ICT Update for
49th Annual Illinois Bituminous Paving Conference

December 3, 2008

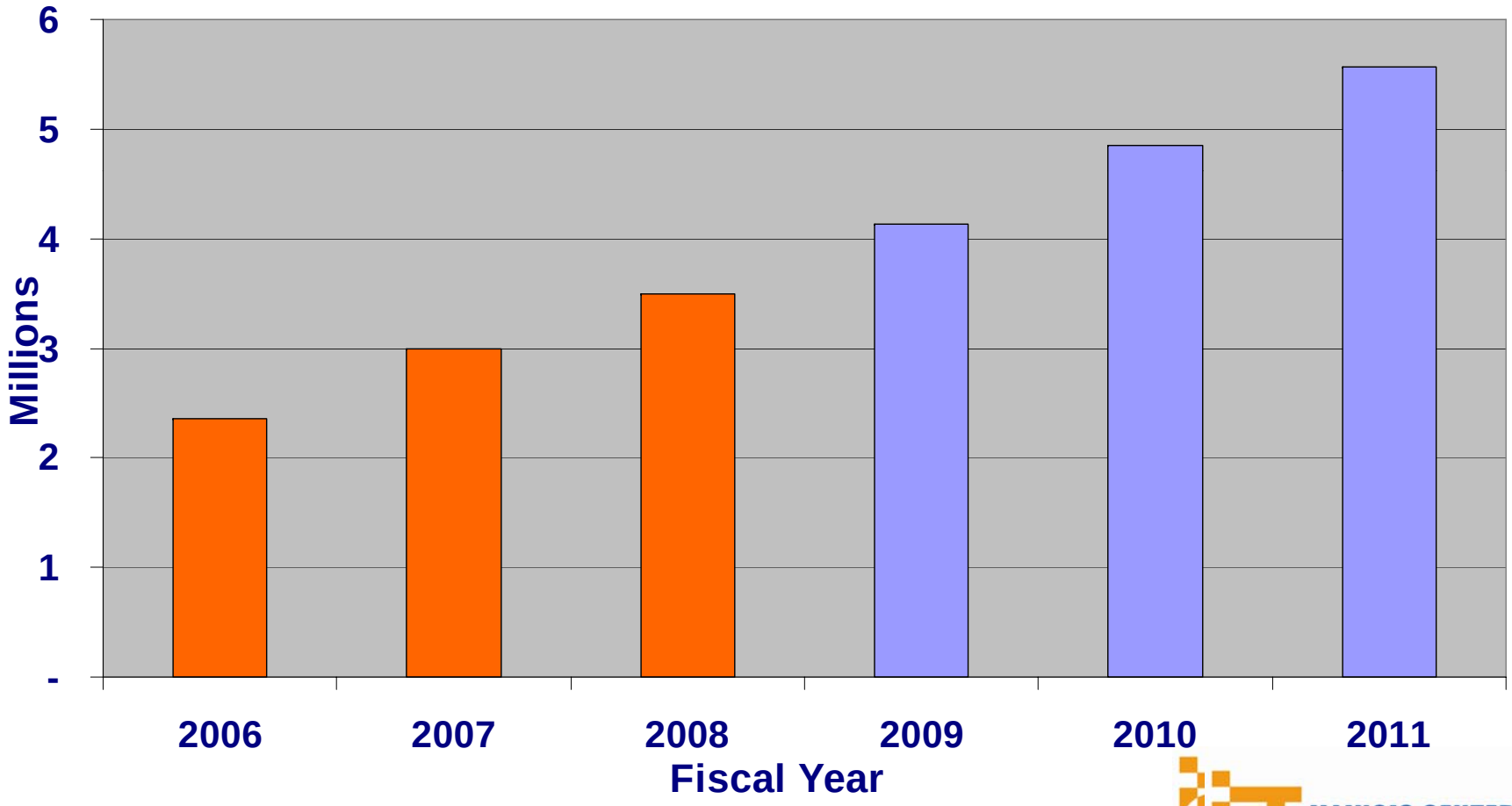
ILLINOIS CENTER FOR TRANSPORTATION

ICT Vision

- Serve the transportation needs of IDOT, the State of Illinois, and the nation through *research, education, and outreach*
  - Rapid response to future scientific challenges in transportation
  - Adapt to changing needs
- Develop and implement innovative and cost-effective technologies
- Optimize the limited resources of IDOT

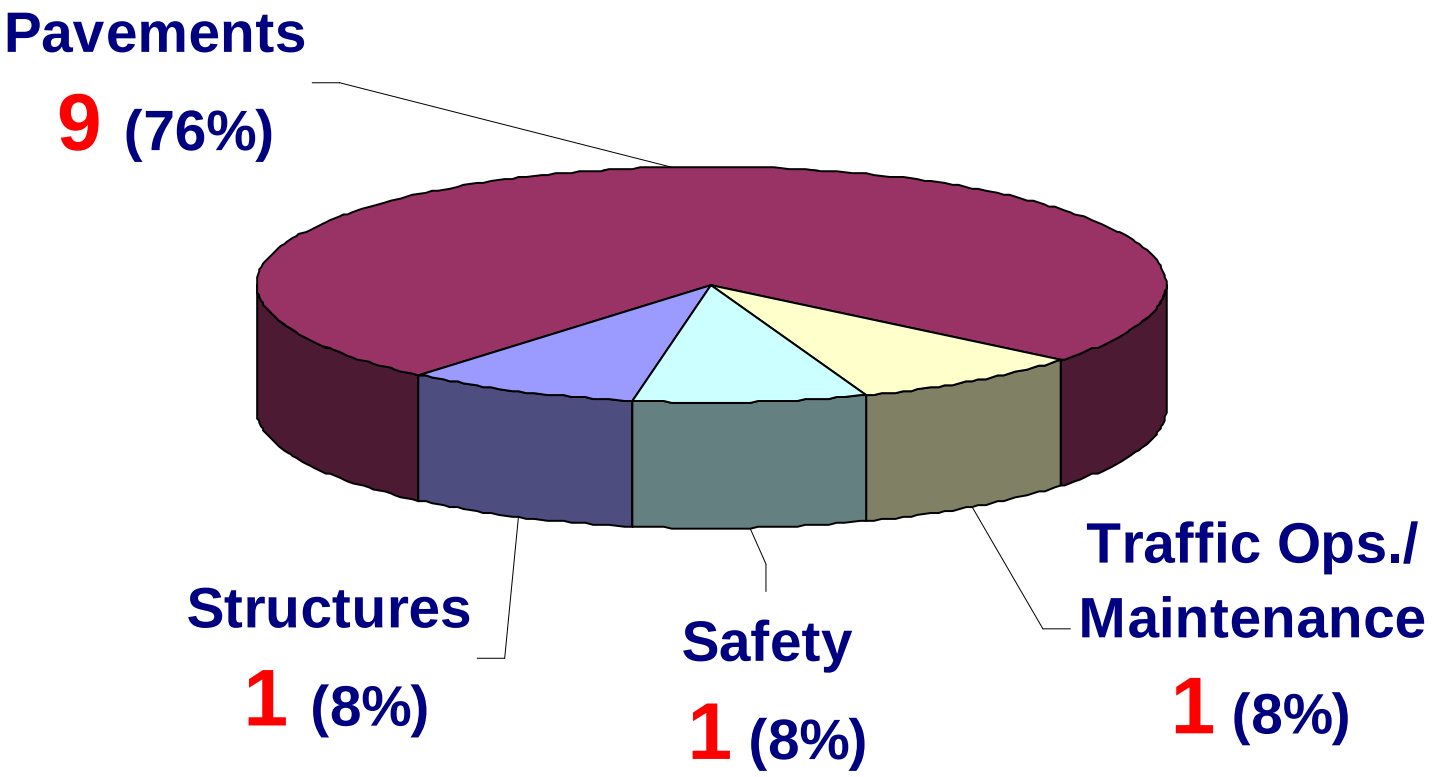
ILLINOIS CENTER FOR TRANSPORTATION

ICT Growth



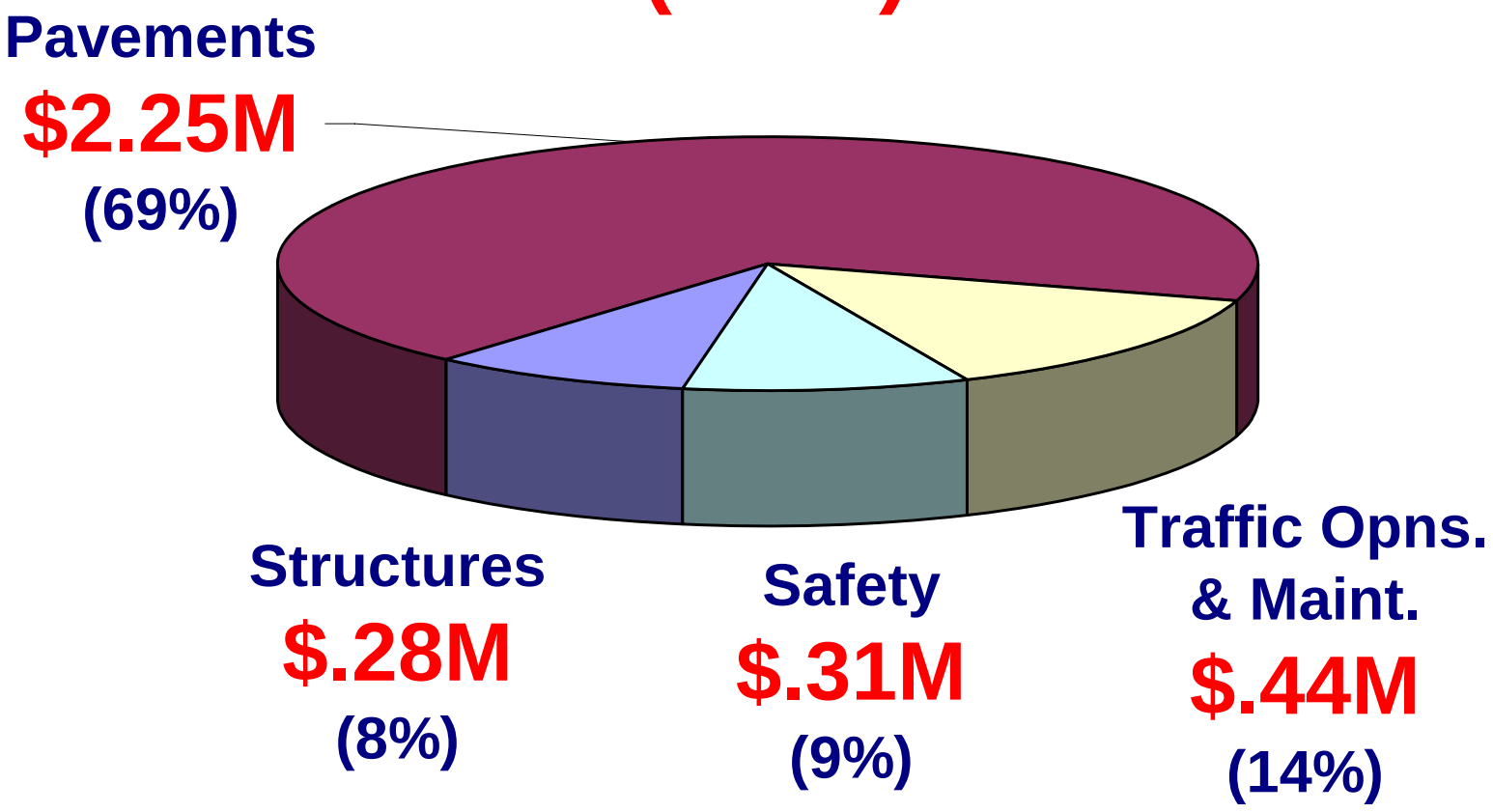
ILLINOIS CENTER FOR TRANSPORTATION

Initial Projects, 2005



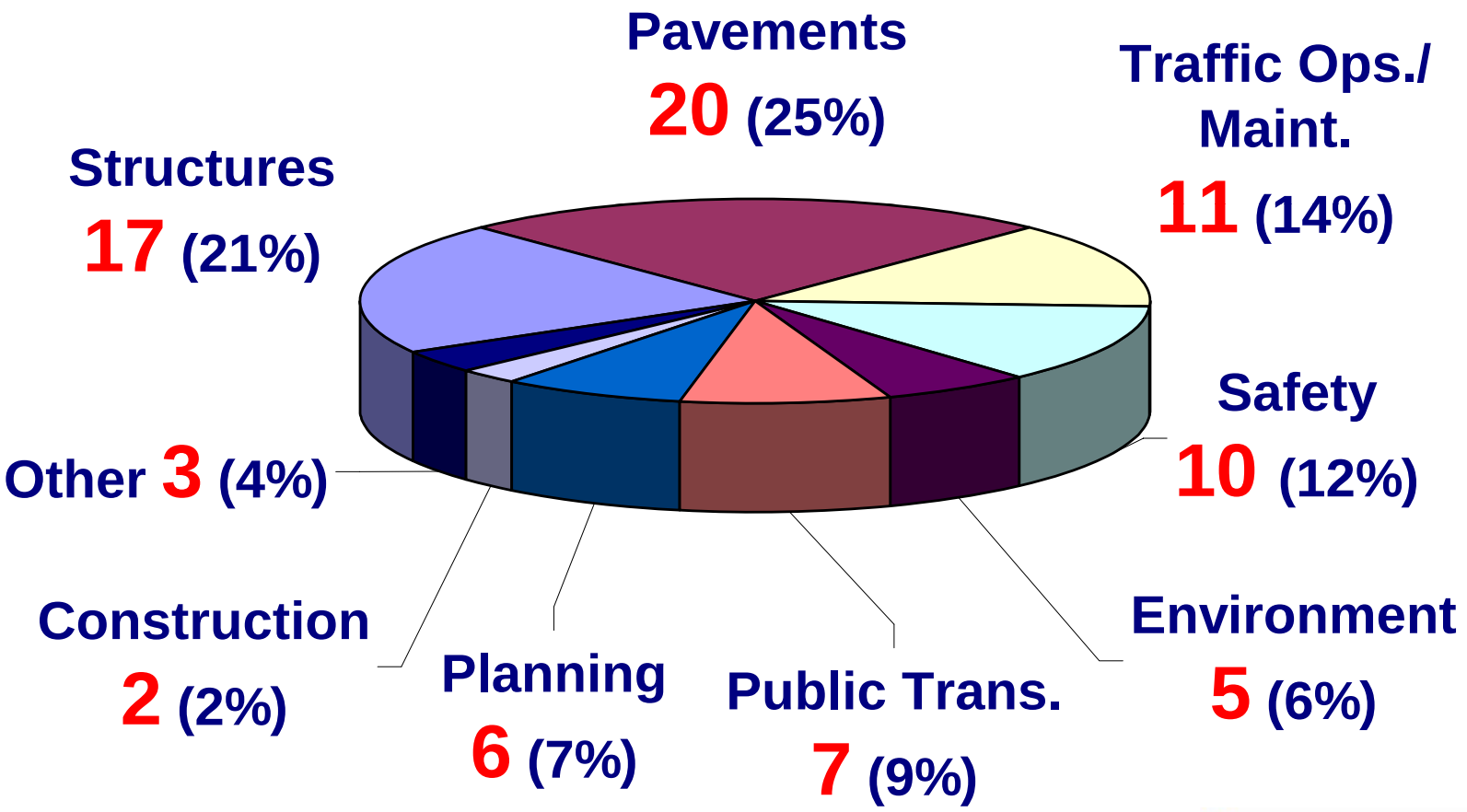
ILLINOIS CENTER FOR TRANSPORTATION

Initial Funding by Focus Area (2005)



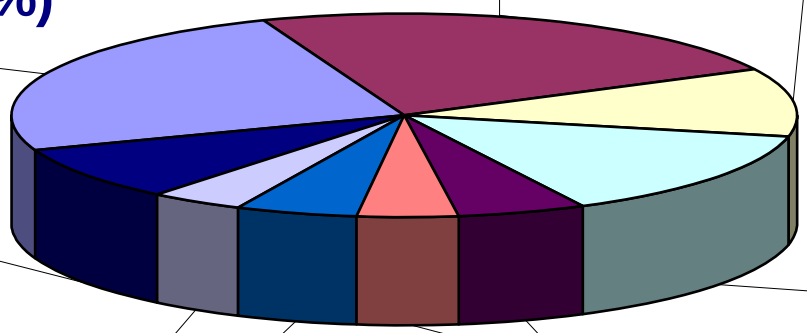
ILLINOIS CENTER FOR TRANSPORTATION

Transportation Diversity!



ILLINOIS CENTER FOR TRANSPORTATION

New Funds by Focus Area



Pavements
$3.0M
(24%)

Structures
$3.1M
(24%)

Traffic Opns. & Maint.
$1.4M
(11%)

Other/ Dept.-wide
$1.1M (9%)

Safety
$1.8M
(14%)

Construction
$0.5M (4%)

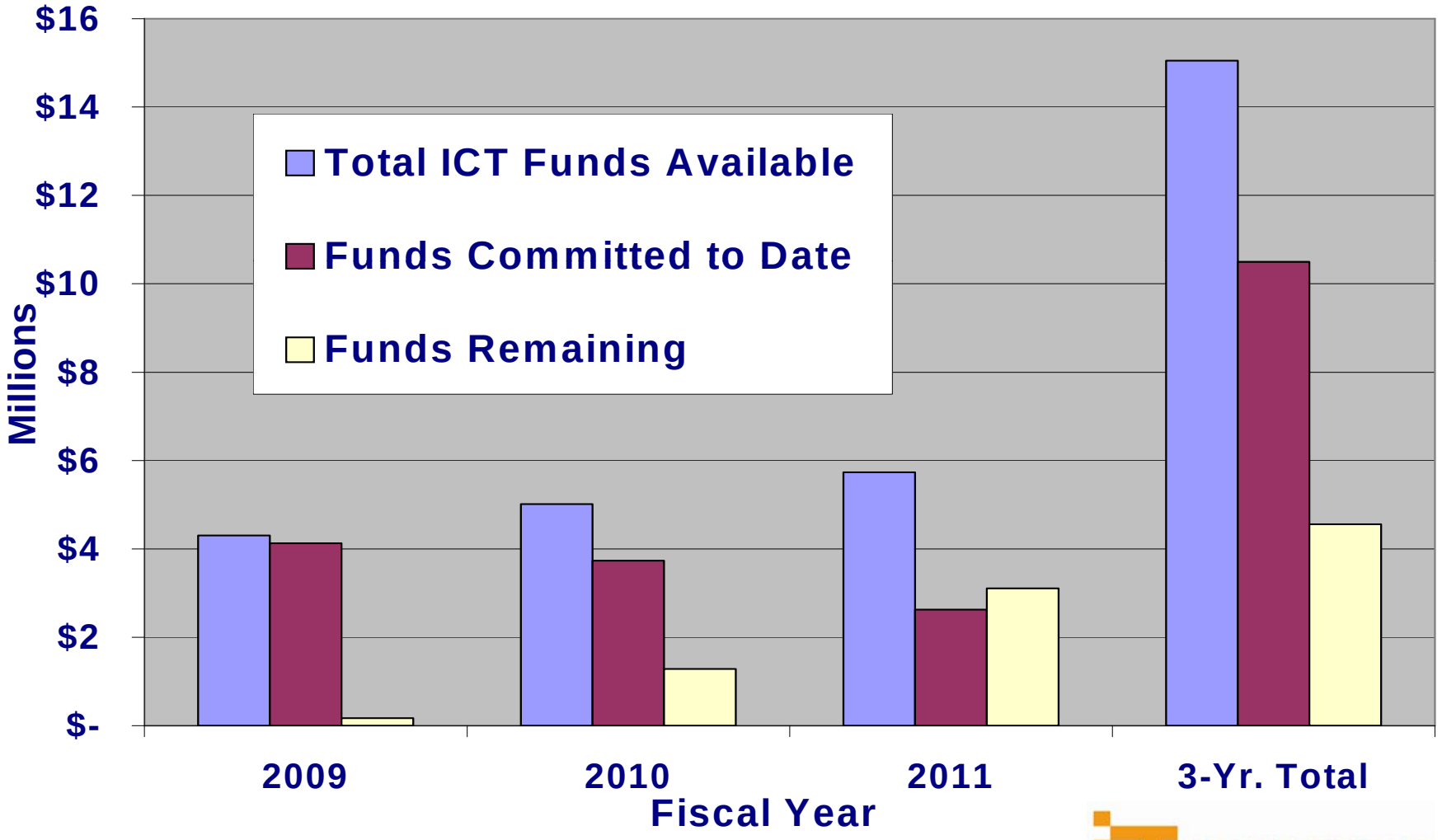
Planning
$0.6M
(5%)

Public Trans.
$0.5M
(4%)

Environment
$0.7M (5%)

ILLINOIS CENTER FOR TRANSPORTATION

ICT Funds Available, Committed and Remaining by Year



ILLINOIS CENTER FOR TRANSPORTATION

Research Progress/ Status

- **Total Projects Approved to Date = 93**
  - **81** Regular Projects – Selected by Exec. Committee
  - **12** Special (Short-Term) Projects
- **24 Projects Are Completed**
  - **16** Regular Projects
  - **8** Special (Short-Term) Projects
- **24 ICT Reports Published on Website**
- **69 Active ICT Projects**

ILLINOIS CENTER FOR TRANSPORTATION

Outsourcing Growth

- **Initial Project List in August 2005 IDOT-UIUC Agreement**
  - 12 UIUC Projects/ $3.3M
  - **0 Outsourced Projects**
- **81 Project Additions (12/05 - 11/08)**
  - 59 UI Projects/ $10.3M
  - **22 Outsourced Projects/ $2.2M**

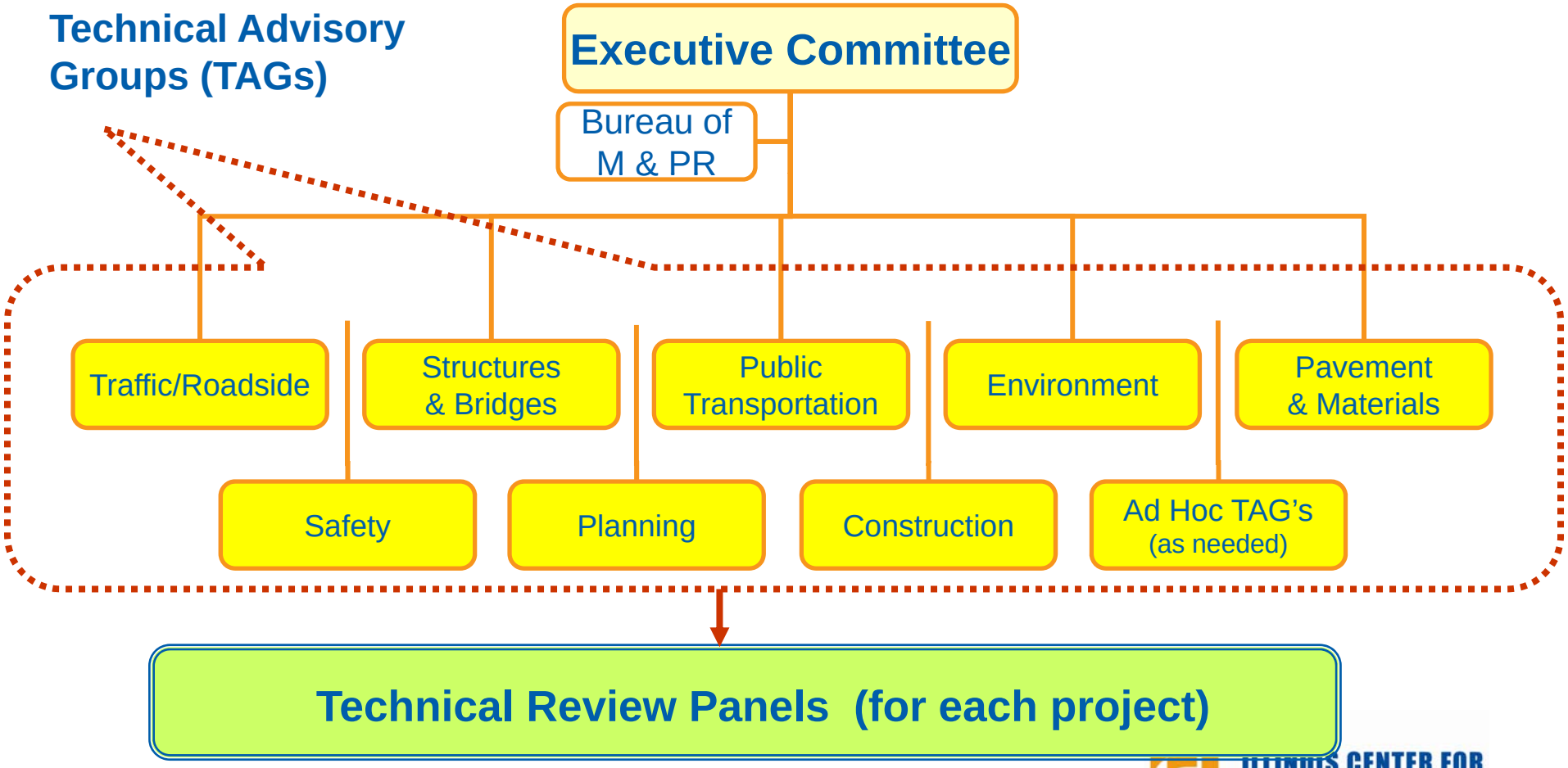
ILLINOIS CENTER FOR TRANSPORTATION

Who's Participating in ICT?

- **40 Academic Researchers** (PI's/ Co-PI's)
- **50 Graduate Students**
- **9 Universities**
- **4 Private Consulting Firms**
- **2 Federal/ Local Gov't. Agencies**
- **Consultants**

ILLINOIS CENTER FOR TRANSPORTATION

Research Need Selection



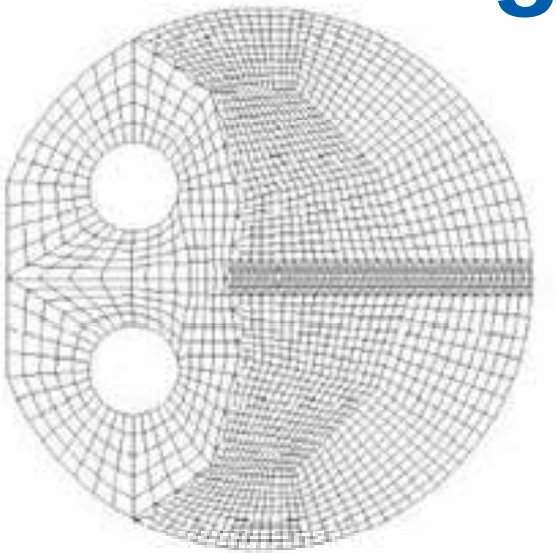
ILLINOIS CENTER FOR TRANSPORTATION

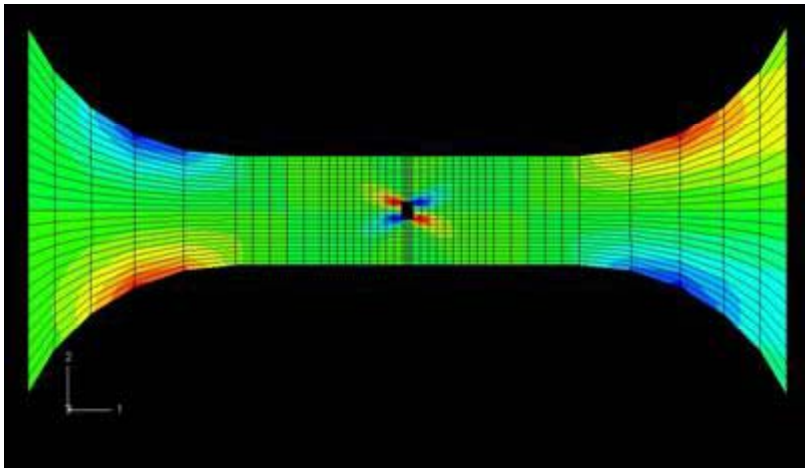
Served by a Top Facility - ATREL

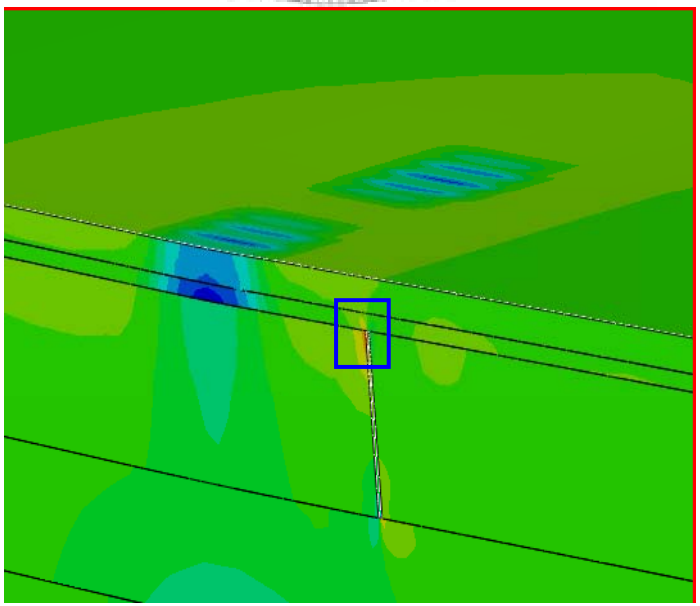
Materials Testing Laboratory

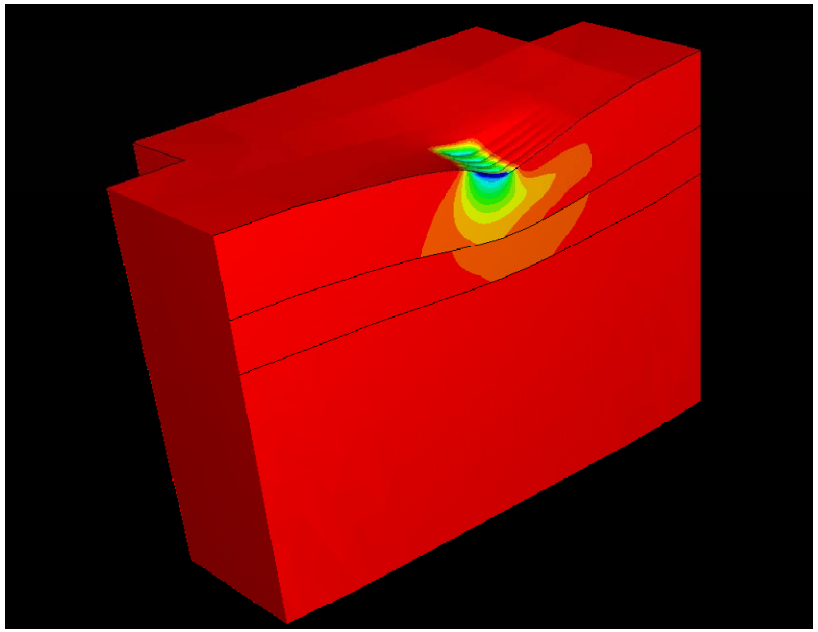
ILLINOIS CENTER FOR TRANSPORTATION

Modeling









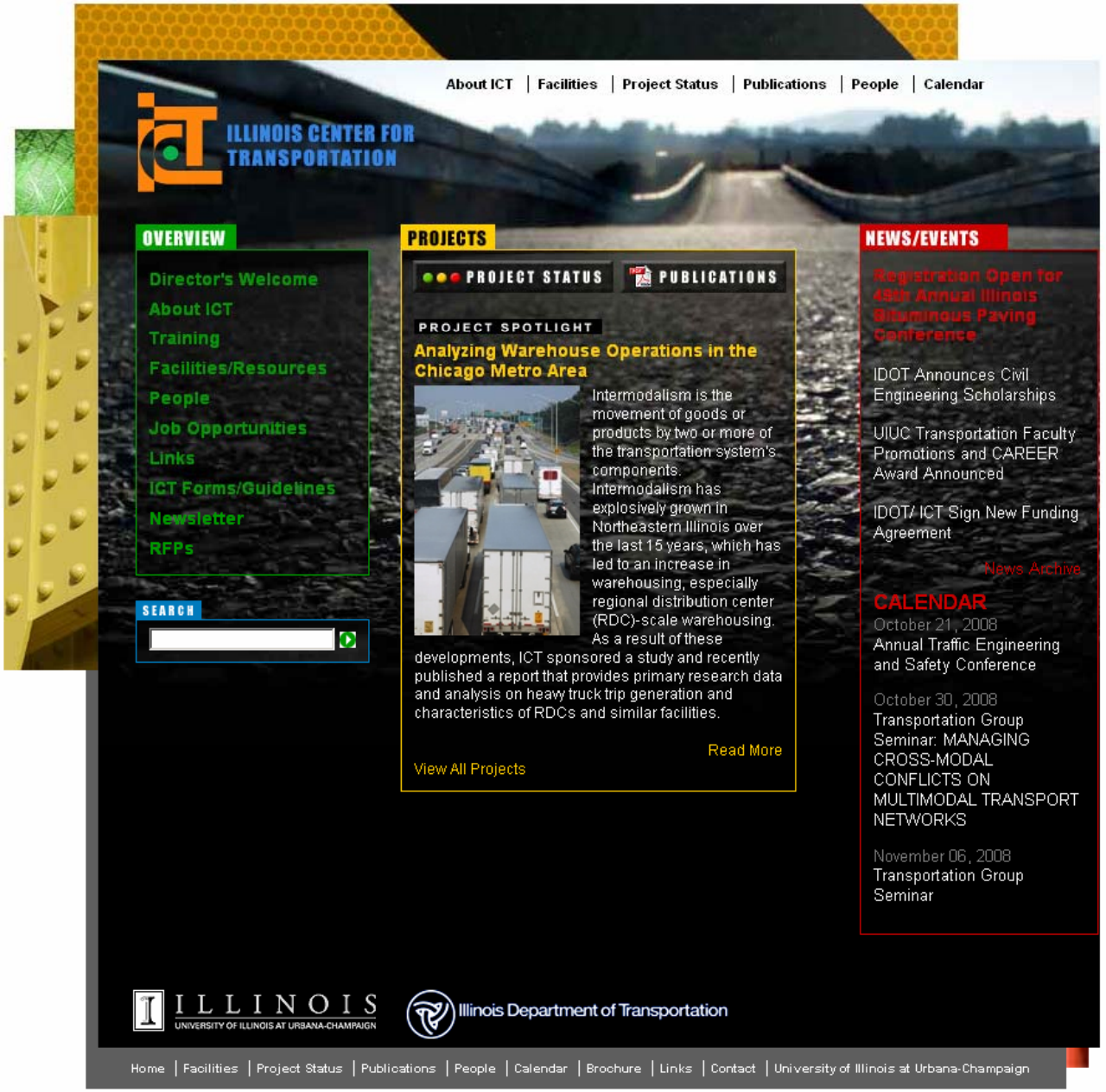
Accelerated Transportation Loading ASsembly (ATLAS)

New Opportunities

2004

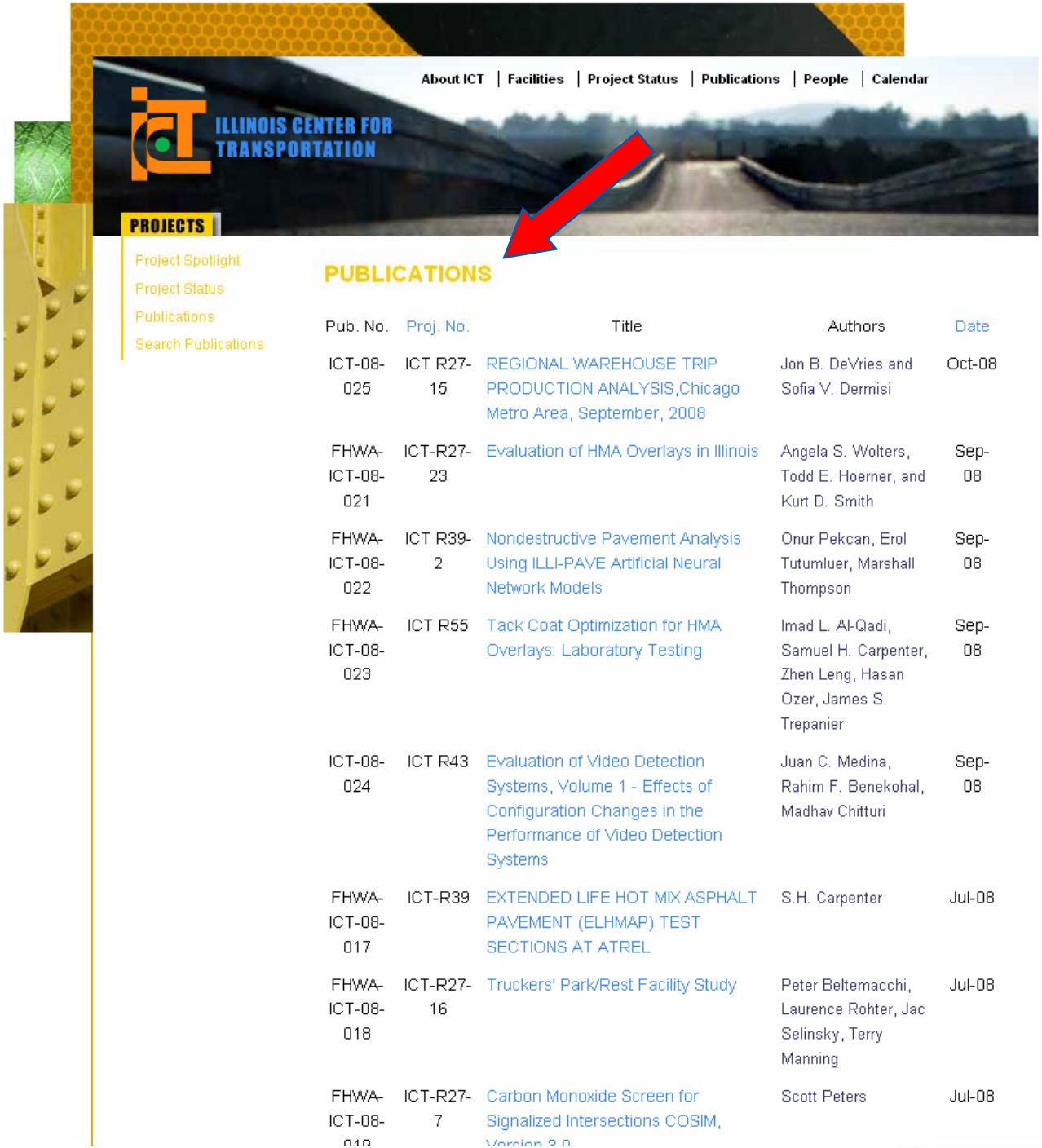
2007

ATLAS Upgrade

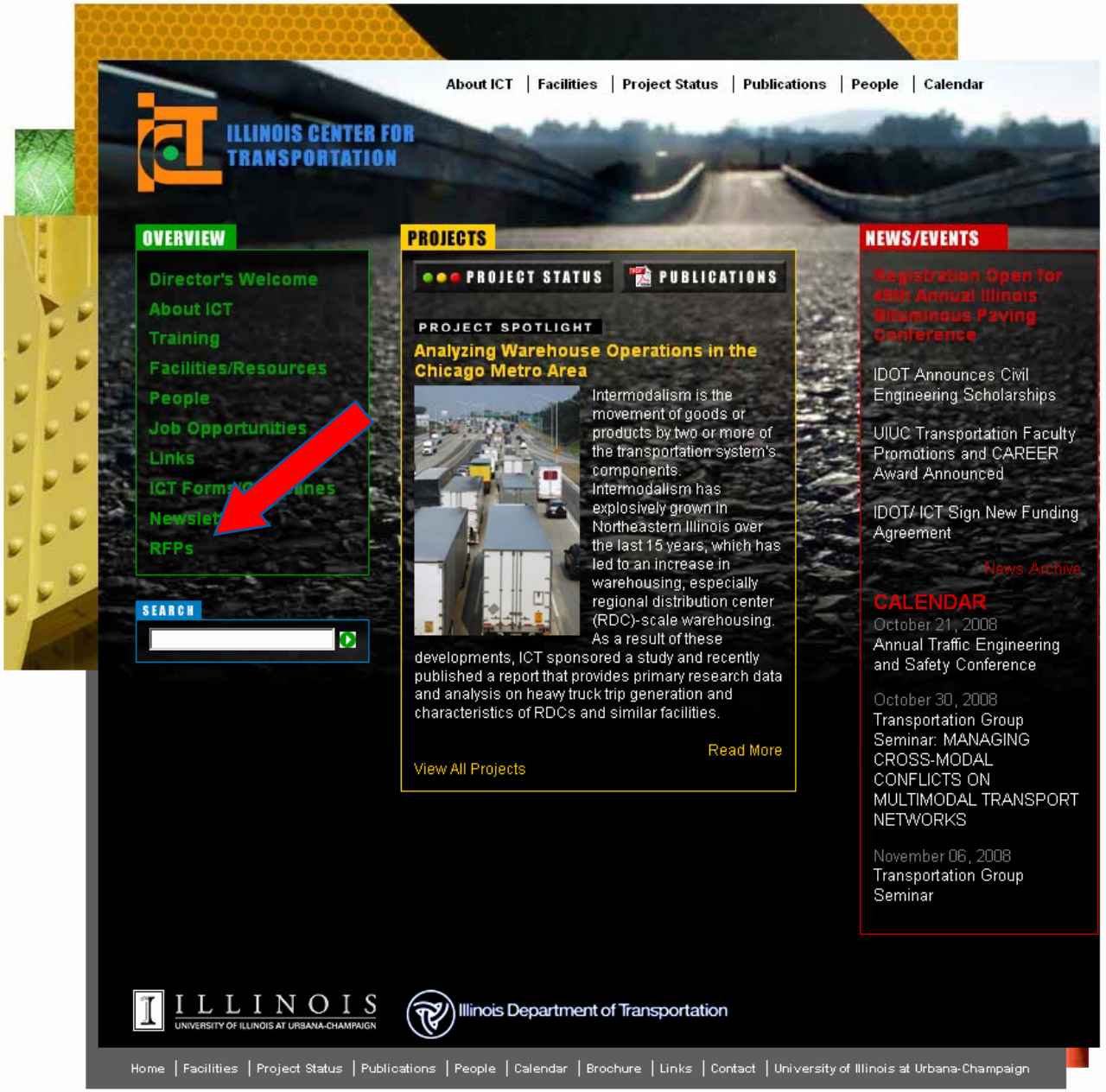


www.ict.uiuc.edu

IS CENTER FOR
SPORTATION



Pub. No.	Proj. No.	Title	Authors	Date
ICT-08-025	ICT R27-15	REGIONAL WAREHOUSE TRIP PRODUCTION ANALYSIS,Chicago Metro Area, September, 2008	Jon B. DeVries and Sofia V. Dermisi	Oct-08
FHWA-ICT-08-021	ICT-R27-23	Evaluation of HMA Overlays in Illinois	Angela S. Wolters, Todd E. Hoerner, and Kurt D. Smith	Sep-08
FHWA-ICT-08-022	ICT R39-2	Nondestructive Pavement Analysis Using ILLI-PAVE Artificial Neural Network Models	Onur Pekcan, Erol Tutumluer, Marshall Thompson	Sep-08
FHWA-ICT-08-023	ICT R55	Tack Coat Optimization for HMA Overlays: Laboratory Testing	Imad L. Al-Qadi, Samuel H. Carpenter, Zhen Leng, Hasan Ozer, James S. Trepanier	Sep-08
ICT-08-024	ICT R43	Evaluation of Video Detection Systems, Volume 1 - Effects of Configuration Changes in the Performance of Video Detection Systems	Juan C. Medina, Rahim F. Benekohal, Madhav Chitturi	Sep-08
FHWA-ICT-08-017	ICT-R39	EXTENDED LIFE HOT MIX ASPHALT PAVEMENT (ELHMAP) TEST SECTIONS AT ATREL	S.H. Carpenter	Jul-08
FHWA-ICT-08-018	ICT-R27-16	Truckers' Park/Rest Facility Study	Peter Beltemacchi, Laurence Rohter, Jac Selinsky, Terry Manning	Jul-08
FHWA-ICT-08-019	ICT-R27-7	Carbon Monoxide Screen for Signalized Intersections COSIM, Version 3.0	Scott Peters	Jul-08

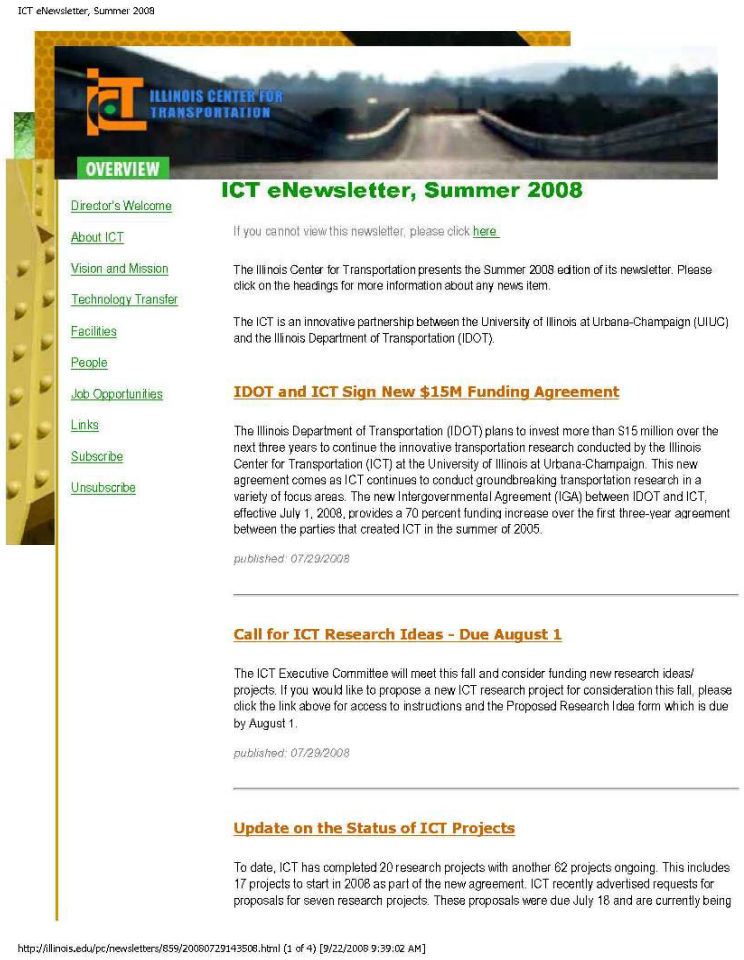


www.ict.uiuc.edu

IS CENTER FOR
SPORTATION

Quarterly ICT E-Newsletter

- **Redesigned early 2008**; emailed in February, May, August, November.
- **Covers ICT, UIUC, and IDOT news**, including project updates, publication updates, RFP posting, transportation conferences, etc.
- **Broad mailing list** includes IDOT associates, UIUC alumni, international contacts, other transportation centers, many more.



ICT eNewsletter, Summer 2008

ILLINOIS CENTER FOR TRANSPORTATION

OVERVIEW

Director's Welcome
About ICT
Vision and Mission
Technology Transfer
Facilities
People
Job Opportunities
Links
Subscribe
Unsubscribe

ICT eNewsletter, Summer 2008

If you cannot view this newsletter, please click here

The Illinois Center for Transportation presents the Summer 2008 edition of its newsletter. Please click on the headings for more information about any news item.

The ICT is an innovative partnership between the University of Illinois at Urbana-Champaign (UIUC) and the Illinois Department of Transportation (IDOT).

IDOT and ICT Sign New $15M Funding Agreement

The Illinois Department of Transportation (IDOT) plans to invest more than $15 million over the next three years to continue the innovative transportation research conducted by the Illinois Center for Transportation (ICT) at the University of Illinois at Urbana-Champaign. This new agreement comes as ICT continues to conduct groundbreaking transportation research in a variety of focus areas. The new Intergovernmental Agreement (IGA) between IDOT and ICT, effective July 1, 2008, provides a 70 percent funding increase over the first three-year agreement between the parties that created ICT in the summer of 2005.

published: 07/29/2008

Call for ICT Research Ideas - Due August 1

The ICT Executive Committee will meet this fall and consider funding new research ideas/ projects. If you would like to propose a new ICT research project for consideration this fall, please click the link above for access to instructions and the Proposed Research Idea form which is due by August 1.

published: 07/29/2008

Update on the Status of ICT Projects

To date, ICT has completed 20 research projects with another 62 projects ongoing. This includes 17 projects to start in 2008 as part of the new agreement. ICT recently advertised requests for proposals for seven research projects. These proposals were due July 18 and are currently being

http://illinois.edu/pc/newsletters/859/20080729143508.html (1 of 4) [9/22/2008 9:39:02 AM]

ILLINOIS CENTER FOR TRANSPORTATION

Online/ Electronic Initiatives

Examples of Initiatives In Progress:

- Online Research Needs Submission
- Online Reporting of Project Progress
- Automated Quarterly Progress Reports
- Online Registration/Payment for Continuing Education Classes/ Short Courses
- More Online Meetings & Training

ILLINOIS CENTER FOR TRANSPORTATION

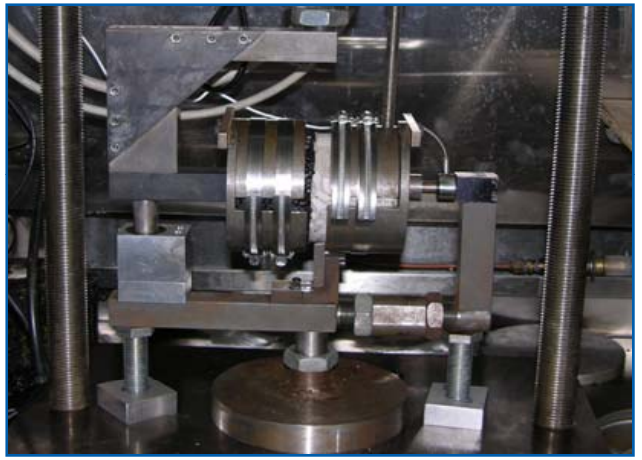
Examples of Current ICT Projects

- **Green Technology:** Pavement Recycling & Rehabilitation
- **Traffic/ Engineering Safety:** Nighttime Construction; Speed Photo-Enforcement
- **Secure Bridges:** Chicago Bridge Assessment
- **Renewal Energy:** Wind Energy
- **Training Initiatives:** Documentation of Contract Quantities

ILLINOIS CENTER FOR TRANSPORTATION

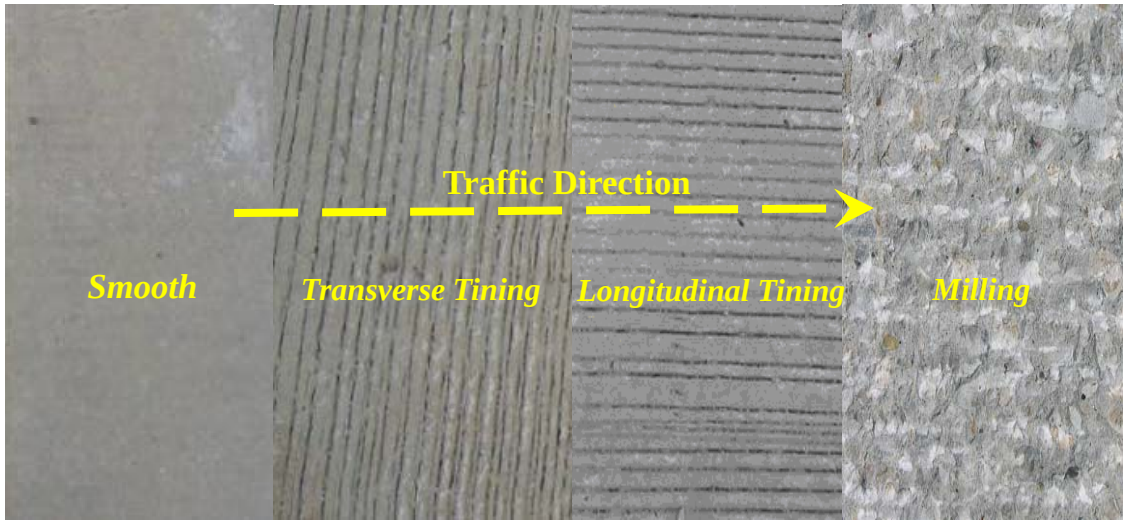
Evaluation/ Optimization of Tack Coat & Bond of HMA Overlays of PCC

- The effectiveness of tack coat application between existing PCC pavement and HMA overlay was quantified through lab testing and accelerated pavement testing (APT).
- **Outcome:** Optimized tack coat type and application rate.
- **Status:** Lab testing report is available on ICT website; APT report is being finalized.



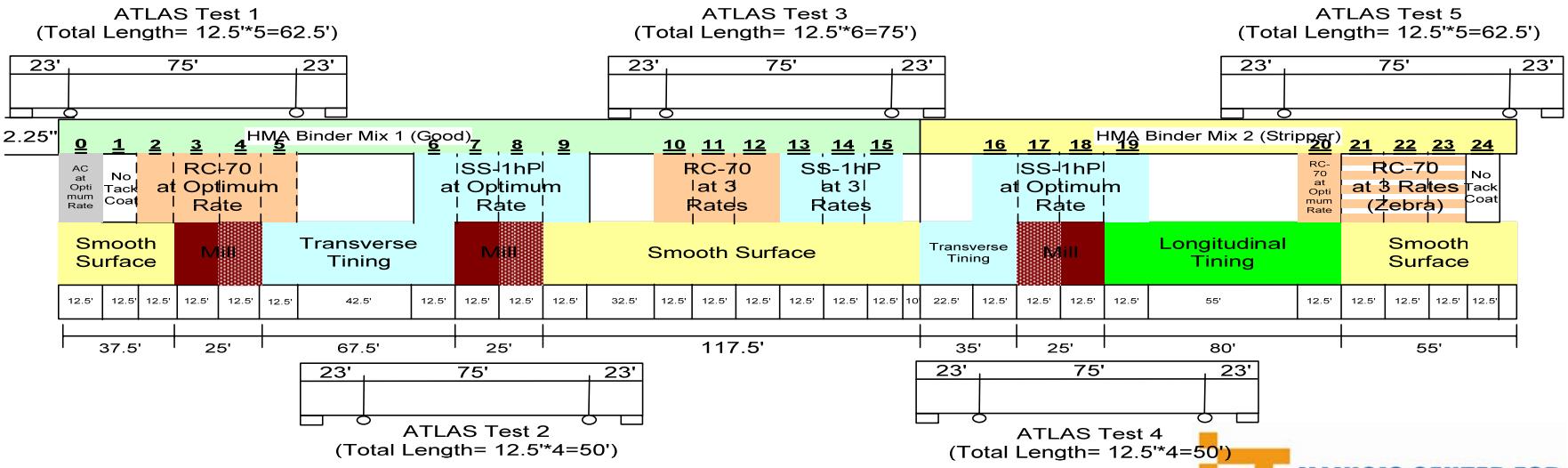
Laboratory Testing

- A specially designed direct shear testing fixture was used.
- Experimental variables include tack coat type, tack coat application rate, HMA type, temperature, and moisture.



TRANSPORTATION

Accelerated Pavement Testing (APT)



Indicates a milled surface that is broom cleaned only.

Indicates a milled surface that is thoroughly cleaned with an air blast.

ILLINOIS CENTER FOR TRANSPORTATION

Field Tack Coat Application

Centennial variable-bar liquid distributor

Geotextile pad for tack coat application rate measurement

Research Outcome

- Lab and field testing results suggest that asphalt emulsion provides better interface bonding than cutback; no significant difference between SS-1hP and SS-1h.
- From lab testing, optimum residual tack coat application rate is 0.04 gal/yd^2. This value was validated in the field.
- Lab testing results showed that temperature and moisture affected interface shear strength.
- How to improve bonding:
  - Mill PCC surface
  - Clean PCC surface
  - Uniform tack coat distribution

ILLINOIS CENTER FOR TRANSPORTATION

Determination of Usable Residual Asphalt Binder in RAP

- Characterization of the amount of binder contribution from RAP materials during the mixing process
- **Outcome:** Validation of current mix design procedure and impact of various levels of RAP on HMA design and performance
- **Status:** Final report is being reviewed.

ILLINOIS TRANSPORTATION

Research Approach

- Binder and aggregate recovery using Rotovapor method
- Prepare mixes using typical RAP as well as recovered materials
- Residual binder evaluation
- Impact of RAP on mixes:
  - Content: various levels (0, 20, and 40%)
  - Performance: complex modulus, moisture sensitivity, and fracture energy
  - Interaction Mechanism: Electron microscopy

ILLINOIS CENTER FOR TRANSPORTATION

Preliminary Research Outcome

- RAP binder (for mixes up to 40% RAP) is efficiently working in the mixes.
- Current mix design procedure has been validated.
- Complex modulus results showed an increase in mix stiffness with RAP increase.
- Moisture susceptibility may be reduced when RAP is used.
- Preliminary testing suggests an increase in low temperature cracking potential with increasing RAP.

ILLINOIS CENTER FOR TRANSPORTATION

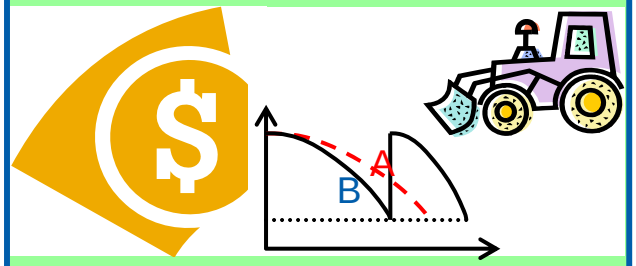
Impact of High RAP Content on Pavement Structural Performance

- Demonstrate impact of high RAP percentages (20+ to 40+%) on HMA structural and performance characteristics (E*, fatigue, low temperature fracture, rutting, and moisture susceptibility)
- Prepare mix designs at a variety of % RAP, binder grade (PG 64-22, PG 58-22, and PG 58-28); perform structural tests; conduct performance tests
- **Outcome:** impact of high RAP % on HMA performance (limitation); impact of grade bumping on performance properties
- **Status:** To be started

ILLINOIS CENTER FOR TRANSPORTATION

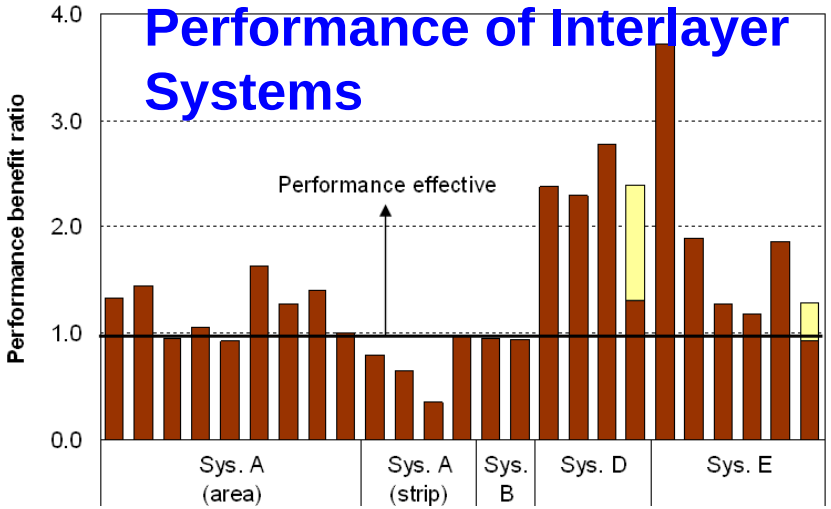
Cost-Effectiveness and Performance of Overlay Systems in Illinois

- Evaluate the effectiveness of interlayer systems in controlling reflective cracking.
- **Outcome:** Develop an interlayer system assessment system and quantify the interlayer system effectiveness.

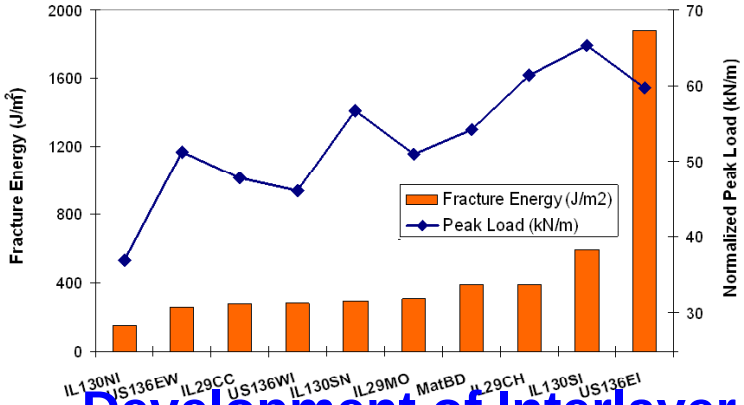
Field Crack Survey	Forensic Investigation	Life-Cycle Cost Analysis
		
Pavement Distress Survey Joint/Patch Detection Reflective Crack Identification	Reflective Crack Pattern Interface Failure Phenomenon Material Properties	Cost-Effectiveness Agency and User Cost Interlayer Systems Decision

Research Outcome

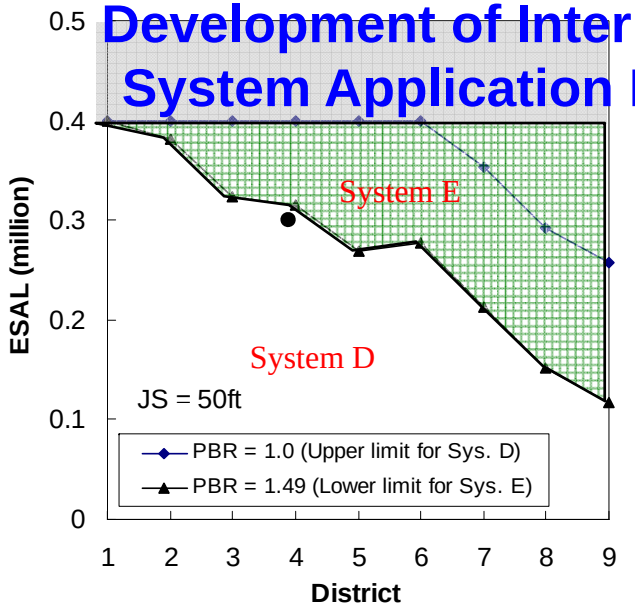
Performance of Interlayer Systems



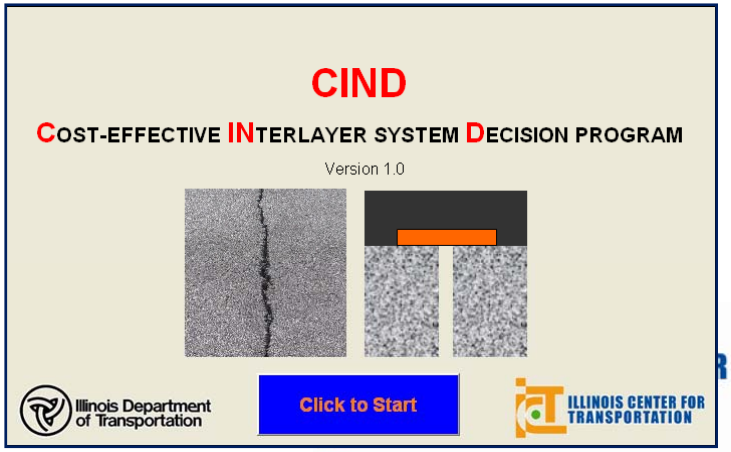
Evaluation of Material Properties of HMA



Development of Interlayer System Application Map



Development of Interlayer System Decision Program



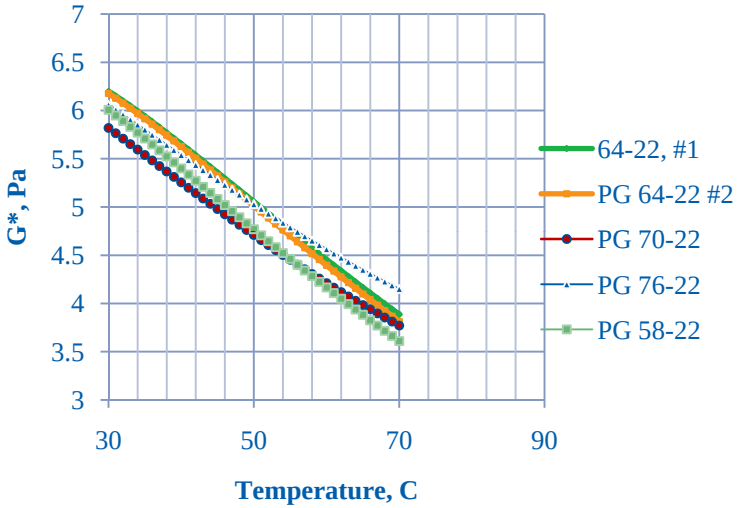
Preliminary Findings

- **The cost-benefit of interlayer systems depend on field performance, material cost, construction time, and joint spacing (*based on quantitative assessment of various types of reflective cracking interlayer systems*)**
- **System D (ISAC) outperformed the other investigated systems regardless of traffic volume, followed by system E (Sand mix). Area-wide System A (Non-woven fabric) had a marginal performance benefit.**
- **A simplified ESAL-T_L chart was developed to select the appropriate interlayer system to retard reflective cracking; a program (CIND) was developed for detailed and cost effectiveness analysis.**
- **Fracture energy of overlay and interlayer system materials was highly correlated with field performance.**

ILLINOIS CENTER FOR TRANSPORTATION

Binder Testing and Analysis

- Analyze DSR data, G*, of typical IDOT binders to provide indications of expected HMA Dynamic Modulus (E*) values for use in pavement design
- Construct G* Master Curves using rhea software, then predict E* Master Curves using Hirsch Model (*bad low temp data*)



ILLINOIS CENTER FOR TRANSPORTATION

Binder Testing and Analysis (Outcome)

- Predicted E* within PG64-22 grade was comparable to lab-measured E*
- Cannot assign E* differences based on grade differences nor within a grade.
- Binder modulus is highly variable at pavement structural temperatures (70–90F); it is not indicated by grading temperature information

ILLINOIS CENTER FOR TRANSPORTATION

Validation of Extended Live HMA Pavement Designs

- Verify structural analysis for multi-layered pavement structure; provide test data for dynamic modulus, E*, and fatigue for current IDOT mixes; validate the existence and magnitude of a fatigue endurance limit (FEL).
- **Outcome:** Verification of typical E* values for surface and binder mixtures; verification of improved typical fatigue algorithms for IDOT binder mixtures and FEL; examination of response and fatigue failure in thin sections; differences between field and lab
- **Status:** New fatigue equations for rubblization and full depth HMA designs (report on ICT website)

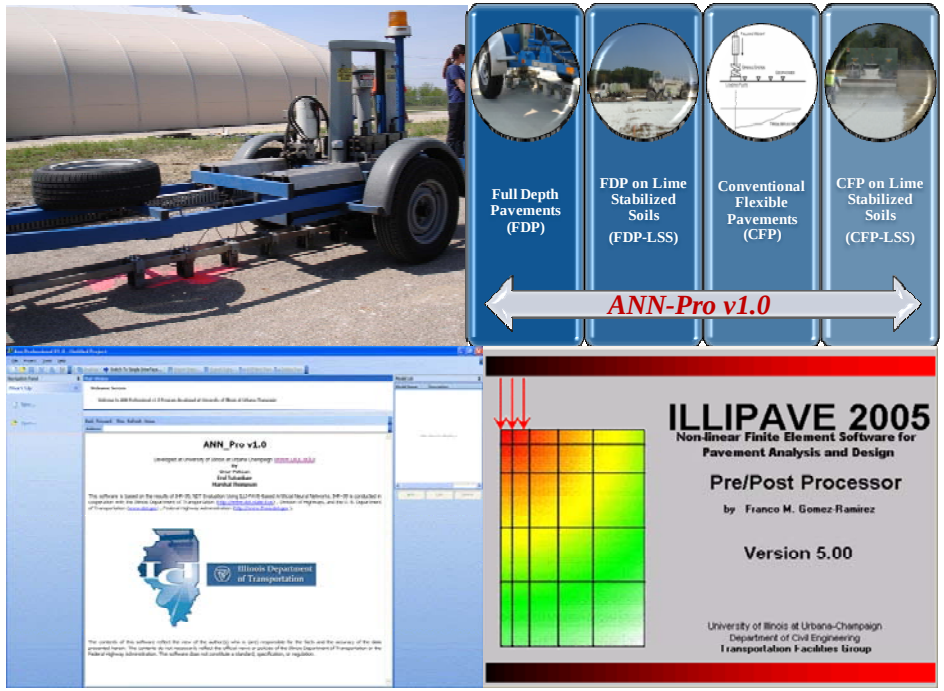
Performance of HMA Overlays in Illinois

- Assessed overall performance of overlaid pavement sections on two subsets of network pavement
- **Outcome**: Effectiveness of SMART (Surface Maintenance at the Right Time) & of policy overlays for sections constructed from 1980-2001 vs. 2001-present.
- **Status:** Final report posted on ICT website in September ‘08

ILLINOIS CENTER FOR TRANSPORTATION

Nondestructive Pavement Evaluation Using ILLI-PAVE Based ANN Models

- Developed advanced models based on ILLI-PAVE FE solutions for rapidly and more accurately back-calculating pavement layer properties from FWD data.
- **Outcome:** ANN-Pro and SoftSys software for computing pavement layer moduli & thicknesses.
- **Status:** Final report is available on ICT website.

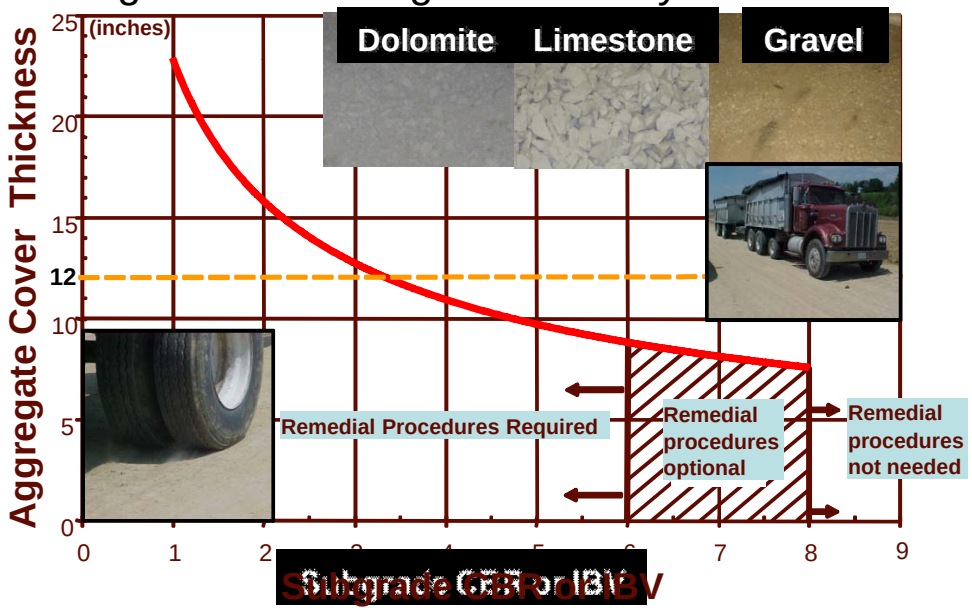


ILLINOIS CENTER FOR TRANSPORTATION

Characterization of IL Aggregates for Subgrade Replacement & Subbase

- Characterizes strength, stiffness, and deformation behavior of various types IL commonly used aggregate.
- **Outcome:** Improved aggregate cover thickness predictions for subgrade replacement and subbase
- **Status:** Lab testing 80% completed; Final Report due in June 2009.

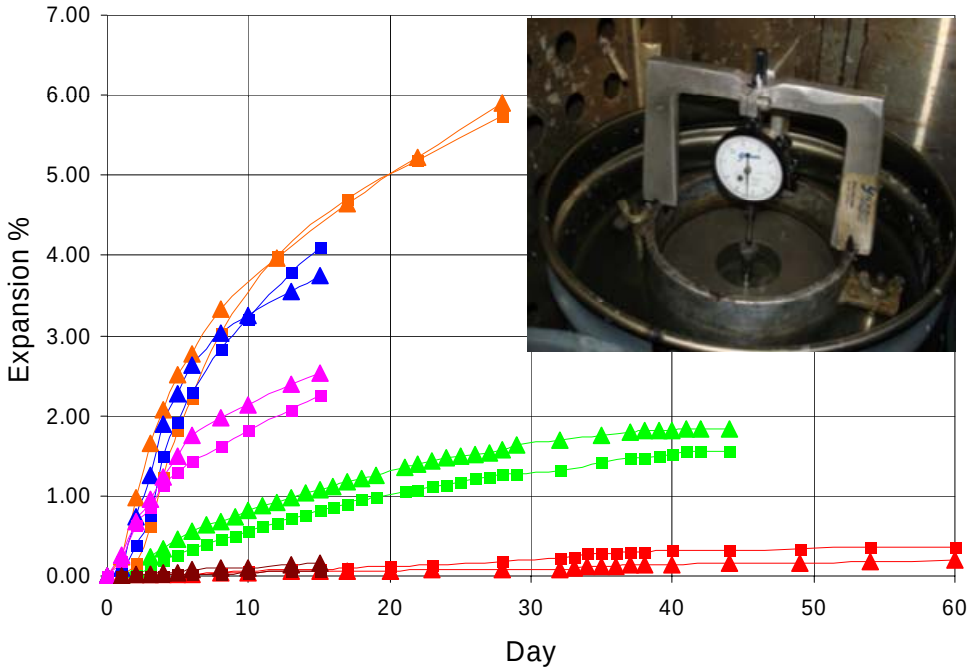
Figure A-2 – Subgrade Stability Manual



ILLINOIS CENTER FOR TRANSPORTATION

Expansive Characteristics of Recycled Materials Used as Pavement Base Materials

- Evaluated expansive properties of some RAP for use as pavement base.
- **Outcome:** Recommendations for RAP material expansion potentials compared to virgin steel slag aggregate.
- **Status:** Final report is currently under review; to be available end of 2008.



ILLINOIS CENTER FOR TRANSPORTATION

M-E Design, Implementation & Monitoring of Flexible Pavements

- Cooperate with IDOT to update, revise & justify full-depth HMA design procedure; review/revise HMA OL thickness design algorithm for rubblized PCCP; & provide technical support
- **Status:** In progress/ current emphasis on full depth HMA

ILLINOIS CENTER FOR TRANSPORTATION

Development of a Thin, Quiet, Long-Lasting, High Friction Surface Layer for Economical Use in Illinois

- Physical properties as well as cost-benefit of various newly developed surface mixtures will be measured and compared.
- **Outcome:** identify/ develop a cost-effective mix for a new generation of surface layers (durable, high friction, and low noise).
- **Status:** In Progress.

ILLINOIS CENTER FOR TRANSPORTATION

Other Selected ICT Projects: Hot-Mix Asphalt

- Profile Equipment Verification
- Hot-Mix Asphalt Sampling
- Cold In-Place & Full-Depth Recycling with Asphalt Products
- Performance of HMA Overlays in Illinois
- Evaluation of Pavement Damage Due to New Tire Designs (Wide-Base Tires)
- Expansive Characteristics of Recycled Materials Used as Pavement Base Materials
- Characterization of IL Aggregates for Subgrade Replacement & Subbase

ILLINOIS CENTER FOR TRANSPORTATION

Nighttime Construction: Evaluating Lighting Glare

- Levels of glare and lighting performance of various lighting arrangements were analyzed and compared.
- **Outcome:** Recommendations for lighting arrangements that reduce and control glare at nighttime work zones.
- **Status:** Final report is available on ICT website.

ILLINOIS CENTER FOR TRANSPORTATION

Acknowledgements

The Illinois Center for Transportation (ICT) is an innovative partnership between the Illinois Department of Transportation (IDOT) and the University of Illinois at Urbana-Champaign (UIUC). FHWA support is greatly appreciated.

Illinois Department of Transportation

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

ILLINOIS CENTER FOR TRANSPORTATION