



Quality pavements that are safe and smooth-riding are the result of optimal design and rehabilitation strategies that have been years in the making. ICT investigators research these strategies, investigate the causes of pavement deterioration, and devise ways to improve pavement design, performance, and rehabilitation methods. The information gained from these studies leads to lower construction costs, increased maintenance intervals, extended pavement life, and reduced travel delays.

Evaluation / Optimization of Tack & Bond of HMA Overlays of PCC



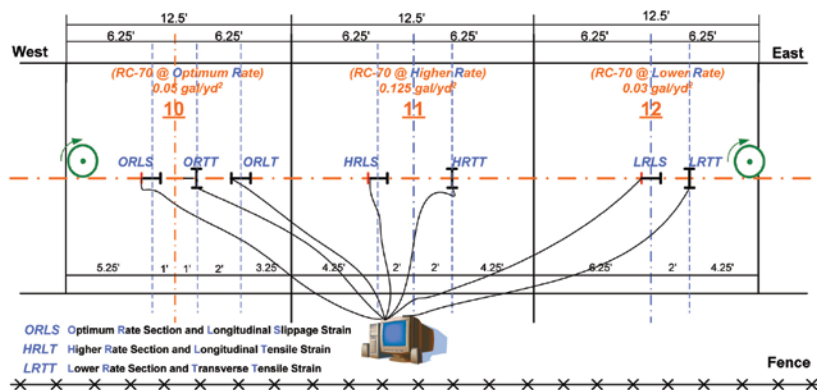
Background: Interface bonding between hot-mix asphalt (HMA) overlays and Portland cement concrete (PCC) pavements can be one of the most significant factors affecting overlay service life. The assumption in pavement design is that adjacent layers are fully bonded together without any relative slip. However, in reality, this is not always true. Various factors may affect the bonding condition at the interface, including HMA material, tack coat material, tack coat application rate, PCC surface texture, temperature, and moisture conditions. At locations with poor interface bonding, debonding occurs, and pavement distresses will quickly appear.

Research: This study included three major components to quantify the impact of various parameters on the permanent deformation of HMA overlay: laboratory testing, numerical modeling, and accelerated pavement testing. During the laboratory testing, the following parameters were evaluated: HMA material type, tack coat type, tack coat application rate, PCC surface texture, temperature, and moisture conditions. A monotonic direct shear test was used to determine optimum tack coat application rate at the HMA overlay-PCC pavement interface. The significance of the test results was statistically validated. The field work consisted of creating 25 test sections of HMA overlays placed on PCC. The test sections had varied HMA types, tack coat types, tack coat application rates, and PCC surface textures. The test sections were loaded with ATLAS, to simulate real-life traffic loading. After accelerated loading, the test sections were evaluated for differences in rut depths to provide insight into the importance of tack coat and interface conditions on overlay performance. The field testing results were also used to validate the finite element models developed in the project.

Impact: IDOT is in the process of adopting the appropriate tack coat type and the optimized application rate as part of the IDOT specifications.

PIs: Imad Al-Qadi and Sam Carpenter

See Research Appendix for Additional Completed PAVEMENT DESIGN & MANAGEMENT/ MATERIALS Research.



- The ATLAS wheels are moving from the West to the East;
- Strain gauge with both ends attached to the bottom of HMA to measure the longitudinal tensile strain;
- Strain gauge with both ends attached to the bottom of HMA to measure the transverse tensile strain;
- Strain gauge with the red end glued to the PCC surface and black end attached to the bottom of HMA to measure the longitudinal slippage strain.

Safer Rolling Lane Closures



Background: Rolling lane closures are a common traffic control technique in work zones; they consist of a convoy of traffic protection vehicles equipped with warning lights and arrowboards that alert drivers to the presence of work crews and guide them to the adjacent lane until they have safely

passed the work zone. However, a danger of rolling closures is that their moving nature does not allow for the placement of barricades between the work crew and the adjacent open traffic lane.

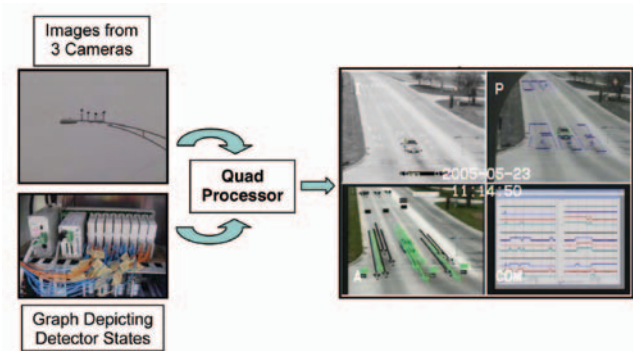
Research: This project aimed to improve the safety of work crews, traffic control providers, and the traveling public by studying the factors that affect driver behavior around moving work zones. Specifically, the researchers studied pertinent safety parameters that include traveling speed, number and 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 determining energy absorption to predict typical roll-ahead distances of protection vehicles when they are impacted by vehicles of varying sizes and speeds.

Impact: This study identified specific hazards that make moving lane closures inherently dangerous and the effect of specific design features (such as truck spacing) on driver behavior. It resulted in an overall better understanding of traffic patterns around moving lane closures. Phase II of this study is now underway, which will develop specific recommendations to enhance existing standards for moving lane closures. The implementation of this research could help reduce the thousands of accidents that occur on our nation's highways each year, including the numerous fatalities occurring in highway work zones.

PIs: Douglas Steele and William Vavrik

Signal Systems Testing

Background: A video detection system (VDS) is an application based on video processing technology that detects vehicles within a camera's field of view. A "tripline" VDS detects relative changes in the properties of the pixels located on the detection zones to identify the presence of a vehicle. VDS are increasingly being used, instead of inductive loops, at signalized intersections. The benefits of VDS include flexibility, adaptability to changing conditions, and their non-intrusive nature. In addition, VDS can be used for special purpose applications such as



intersections at railroad crossings or detection on bridge decks. Additionally, some jurisdictions plan to use them to obtain traffic counts for redesigning timing plans and for signal coordination. Although VDS entered the vehicle detection market more than a decade ago, no studies had been conducted to evaluate the systems from different manufacturers under specific weather and illumination conditions using side-by-side installation.



Research: This research compared the detection performance of three commercial VDS (Autoscope, Peek, and Iteris) at a signalized intersection under a wide range of illumination and adverse weather conditions. The results

showed significant changes in the performance of the three VDS as illumination conditions changed from cloudy to sunny and from daytime to nighttime.

Impact: The recommendations from this study will be used to develop performance-based specifications to procure VDS. Additionally, the insight gained will be used to mitigate detection errors during adverse weather and thus maintain safe and efficient operations in these conditions.

PI: Rahim Benekohal

NOTABLE



For projects related to traffic signal components and fiber optic communications, ICT has access to the Traffic Operations Lab (TOL). TOL houses an extensive collection of traffic signal control hardware, including controllers, detector units, and conflict monitors, which provide a valuable resource for hands-on instruction and research. The laboratory was established in 1998 to train IDOT personnel and contractors in the integration and working relationship of the railroad and highway signal systems and has been continually updated since then.

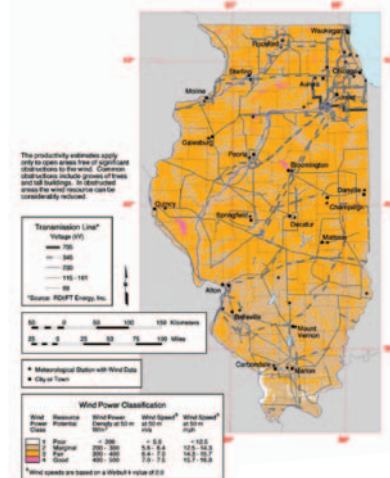
Wind-Powered Rest Areas



Background: Wind power is an attractive option because it is a clean, renewable energy source that avoids greenhouse gases; it uses relatively little land or other natural resources; and it is a hedge against further increases in electricity costs.

Research: The ICT investigated the viability of using wind power

to provide electricity for rest areas and weigh stations along Illinois highways. 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. The final report includes site-by-site recommendations along with an economic analysis for using wind turbines.



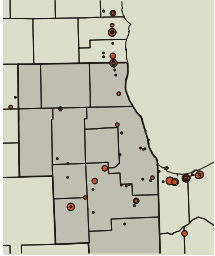
Illinois - Wind Resource Map

Impact: IDOT plans to install and maintain wind turbines at four of the selected locations from the study, as a pilot project. The implementation of this project's recommendations could reduce IDOT's energy costs while protecting the environment.

PI: Patrick Chapman

See the Research Appendix for Additional TRAFFIC OPERATIONS AND ROADSIDE MAINTENANCE Research Completed.

Truck Parking Facilities Program Design



Background: Studies have shown that independent over-the-road truckers and company drivers have difficulty finding parking spaces as often as once a week. A lack of acceptable truck parking leads to their “nuisance” parking in residential, retail, or manufacturing areas. The consequences of nuisance parking include safety hazards, problematic environmental effects from emissions and toxins, and a diminished freight transportation system affecting the local economy.

Research: This ICT 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 investigators completed a taxonomic study of truck traffic volume and truck parking availability and conducted interviews with state, county, and municipal authorities, and truck drivers. The investigators identified two separate groups of truckers. The first group, the independent, over-the-road drivers with Chicagoland deliveries and pickups, has fewer resources available for securing parking when needed. The second group, local company drivers, also contribute to nuisance parking by parking in areas designed for over-the-road truckers and access ramps.

Impact: The investigators developed specific recommendations for dealing with nuisance parking. As part of Phase II of the study, the investigators are developing a handbook to help alleviate truck parking problems.

Pls: Laurence Rohter and Peter Beltemacchi

NOTABLE

The Chicago-area offers many opportunities for ICT research to make an impact on public transportation and multi-modalism (the connections among various modes of transportation). For example, ICT investigators John DeVries and Karen Nance met with the Chicago Metropolitan Agency for Planning’s (CMAP’s) Freight Committee during June 2009 to present their data and analysis on the characteristics of regional distribution centers that will help CMAP determine the demand freight transportation has on infrastructure, forecast travel activity, and anticipate additional transportation assets.

Effectiveness of Transit Strategies Targeting Elderly People

Background: By 2030, the elderly population in the U.S. is expected to double. An aging population brings new challenges for transportation researchers, such as providing seniors with innovative transportation alternatives that help them maintain their independence while also assuring the safety and comfort of other travelers. A recent law provides free public transportation for Illinois seniors. This certainly encourages seniors to use public transportation. However, cost hasn’t been the only detriment to seniors’ use of these services.



Time-of-Day Frequency Distribution for Social and Recreational Trips

Research: This ICT study explored the usefulness of strategies that can encourage seniors’ use of the public transit system. The results showed that many seniors keep driving because

they are not familiar with the public transportation system. Additionally, their safety concerns and expectations of frequent stops and wait time influence their choices about transit. The study showed that the most appealing technological solutions to seniors are the availability of real-time wait time and lower-height buses. Other successful strategies could include transit schedule brochures, increased frequency of services, and fixed routes especially designed for seniors.

Impact: This research, which has two phases, will help Illinois offer seniors safer, cleaner, well-equipped, and more accessible services. The results of these studies will facilitate more efficient transit services that target senior travelers, positively change their attitude towards public transportation, and help transportation and transit agencies promote effective transportation solutions for an aging population.

Pls: Kouros Mohammadian and Piyushimita Thakuriah

See the Research Appendix for Additional PUBLIC TRANSPORTATION/ MULTI-MODAL Research Completed.

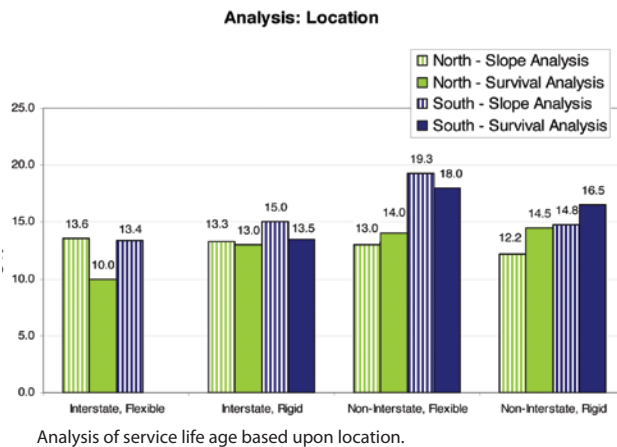
PLANNING

Performance of HMA Overlays in Illinois



Background: IDOT has evaluated the performance of the pavements in Illinois in a variety of studies over the years. Since those studies were conducted, several changes in IDOT practices, policies, and procedures sparked the need to reassess the performance of hot-mix asphalt (HMA) overlays in Illinois.

Research: 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.



Impact: This study validated the service life for various HMA overlays and pointed out the impact of certain attributes on the service life, which are included in an extensive database for future use.

PIs: Angie Wolters and Kurt Smith

Commercial Vehicle Info. Systems & Networks (CVISN)



Background: A commercial vehicle information system manages the information related to the safety and credentials of commercial motor carriers and vehicles. The safety information includes selected statistics related to accidents, violations and inspections, as well as safety ratings, if they exist. The credential information is equivalent to the decals and paper documents carried on commercial vehicles.

Research: This project developed system requirements for Commercial Vehicle Information Systems 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 that serve to improve vehicle regulations include 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.

Impact: The use of CVISN improves Illinois highway safety, streamlines regulation of the trucking industry, and enhances motor carrier efficiency and productivity.

PI: Peter Nelson

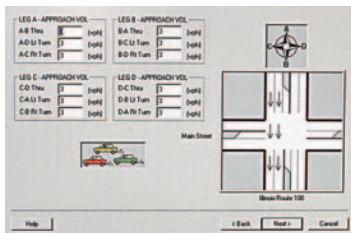
See Research Appendix for Other PLANNING Research Completed.

Updating the Illinois Carbon Monoxide Screen for Intersection Modeling (COSIM)



Background: IDOT uses a computer screening model, Illinois CO Screen for Intersection Modeling (COSIM), to estimate worst-case carbon monoxide (CO) concentrations for proposed roadway projects affecting signalized intersections.

If the results from COSIM are within the National Ambient Air Quality Standards (NAAQS) for CO, no further CO modeling is required for the intersection. If the results from COSIM indicate that the project may cause a NAAQS violation, a detailed analysis is required to more accurately evaluate potential CO levels. The original model was developed in 1999 as part of an Illinois Transportation Research Center (ITRC) research project. In 2007, regulatory changes in the Illinois Vehicle Inspection and Maintenance (I&M) program prompted the Illinois Environmental Protection Agency (IEPA) to recommend that IDOT update COSIM with new emission factor (EF) tables generated from U.S. EPA's mobile source emission model, MOBILE 6.2.



Research: This project facilitated the release of COSIM Version 3.0 in June 2008. Version 3.0 incorporates new emission factors for the Illinois On-board Diagnostics-only

Vehicle Inspection and Maintenance program, enhancements to the pre-screen feature, and other updates.

Impact: Version 3.0 of COSIM is being used by IDOT to accurately predict CO concentrations.

PI: Scott Peters

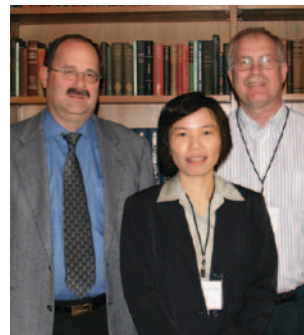
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Fittingly, the attendees of the ICT's peer exchanges on environmental topics enjoyed the natural beauty of Allerton Park, a 1,517-acre park, nature center, and conference center located on the upper Sangamon River outside of Monticello. The park and manor house were laid out and built by industrialist Robert Allerton, who gave the complex to the University of Illinois in 1946. The park includes a mansion, formal gardens, sculptures, and restored prairie.



Midwest Peer Exchanges

Background: Air toxics is an emerging area that receives more and more attention from transportation/environmental agencies, academic researchers, and the public because of potential health issues and uncertainties with modeling and the science behind mobile source air toxics (MSAT). Particulate matter (PM) is a generic term for a broad class of chemically and physically diverse substances that exist as discrete particles (liquid droplets or solids) over a wide range of sizes. PM is emitted into the air through combustion exhausts or mechanical wear-and-tear from cars and trucks, power plants and factories, and construction sites. A hot-spot analysis is an estimation of likely future localized pollutant concentrations and a comparison of those concentrations to the National Ambient Air Quality Standards (NAAQS) set by the U.S. EPA.



Activities: ICT sponsored two separate peer exchanges where subject matter experts on PM and MSAT gathered at Allerton Park in Monticello, IL to exchange ideas and experiences, including monitoring and compliance. The attendees included staff from Midwestern state Departments of

Transportation (DOTs), metropolitan planning organizations, the U.S. EPA, the Illinois EPA, University faculty, and the FHWA. In general, the peer exchange participants were concerned with making sure their new transportation projects are in compliance with U.S. EPA regulations. The PM meeting offered the attendees opportunities to identify hot-spot requirements, discuss PM modeling uncertainties and monitoring of PM, and learn about how other states are documenting the analyses. The MSAT meeting covered both the technical and practical issues/uncertainties emerging from the new MSAT regulations guidance and allowed participants to exchange ideas and experiences in documenting MSATs in the NEPA documents.

Impact: The peer exchanges resulted in documented challenges in practice, research needs, and practical guidelines on particulate matter and mobile source air toxics, which are useful to all state DOTs.

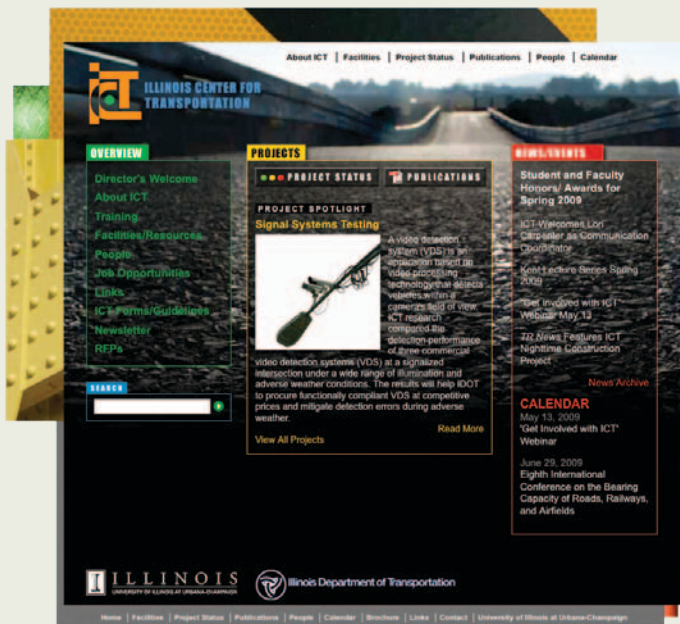
PI: Jie Lin (The photo above shows Jie at the PM peer exchange with David Lippert and Walt Zyzniwski from IDOT.)

ICT maximizes the impact of its research through outreach activities, which include a quarterly electronic newsletter, a regularly updated web site, webinars, and short courses. Additionally, ICT actively publishes its research in a wide variety of publications and presents its research at numerous national and international conferences and events throughout the year.



New Logo and Redesigned Web site

In 2008, the ICT unveiled its new visual "identity" with a redesigned logo and web site. The new logo includes abstractions of street shapes (road, exit ramp, intersection) and a green traffic light. The orange and blue colors are symbolic of the center's ties to the University of Illinois at Urbana-Champaign (UIUC). This innovative logo is an appropriate symbol of the cutting-edge research ICT conducts. Additionally, visitors to the redesigned ICT web site, <http://ict.illinois.edu>, noticed several enhancements including a comprehensive event calendar, a user-friendly search feature, an updated status of ongoing research, searchable reports, timely news articles, and improved visual appeal.



Quarterly Newsletter

ICT launched its newsletter in late 2007 and since then has used this tool, which is emailed quarterly, to keep its colleagues and friends around the world up to date on ICT research and activities. To join the newsletter distribution list, send an email to lsweet@illinois.edu.

Short Courses

ICT's short courses disseminate research findings in a classroom setting to those who can most benefit from the information. The first short course covered the design and concrete material requirements for ultra-thin whitetopping (UTW). The UTW course participants, many of whom were Illinois county and municipality employees, learned the structural design and construction guidelines for UTW along with the appropriate concrete material requirements to achieve a design of the intended service life. By implementing the outcome of this research, local agencies can improve the efficiency and quality of design and construction for UTW projects.

Webinars

In spring 2009, ICT implemented Adobe ConnectPro to facilitate its webinars. ICT's first two webinars explained the processes and procedures for getting involved in ICT research to "attendees" from Illinois universities. ICT posts recorded versions of webinars on its web site.

NOTABLE

ICT Offers Documentation Training Class

In fall 2008, ICT began offering the Documentation of Contract Quantities class. All consultants who perform construction inspection (Phase III) work for IDOT must take and pass this class. In 2009, ICT offered 13 three-day classes that were attended by a total of 417 students.

This course assures well-trained, 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. Additionally, ICT was able to build processes, such as web-based registration and an enrollment database, that will aid in the facilitation of future technology transfer activities.



Final Reports Posted

When an ICT project is complete, the final research report is published and posted on the ICT website's publications page (<http://ict.illinois.edu/Publications.asp>).

*In some rare 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 special cases, the findings or conclusions are usually disseminated to the specific IDOT personnel that would be affected or interested.

A sampling of the publications, websites, and events where ICT research has been published, featured, or presented:

Journals, Magazines, and Websites

- *Accident Analysis & Prevention*
- *ASCE Journal of Construction Engineering and Management*
- *ASCE Journal of Transportation Engineering*
- *Asphalt Contractor*
- *Better Roads*
- *CEE* (UIUC alumni publication)
- *Community Concierge*
- *Grading & Excavation (GX) Contractor*
- *Engineering Structures*
- <http://streamstats.usgs.gov/ilstreamstats/>
- *International Journal of Pavement Engineering*
- *Journal of the Association of Asphalt Paving Technologists*
- *Journal of the Transportation Research Record*
- *Physorg.com*
- *Rockford Register Star*
- *The News-Gazette*
- *Tire Technology International*
- *TR News*
- *Tyre Asia*
- *WILL- A.M.*
- www.buzzle.com
- www.chicagoimprint.uiuc.edu
- www.eurekalert.org
- www.firstscience.com



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Illinois StreamStats Site Gets High Traffic

As of early May 2009, the Illinois StreamStats site (developed as ICT project R27-6) had the third highest number of web requests of all U.S. StreamStats sites in 2009. Illinois StreamStats statistics show that 1,765 (watershed) delineations were completed between 3/11/09 and 5/8/09. In the past, delineating a

watershed could take from a day to weeks, depending on the size of the watershed. Now the watershed delineation, basin characteristics extraction, and flood frequency computations can all be completed by "pointing and clicking." Illinois StreamStats can be accessed at <http://streamstats.usgs.gov/ilstreamstats/>.

Conferences and Meetings

A partial list of the conferences and meetings ICT researchers are involved in is presented below.

- Airfield and Highway Pavements Conference, ASCE
- Annual Illinois Traffic Engineering and Safety Conference
- American Council of Engineering Companies-IL/IDOT Bridge Seminars, 2008
- Annual Transportation and Highway Engineering (T.H.E) Conference
- Annual Gulf (Persian) Conference on Roads
- Association of Asphalt Paving Technologists Annual Meeting
- Chicago Metropolitan Agency for Planning (CMAP) Freight Committee Meeting
- Geo-Institute GeoCongress, ASCE
- GeoAfrica 2009
- Geo-Shanghai International Conference 2006
- Illinois Water Conference 2008
- INFORMS Annual Meeting
- International Conference on Advanced Characterization of Pavement and Soil Engineering Materials
- International ISAP Symposium on Asphalt Pavements and Environment
- NDE Conference on Civil Engineering
- Structural Materials Technology (SMT) Conference
- Transportation Research Board Annual Meeting
- Transportation Research Board Work Zone Safety committee meeting
- Unbound Aggregates in Roads Symposium (UNBAR7)



Leslie Elble (ICT) and Patricia Broers (IDOT) stand in front of the ICT exhibit.

- Work Zone Safety Conference 2009
- 1st International Conference on Transportation Geotechnics
- 3rd International Conference on Accelerated Pavement Testing
- 3rd International Conference on Advances on Mechanical Engineering and Mechanics
- 5th and 6th International Conferences on Maintenance and Rehabilitation of Pavements and Technological Control
- 6th International Symposium on NDT in Civil Engineering

NOTABLE

Research Pays Off

The Research Pays Off column in *TR News*, a publication of the Transportation Research Board of the National Academies, has featured ICT research twice recently: Nighttime lighting glare research was highlighted in the January/February 2009 issue, and uninterruptible power supply (UPS) for traffic signals research was highlighted in the September/October 2008 issue.



NOTABLE



Tire Design Paper Wins Award

A paper based on the results of ICT project R59, Evaluation of Pavement Damage Due to New Tire Designs, was the runner-up for the TRB K. B. Woods Award at the 2009 Annual Meeting of the Transportation Research Board (TRB). The K. B. Woods Award was established by the Executive Committee in 1971 and may be given annually for the outstanding paper published in the field of design and construction of transportation facilities. The paper was authored by Imad L. Al-Qadi, Hao Wang, Pyeong Jun Yoo, and Samer H. Dessouky and was titled, "Dynamic Analysis and In-Situ Validation of Perpetual Pavement Response to Vehicular Loading."

- 6th RILEM International Conference on Cracking in Pavements
- 7th International RILEM Symposium on Advanced Testing and Characterization of Bituminous Materials (ATCBM09)
- 7th Structural Materials Technology
- 8th International Conference on the Bearing Capacity of Roads, Railways and Airfields (BCR2A'09)
- 12th International Conference of International Association for Computer Methods and Advances in Geomechanics (IACMAG)
- 2007 Construction Research Congress, ASCE

Conferences Sponsored and/or Exhibited

An integral part of ICT outreach activities is its sponsorship of and participation in the following transportation-related conferences.

- Annual Illinois Bituminous Paving Conference
- Annual Illinois Traffic Engineering and Safety Conference
- Annual Transportation and Highway Engineering Conference
- Innovations Conference on Asphalt & Transportation
- Nextrans Inaugural Summit
- UIUC Engineering Open House
- 6th RILEM International Conference on Cracking in Pavements
- 8th International Conference on the Bearing Capacity of Roads Railways and Airfields (BCR2A)

PROJECT TITLE	PROJECT CODE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
SAFETY ENGINEERING						
Speed Photo Enforcement	R56	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, speeding tickets contested in court, 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	Active
Median Cable Scanning Tour	R27-SP1	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
Nighttime Construction: Evaluation of Lighting Glare for Highway Construction in IL	R27-2	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
Crash Data Analysis & Engineering Solutions for Local Agencies	R27-18	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	Active
Develop Safety Performance Functions for Illinois	R27-20	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	Active
Alternative Intersections - Roundabout Evaluation and Design	R27-21	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 10 intersections in Illinois that have the potential to reduce fatalities 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/section guidelines for roundabouts in Illinois.	Rahim Benekohal	Varun Atluri	Sean Coyle	Active

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

PROJECT TITLE	PROJECT CODE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
Safety Impacts of Shoulder Attributes in Illinois	R27-40	This study is analyzing the extent to which the presence/absence and width of paved shoulders contribute to vehicle crashes by severity and type; assessing the safety effectiveness of shoulder paving; identifying, mapping, locating, and defining the potential for safety improvements for individual highway segments; and ranking and prioritizing highway segments with high potential for safety improvements for rural two-lane and multilane highways in Illinois in the most cost-effective manner. Outcome: Ranking and prioritizing highway segments for shoulder paving and updating current guidelines and practices for IDOT shoulder paving.	Zongzhi Li (IIT)		James Allen	Active
Studying & Minimizing Traffic-Related Work Zone Crashes in Illinois	R27-52	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
SafetyAnalyst Software for Illinois	R27-65	The objective of this project is to convert linked crash and roadway files to a site-level database that the SafetyAnalyst (a software program developed by FHWA) can be applied to. Once adapted, this software will identify and manage a systemwide program of site-specific improvements, conduct necessary analyses, and develop strategies to prevent motor vehicle crashes. The SafetyAnalyst package will be incorporated into the national Highway Safety Manual, and it will soon be mandatory for the states to adopt. Outcome: Implementing and adapting SafetyAnalyst software for use in Illinois.	Yanfeng Ouyang		Mehdi Nassirpour	Active
Effectiveness of Innovative Speed Enforcement Techniques in Illinois	R27-66	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 (ISP) to better allocate their resources and ultimately reduce speed-related accidents on Illinois highways. Outcome: Developing best practices for patrol and saturation patrol procedures.	To Be Determined by RFP Process		Priscilla Tobias & Scott Abbott (ISP)	New
National Safety Performance Function (SPF) Summit	R27-67	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 improvements. Such a summit will also assist practitioners with the implementation of the proposed AASHTO Highway Safety Manual Key. Outcome: Introducing the concept of SPFs to a wider audience and facilitating the exchange of ideas and best practices related to SPFs.	Yanfeng Ouyang	Sharan Dhanaraju	Priscilla Tobias	Active

PROJECT TITLE	PROJECT CODE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
STRUCTURES/ HYDRAULICS/ GEOTECHNICAL						
Precast Deck Beam Lifting Loops	R54	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		Kevin Riechers	Active
Chicago Bridge Deck & Bridge Piers	R27-SP2	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		David Lippert	Completed
Non-Destructive Evaluation of Reinforced Concrete Structure	R27-SP7	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		David Lippert	Completed
DeKalb County Bridge Collapse Investigation	R27-SP12	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
Illinois StreamStats	R27-6	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	Active
I-39 Kishwaukee Bridge Monitoring	R27-9	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)		Todd Ahrens	Active

PROJECT TITLE	PROJECT CODE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
Pier Scour Prediction in Cohesive Soils: Use of EFA-SRICOS Method in IL	R27-19	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)		Matt O'Connor	Active
Evaluation/ Modification of IDOT Foundation Piling Design & Construction Policy	R27-24	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		William Kramer	Completed
Modification of IDOT Integral Abutment Design Limitations & Details	R27-25	Because the current guidelines and limitations that apply to integral abutment bridges (IABs) have several gaps and grey areas, IDOT requested further investigation. The objective of this project is 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: Developing a new design approach for IABs in Illinois.	Scott Olson & James Long		William Kramer	Active
Free-Cutting Brass Breakaway Couplings	R27-26	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		Christopher Hahin	Active
Simple Cost Effective Scour Sensor	R27-35	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)		Dave Copenbarger	Completed

PROJECT TITLE	PROJECT CODE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
Transfer/ Development Length of Prestressing Tendons in AASHTO I-Girders Using S-C Concrete	R27-36	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 and evaluate how SCC compares with conventional concrete and investigated 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
Instrumentation & Monitoring of “Extreme” Integral Abutment Bridges in Illinois	R27-55	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		William Kramer	Active
Transfer & Development Lengths in Prestressed Self-Consolidating Concrete Bridge Box & I-Girders	R27-56	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
Superiority & Constructability of Fibrous Additives for Bridge Deck Overlays	R27-57	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 fibrous additives.	Mohammad Alhassan & Suleiman Ashur (Purdue)	James Welch	Gary Kowalski	Active
Improved Design for Driven Piles Based on a Pile Load Test Program in Illinois	R27-69	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		William Kramer	Active
Calibration & Refinement of Illinois’ Earthquake Resisting System Bridge Design Methodology	R27-70	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.	Jerome Hajjar, James LaFave, & Larry Fahnestock	Joshua Steelman	Daniel Tobias	Active

PROJECT TITLE	PROJECT CODE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
Field Implementation and Evaluation of the Simple Cost-Effective Scour Sensor	R27-71	The objective of this project is to implement and evaluate a scour sensor that was developed in a previous ICT project. The investigators will perform comprehensive field testing on a multi-span bridge with several piers and will examine various design parameters in terms of sensor dimensions, scour depths, resolution, and numerical calibration schemes. The optimum sensor parameters will be selected based on these parameters. The research will focus on installation of several sensors at different pier locations and interface software for simultaneous detection of scour. Outcome: Developing design and installation details and performing field implementation and instrumentation for the scour sensor.	Fahrad Ansari (UIC)		Dave Copenbarger	Active
Fatigue Testing of Brass Breakaway Couplings	R27-80	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.	To Be Determined		Chris Hahin	New
Field Performance Evaluations of IL Aggregates for Subgrade Replacement & Subbase - Phase II	R27-81	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		Greg Heckel	New
Strengthening of Bridge Wood Pilings Retrofits for Moment Resistance	R27-82	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		Dan Tobias	New
CONSTRUCTION						
Evaluation of 3-D Laser Scanning for Construction Applications	R27-30	This project is researching the feasibility of using laser technology to monitor IDOT highway construction activities and transportation structures. Data obtained using laser scanning technology is being compared to data obtained using traditional methods. Outcome: Validating a cost-effective and accurate laser technology, which can impact the efficiency and cost control of future construction projects.	Dianne Slattery & Kerry Slattery (SIUE)		Ted Nemsy	Active
Documentation of Contract Quantities Training	R27-49	Beginning in 2009, the ICT took over the administration of the Documentation 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

PROJECT TITLE	PROJECT CODE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
PAVEMENT DESIGN & MANAGEMENT/ MATERIALS						
Mechanistic-Empirical (M-E) Design, Implementation & Monitoring for Flexible Pavements	R28-1/ R27-60	This project provides technical support to IDOT concerning the mechanistic-empirical (M-E) design, implementation, and monitoring of flexible pavements. 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 procedures 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
Binder/ Mixture Testing and Analysis	R28-2	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	Active
Validation of Extended Life HMA Pavement Design	R39-1	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	Active
Nondestructive Pavement Evaluation Using ILLI-PAVE Based Artificial Neural Network Models	R39-2	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 State 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
Self-Consolidating Concrete	R44	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
Concrete Distress Identification	R53	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 maintenance procedures due to a better understanding of ASR deterioration.	Leslie Struble		Brian Pfeifer	Completed

PROJECT TITLE	PROJECT CODE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
Evaluation / Optimization of Tack & Bond of HMA Overlays of PCC	R55	This study included three major components to quantify the outcome of various parameters on the permanent deformation of HMA overlay: laboratory testing, numerical modeling, and accelerated pavement testing. The lab testing evaluated HMA material type, tack coat type, tack coat application rate, PCC surface texture, temperature, and moisture conditions. The field work consisted of creating 25 test sections of HMA overlays poured on PCC with varied HMA types, tack coat types, tack coat application rates, and PCC surface textures. The test sections were then loaded with ATLAS. The APT results validated laboratory determined optimum tack coat application rate, which provided the lowest interface strain and surface rutting in the field. Outcome: Validated specific tack coat application rates that are in IDOT standard specifications.	Imad Al-Qadi & Samuel Carpenter	Zhen Leng & Hasan Ozer	Jim Trepanier	Completed
Evaluation & Implementation of Improved CRCP & JPCP Design	R57	This study refined IDOT's jointed plain concrete pavement (JPCP) design and developed a continuously reinforced concrete pavement (CRCP) design process 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	Amy Schutzbach	Completed
Cost-Effectiveness & Performance of Overlay Systems / Crack Control Methods in IL	R58	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	Jongeeun Baek & Minkyum Kim	Joe Vespa	Completed
Evaluation of Pavement Damage Due to New Tire Designs	R59	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

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Profile Equipment Verification (PEV) - FY06 - FY09	R27-SP3	This program certifies that contractors' profilograph machines, which measure the smoothness of pavements, meet IDOT standards. Each year, clean, marked test lanes with an initial baseline profile for comparison are set up as a test track at the Rantoul Airport. Then, contractors' machines are tested on the track, and the results are forwarded to IDOT. All contractors wanting to work with the state need to have their machine tested on this track. Outcome: Implementation of 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
2008 RILEM Conference on Cracking in Pavements	R27-SP6	The ICT 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
Analysis of I-57 Recycled CRCP Cores	R27-SP11	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		Mark Gawedzinski	Completed
Characterization of IL Aggregates for Subgrade Replacement and Subbase	R27-1	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	Active
Design & Concrete Material Requirements for Ultra-Thin Whitetopping Procedures	R27-3	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)		James Krstulovich	Completed
Hot Mix Asphalt (HMA) Sampling	R27-8	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
Determination of Usable Residual Asphalt Binder in RAP	R27-11	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	Jim Trepanier	Completed

PROJECT TITLE	PROJECT CODE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
Cold In-Place & Full Depth Recycling with Asphalt Products (CI & FDRwAP)	R27-12	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		Kevin Burke	Completed
Expansive Characteristics of Recycled Materials Used as Pavement Base Materials	R27-27	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: Developing a test method for the expansion of RAP aggregate and determining 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	Active
8th International Conference on Bearing Capacity of Roads, Railways & Airfields (2009)	R27-28	Objective/Outcome: The ICT is a sponsor of the Eighth International Bearing Capacity of Roads, Railways & Airfields (BCR2A) Conference, convening on the UIUC campus. The main objective of the BCR2A Conference is 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	Active
Impact of High RAP Content on Pavement Structural Performance	R27-37	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 Aurangzeb	Jim Trepanier	Active
Development of an Improved Specification for Maximum Plastic Concrete Temperatures	R27-38	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	Carol Peterson	Derek Parish	Active
Performance of I-57 Recycled Concrete Pavement	R27-41	The state of Illinois first used recycled concrete aggregate (RCA) twenty years ago to rehabilitate a section of I-57. This project summarizes and documents this pavement section's performance and compares 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		Mark Gawedzinski	Completed

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Thin Quiet Long-Lasting High Friction Surface Layer	R27-42	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	Shih-Hsien Yang & Song Su Song	Tom Zehr	Active
Mechanistic-Empirical Design Implementation & Monitoring for Rigid Pavements	R27-61	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 current practices.	Jeffery Roesler		Charles Wienrank	Active
Material Quality Testing Risk Assessment & Multi-State Peer Exchange	R27-62	The objective of this peer exchange is 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: Determining 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	Active
Evaluation of the Long-Term Durability of Joints Cut Using Early-Entry Saws on Rigid Pavements	R27-63	This project will establish 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 will be determined. The expected joint durability of no-seal joints when cut using early entry techniques will be evaluated compared to IDOT's standard practice for saw cuts. The joint performance as a function of cut depth and time shall also be considered. Outcome: Developing definitive recommendations on whether the early entry sawing technique is viable for IDOT work.	Thomas Van Dam & Kurt Smith (APTech)		Mark Gawedzinski	Active
Evaluating the Compatibility of Durable Pavement Markings on Various HMA Mixes (or Pavements?)	R27-77	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.	To Be Determined by RFP Process		Kelly Morse	New
Evaluating the Effects of Various Asphalt Binder Additives/ Modifiers of Moisture Sensitivity in HMA	R27-78	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.	To Be Determined		Jim Trepanier	New
Designing, Producing & Constructing Fine-Graded Hot Mix Asphalt (HMA) on IL Roadways	R27-79	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.	To Be Determined		Laura Shanley	New

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TRAFFIC OPERATIONS & ROADSIDE MAINTENANCE						
Traffic Operations Lab - Signal Systems Testing	R43	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 & Madhav Chitturi	Completed
Highway Maintenance Manpower Needs Study	R27-SP4	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, 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		James Hill	Completed
Online Training Course Prototype	R27-SP10	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
Radiation Detection Pilot Program	R27-4	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
Regional Trans. Data Mgmt. and Archiving System	R27-22	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	Active
Wind Powered Electrical Systems for Highway Facilities	R27-31	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		David Johnson	Completed
Rolling Lane Closures	R27-32	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	Active

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Queue and Users' Cost in Highway Work Zones	R27-33	This study will develop methods for estimating speed, capacity, delay, queuing, and user's costs for interstate highway work zones where queuing and congestion occurs which will help IDOT to meet the requirements of Work Zone Safety and Mobility Policy that went into effect in fall 2007. Outcome: Assuring IDOT's compliance with the Work Zone Safety and Mobility Policy.	Rahim Benekohal	Hani Ramezani, Kivanc Avrenli	Marshall Metcalf	Active
Evaluation of Wireless Detection Systems at RR Crossings & Signalized Intersections	R27-58	This study will evaluate 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 will be 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 will also be being 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: Documenting 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	Yogesh Gautam	Active
Evaluation of Performance of Solar Powered Flashing Beacons	R27-59	This study will evaluate 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 will also be 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: Documenting performance of flashing beacons for potential use in Illinois.	Rahim Benekohal	Ali Hajbabaie & Juan Medina	Yogesh Gautam	Active
Development of a Highway Incident Management Operational & Training Guide	R27-64	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.	To Be Determined by RFP Process		Geno Koehler	Active
Rolling Lane Closures -- Phase II	R27-72	This project takes the data and results from the previous ICT project on rolling lane closures and presents it to practitioners from around the state of Illinois to get additional feedback from these subject matter experts. This research will lead to a better understanding of driver behavior around temporary work zones and the factors that significantly affect this behavior. It will bring out 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: Developing specific recommendations to enhance existing standards for moving lane closures.	Douglas Steele & William Vavrik (ARA)		Aaron Weatherholt	Active
Clearview Font in Traffic Signs: Assessing IDOT Experiences & Needs	R27-75	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.	To Be Determined		Larry Gregg	New
LED Roadway Lighting Evaluation & Field Testing	R27-76	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.	To Be Determined		Mark Seppelt	New

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PUBLIC TRANSPORTATION/ MULTI-MODAL						
Wireless Internet on Trains	R27-SP8	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
Bus-On-Shoulders Study	R27-5	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	Active
Regional Warehouse Trip Production	R27-15	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 & Dr. Sofia Dermisi (Roosevelt University)		Charles Abraham	Completed
Truck Parking Facilities Program Design	R27-16	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
Effectiveness of Transit Strategies Targeting Elderly People	R27-17	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)		Charles Abraham	Completed

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Trip Chaining Behavior of Senior Travelers & Applications to Public Transportation Planning	R27-50	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)		Charles Abraham	Active
Guidelines, Site Selection, and Design for Implementing Truck Parking/Rest Facilities in Chicago's South Suburbs	R27-51	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 Rohrer (IIT)		Charles Abraham	Active
PLANNING/OTHER						
Update Condition Rating Survey (CRS) Calculation / Prediction Models	R27-13	This study revised IDOT's existing Condition Rating Survey (CRS) calculation and prediction models, which are used to estimate future CRS values and the anticipated needs for future rehabilitation, and developed new models to reflect the changes in pavement systems and the rehabilitation and assessment techniques. Outcome: Developed more accurate CRS values for IDOT resulting in more accurate projections of future rehabilitation needs.	Yanfeng Ouyang with Laura Heckel (HERE)		David Felts	Completed
Commercial Vehicle Info. Systems & Networks (CVISN)	R27-14	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 (UIC)		Chuck Sikaras	Completed
Performance of HMA Overlays in Illinois	R27-23	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

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Pavement Program Planning Process Based on Benefit-Cost Analysis	R27-34	This project is studying successful pavement management programs to understand the state of the practice. Effective (yet simple) mathematical models are being 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: Developing an advanced pavement program planning procedure based on life-cycle benefit-cost analysis.	Yanfeng Ouyang	Fan Peng	Jeffrey South	Active
Context Sensitive Solutions Online Training Course Development	R27-39	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
Utah LTAP GIS Software Replication/ Training in IL	R27-43	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
Travel Demand Modeling for Small & Medium Size MPOs in Illinois	R27-48	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)		Leslie Nunes	Active
Distance Technology Transfer Course Content Development	R27-73	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 within the first six months of the project so IDOT can assess functionality and applicability to other technology transfer programs in the early stages of the project. 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	Kevin Burke	Active
Goods Movement Study in IL: Applications to Freight Transportation & Logistics	R27-83	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)		Keith Sherman	New

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Develop Travel Reliability Inventory for Highway Networks	R27-84	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 to 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.	To Be Determined by RFP Process		Chuck Sikaras & Jeff Galas	New
Materials Management Training	R27-85	The objective of this project is to expand the training for IDOT construction staff and consultants providing Phase III inspection to elevate their knowledge of materials incorporated on projects they may oversee. Outcome: Well-trained inspectors armed with a basic understanding of typical materials incorporated into projects and who are aware of the pitfalls that may occur when non-specification materials are incorporated or when proper procedures are not followed.	To Be Determined		Matt Mueller	New
ENVIRONMENT						
Update the Illinois Carbon Monoxide Screen for Intersection Modeling (COSIM)	R27-7	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 Zyzniwski	Completed
Documenting Air Toxics in NEPA Documents: A Midwest Peer Exchange	R27-10	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 Zyzniwski	Completed
Particulate Material (PM) 2.5 & PM10 Hot Spot Analysis: Midwest Peer Exchange	R27-29	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 Zyzniwski	Completed

PROJECT TITLE	PROJECT CODE	OBJECTIVE/ OUTCOME	PRINCIPAL INVESTIGATOR(S)*	RESEARCH TEAM	TRP CHAIR	STATUS
Storm Water Pollution, Erosion & Sediment Control Products Demonstration & Training Center	R27-54	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		Thomas Ripka	Active
Midwest Transportation Air Quality Summit	R27-68	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	Active
“Green Friendly” Best Management Practices (BMP) for Interstate Rest Areas	R27-74	This project will investigate, determine, and provide 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.	To Be Determined		Craig Mitckes	New

COMMONLY USED ACRONYMS

APTech: Applied Pavement Technology, Inc.
ARA: Applied Research Associates, Inc.
ASCE: American Society of Civil Engineers
ATLAS: Accelerated Testing Loading ASsembly
DOT: Department of Transportation
EPA: Environmental Protection Agency
ERI: Engineering & Research International, Inc.
FHWA: Federal Highway Administration
FY: Fiscal Year
HERE: Heckel Engineering, Research, and Education, Inc.
ICT: Illinois Center for Transportation
IDOT: Illinois Department of Transportation
IIT: Illinois Institute of Technology
ISP: Illinois State Police
LADCO: Lake Michigan Air Directors Consortium
PI: Principal Investigator
RPC: Regional Planning Commission
SIUE: Southern Illinois University at Edwardsville
TAG: Technical Advisory Group
TRB: Transportation Research Board
TRP: Technical Review Panel
UIC: University of Illinois at Chicago
UIS: University of Illinois at Springfield
UIUC: University of Illinois at Urbana-Champaign





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