The academic year 2005-2006 marks the end of my three-year term as the Connecticut Transportation Institute Director. It has been a year, and a term, of exciting change and worthwhile growing pains. The support from internal and external stakeholders to advance the Connecticut Transportation Institute’s research, education and service missions has been outstanding. Long-time staff have continued their “can do” approach to all projects, and this philosophy has been fully embraced by new staff.

In summer 2005, the University of Connecticut and the Connecticut Transportation Institute were named one of 60 University Transportation Centers (UTC) in the new federal transportation legislation entitled: Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). CTI enjoyed the support of the UConn administration, the School of Engineering, the Connecticut Department of Transportation and Connecticut’s congressional delegation in obtaining this $2 million investment. The 2005-2006 year has included strategic planning for the UTC and refinement of the center’s theme Transportation for Smart Growth.

In addition to initiating research, and other activities, of great value to the state of Connecticut, the UTC funding will allow CTI to reach even further beyond its traditional home in the School of Engineering to partner with multidisciplinary groups on campus. The solutions to the critical transportation issues in the 21st century require cross-disciplinary partnerships. CTI is the ideal hub for these activities at the University of Connecticut.

Sincerely,

LISA AULTMAN-HALL
Director and Associate Professor
Civil & Environmental Engineering

MESSAGE FROM THE DIRECTOR

The Connecticut Transportation Institute (CTI) has achieved breathtaking success in recent years, both in research and education and in contributions to the state of Connecticut. Transportation issues underpin so much of our day-to-day life, from morning commuter gridlock and durable roadways to clean air and smart community design. CTI has a long tradition of collaboration with the Connecticut Department of Transportation and other agencies to enhance the state’s transit system, roadways and communities now and into the future.

This year, the U.S. Department of Transportation awarded CTI $2 million to establish a University Transportation Center at UConn. The so-called UTC will serve as a hub for activities and stakeholders committed to helping Connecticut achieve a new level of forward-thinking, planned smart growth in its transportation systems and infrastructure. I congratulate CTI, Dr. Aultman-Hall and the faculty and staff who contributed their time and expertise toward bringing this important UTC to campus. The center will allow CTI to expand its outreach by involving faculty and researchers throughout the UConn campus in interdisciplinary activities. We look forward to the opportunity to collaborate with our peers in the sciences, education, psychology and other disciplines.

CTI continues to evolve as a Connecticut resource. In the coming year, the Institute will focus on looking at transportation challenges from an increasingly holistic perspective. Faculty will evaluate traffic management strategies and land use patterns that minimize the negative social and environmental impacts of transportation, seek ways to foster greater pedestrian and bicycle traffic, examine ways to encourage demand for energy efficient/clean vehicles, and assess mass transit options for Connecticut’s increasingly clogged highway arteries. These are exciting areas that will help Connecticut craft a new transportation future even as our population grows and environmental/energy demands become ever more urgent.

I congratulate CTI on an impressive year of achievements and look forward to seeing the Institute help Connecticut reap all of the dividends of its transportation investment.

Sincerely,

ERLING SMITH
Interim Dean, School of Engineering
Professor, Civil & Environmental Engineering
During the past year, the CAP Lab has initiated work on several significant research projects that focus on increasing the long-term durability of pavements in Connecticut. The CAP Lab has also acquired an Asphalt Pavement Analyzer capable of testing asphalt pavement’s ability to resist deformation under wheel loadings with temperature-controlled specimens in either a wet or dry condition. The CAP Lab conducted certification courses for the New England Transportation Technician Certification Program (NETTCP) and participated on several different NETTCP committees.

Sincerely,

JAMES MAHONEY
Program Director and Head Research Engineer

### Research Briefs

#### THE ASPHALT PAVEMENT ANALYZER – A KEY NEW DIAGNOSTIC TESTER FOR CAP LAB

Developed by Pavement Technology Inc. of Georgia, the Asphalt Pavement Analyzer (APA) unit uses a loaded wheel tester to evaluate the deformation of asphalt surfaces that results from wheel rutting, cracking, and exposure to moisture. Purchase of the APA was made possible by a substantial grant from the Connecticut Department of Transportation and the Federal Highway Administration, plus additional matching funds from CTI and the office of the Dean of Engineering. More than 35 states are equipped with APA units.

The asphalt pavement analyzer will be used to conduct research as well as to test alternative asphalt aggregate mixes developed by commercial consultancies throughout the state. The mechanical portion of the unit is linked to an automated data acquisition system that collects rutting depth measurements continuously throughout the duration of the test. Two types of tests may be conducted within the unit’s environmentally controlled chamber: dry specimen and wet specimen, in which samples are immersed in water. Wet road conditions cause the water pressure in roadways to increase as traffic moves over the asphalt pavement, resulting in breakage of aggregate-asphalt bonds within the asphalt pavement and producing greater deterioration of the roadways. The APA unit features a controllable wheel load and contact pressure (up to 200 psi) to simulate actual road conditions.

The APA allows researchers to glean valuable performance data within hours that accurately simulates actual traffic and weather conditions. The regular dry deformation test, for example, takes just 2-1/4 hours to complete 8,000 cycles. Both cold and hot asphalt mixes may be tested.

#### Hot Mix Asphalt Research Investigation for Connecticut

In cooperation with ConnDOT and FHWA, the CAP Lab is conducting a two-year study to: develop guidelines for minimum asphalt binder content for Superpave mix designs; conduct permeability/porosity testing of hot mix asphalt (HMA) mix designs in both the laboratory and field situations; evaluate permeability as a non-destructive dispute resolution methodology for bridge deck density of HMA pavements; and investigate whether premature cracking is more prevalent in certain Superpave mixtures as compared to other Superpave mixtures.

#### Longitudinal Joint Performance Study

In cooperation with ConnDOT and FHWA, the CAP Lab is conducting a one-year study to: perform evaluations on pavements with poorly performing longitudinal joints and compare them to comparably aged pavements with longitudinal joints that are performing well; verify that the newly developed methodology for using nuclear density gauges is adequate for improving the measurement of the density of longitudinal joints; and document the current state of the practice for constructing longitudinal joints. This study will also conduct a preliminary evaluation on the use of a notched wedge longitudinal joint construction methodology on two pilot projects. The notched wedge joint has been used successfully in other states to improve the long-term performance of longitudinal joints.
MESSAGE FROM PROGRAM DIRECTOR

The return of my predecessor, Donna Shea, to private industry completes a seven-year tenure highlighted by strong curriculum development, significant partnering outreach and vital professional contributions to the National Local Technical Assistance Program initiatives. As Donna’s successor, I bring a broad range of public construction experience to the position and, more importantly, a history of strong belief in the value of public agency educational training and technology transfer in Connecticut. The strength of the Connecticut Technology Transfer Center remains in the core program offerings: quality training for local agencies, extensive technical resources and specific collaborative projects with numerous public and private organizations. As we expand our programs and audience, we remain dedicated first and foremost to the local agencies and their transportation needs.

Sincerely,

PETER MONTENEGRO
Program Director

TECHNOLOGY TRANSFER CENTER PROGRAM HIGHLIGHTS

- The 2005 calendar year included 48 training sessions with over 1,400 participants. The combined fiscal 2005-2006 period accounts for over 3,000 in program attendees.

- Presented the Eastern Winter Maintenance Symposium at the new Connecticut Convention Center in Hartford with ConnDOT, FHWA and AASHTO for 800 East Coast attendees.

- Partnered with the Connecticut Division of OSHA for statewide roadway safety training.

- Partnered with the Connecticut Department of Environmental Protection (DEP) to provide storm water management training.

- Partnered with ConnDOT for the Safe Routes to School program kick-off for Connecticut municipalities and their school districts.

- Donna Shea, Program Director, was the keynote speaker at the Connecticut Police Commissioners’ annual dinner to provide an overview of the Legal Traffic Authority certificate program.

- Sponsored a Pavement Maintenance Demonstration that attracted 75 participants representing 42 Connecticut, Massachusetts and Rhode Island municipal public works agencies.

- The first Connecticut Creative Solutions Awards were presented to Paul Pronovost and John DalNegro, III, of the town of Thomaston for their “Under Guide Rail Material Pusher” and to Dwight Ryniewicz and Porter Elliott of the town of Woodstock for their “Catch Basin Top Removal Sling.” Winners were recognized at the Technology Transfer Center Certificate Programs Graduation Ceremony held on September 22, 2005 at UConn.

- Mary McCarthy, CTI Program Coordinator, was appointed to the Connecticut Interlocal Risk Management Agency Risk Control Advisory Committee.

- Stephanie Merrall, CTI Technical Information Specialist, was appointed to the National LTAP Editorial Board.

- The Outstanding Staff Service Award is presented every academic year to a staff member who has made outstanding contributions to the School of Engineering. The award consists of a $2000 cash gift and a certificate of appreciation. This academic year’s recipient, Donna Shea, was the Associate Director of CTI and Program Director for the Technology Transfer Center.
TRANSPORTATION FACULTY

Transportation Planning to Rebuild Hurricane Ravaged Gulf Coast Cities

During fall 2005 and spring 2006, Dr. Norman Garrick was part of a planning team that developed rebuilding plans for over 14 cities on the Gulf Coast of Mississippi and Louisiana that were devastated by Hurricanes Katrina and Rita. The effort in both states was led by world-renowned urban planner, Andres Duany. Dr. Garrick was the primary transportation consultant at most of these charrettes. Many of the cities have adopted the plans from the charrettes as blueprints for their rebuilding efforts, which are now gathering momentum. The Mississippi Recovery Forum, as the charrette in Mississippi was called, has also garnered national attention for the ‘Katrina Cottage’ designed to replace the infamous ‘FEMA trailer.’

Highway Safety Manual

Dr. John Ivan is actively involved in the Transportation Research Board’s “Task Force for the Creation of a Highway Safety Manual” (HSM). The HSM is intended to be a counterpart to the well-known Highway Capacity Manual, and is being developed by an international group of researchers, as a collection of guides and methods for the safety of roads and intersections. He is serving as a reviewer for some chapters while conducting research on a multi-university team for another chapter. Dr. Ivan is also a member of the Connecticut State Traffic Records Coordinating Committee, which advises the Governor’s Highway Safety representative on the data needed for traffic safety analysis and enhancement in the state. In May 2006, Dr. Ivan became Associate Department Head of Civil and Environmental Engineering.

Dr. Britt Holmén, CTI-Affiliated Researcher Speaks to Large Alumni Group

In December 2005, then-Dean Amir Faghri hosted 140 School of Engineering alumni at The Bushnell Center for the Performing Arts in Hartford. Dr. Britt Holmén was the faculty guest speaker presenting a summary of her work on vehicle tailpipe emissions. Her work with transit buses is supported by the Connecticut Cooperative Highway Research Program (CCHRP) and CT Transit. Her light-duty vehicle emissions research is funded in large part by the National Science Foundation.

Bicycle Transportation Enthusiasm Continues

All transportation faculty members at UConn have a strong personal interest in bicycle transportation. Dr. Lisa Aultman-Hall continued this year in her role as Transportation Research Board technical paper review chair for the Bicycle Transportation Committee. CTI hosts the committee’s website.

Dr. Garrick Heads National Transportation Task Force for Urban Design

During the fall 2005, Dr. Norman Garrick was named co-chair of the transportation task force of the Congress for the New Urbanism (CNU). CNU is an international organization of architects, planners, developers, educators and engineers dedicated to sustainable urban planning and design. Dr. Garrick’s transportation task force was among the lead organizations involved in the development of the recently released CNU/ITE/FHWA street design manual – “Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities.” Dr. Garrick is currently involved in the nationwide training effort for this document with CNU, the Seaside Institute and the UK-based Prince of Wales Foundation.
Study Says Too Many Parking Spots

Articles co-authored by Wesley Marshall, a transportation researcher and doctoral candidate in Civil & Environmental Engineering, and Dr. Norman W. Garrick, Associate Professor in Civil & Environmental Engineering at UConn, received significant press and interest this year. The two-year study, which examined six New England shopping sites (downtown areas in West Hartford, Northampton (MA) and Brattleboro (VT), and commercial sites in Glastonbury and Avon (CT)) found that “many shopping areas have more than twice the parking spaces they need—even during peak holiday shopping periods...” The study discusses cost, quality of life and environmental issues associated with creating excessive parking space. The research was funded by the USDOT through the New England University Transportation Center.

PI: Dr. Norman Garrick

Bridge Monitoring in Connecticut

Researchers at UConn and in the Department of Transportation have been installing long-term monitoring systems on a series of Connecticut bridges. The systems are tailored to each bridge, using a variety of sensor types and different monitoring approaches. Data are collected routinely to learn how the bridge is behaving under normal traffic loading. Researchers are exploring different techniques for using the extensive data to efficiently characterize the bridge’s behavior. The long-term goal is to use the data to develop an approach for long-term structural health monitoring. The bridge monitoring program will be expanded to additional bridges in the future.

PI: Dr. John DeWolf

Warrants for Exclusive Left Turn Lanes at Unsignalized Intersections and Driveways

The primary objective of this research is to apply accident and operational experience toward development of a set of warrants prescribing conditions under which it is and is not necessary and safe to install exclusive left turn lanes at unsignalized intersections and driveways. Empirical Bayes analyses and negative binomial modeling are being used to compare the accident experience at unsignalized intersections with and without exclusive left turn lanes, especially noting the contributions of other conditions (e.g., traffic volume level, area type, and roadway geometry). Simulation techniques help the researchers estimate the delay to through and left-turning vehicles at these same intersections, again noting the contributions of these other conditions. The resulting warrants will then consider not only traffic volumes, but also observed safety experience and other pertinent characteristics of the intersection or driveway. Another deliverable will be guidelines describing optimal physical designs and controls for exclusive left turn lanes to maximize safety for all road users.

PI: Dr. John N. Ivan

Identification of Crash-Prone Traffic Flow States on Freeways Using Real-Time Surveillance Data

This project seeks to determine the feasibility of using traffic control measures commonly available in freeway management systems to enhance the safety of urban freeways by anticipating the development of traffic flow conditions likely to result in a crash. The focus is on reducing the risk of primary crashes rather than avoiding secondary crashes once a primary event (crash, vehicle breakdown or compression wave) has occurred. Finding our approach to be feasible will open the door to development of real-time crash mitigation systems for any freeway system with a traffic flow surveillance system and the associated infrastructure needed to implement the strategies indicated by the prevailing traffic flow conditions already in place with minimal additional investment.

PI: Dr. John N. Ivan

Development of New Rheological Tools for Asphalt Binder and Bituminous Concrete Characterization

The purpose of this project is to develop tools that will provide new options for the characterization of asphalt. Shown in the photo is a combinatorial rheometer that was invented as part of this project.
All nine samples of asphalt (black circles) are being tested simultaneously over a 40° Celsius range in this prototype. The two panes are spaced by about 20 minutes.

**PI: Dr. Montgomery Shaw**

**Design and Feasibility Study: Connecticut Transportation Planning Data**

Transportation decision making requires many types of data, and the quality of decisions is dependent on the quality of that data. At a time when budgets for infrastructure and maintenance of our aging system are more limited than ever, the same scarce resources limit our ability to collect relevant data. Over the last year, the research team has been hosting roundtables and using existing national sources of data to develop current household trip rates and trip lengths for planning purposes in the state. A web-based survey is also planned.

**PIs: Drs. Lisa Aultman-Hall and John Ivan**

**Improving Winter Highway Maintenance**

The Connecticut Department of Transportation requested that the Connecticut Academy of Science & Engineering (CASE) investigate alternative winter roadway maintenance strategies. The CASE study committee that collaborated with Dr. Aultman-Hall and her colleagues included both in-state and out-of-state experts: Robert Baker, A. George Foyt, Herbert Levinson, L. David Minsk, Max Perchanok, Leland Smithson and Robert Turner. The team reviewed case studies and recommended improvements intended to result in clearer highways, increased safety and/or reduced costs. A primary goal was the reduction in usage of sand, which is associated with expensive road cleanup and respiratory complications resulting from airborne silica.

**Development of Nationwide Freight Analysis Zones**

The Commodity Flow Survey (CFS) collected by the U.S. Census Bureau and the U.S. Department of Transportation (USDOT) is currently the only nationwide commodity flow data. While the CFS has filled a critical data gap, its success is limited by geographic resolution. Transportation planners require higher spatial resolution to address the planning needs of Metropolitan Planning Organizations and states. Post-doctoral fellow, Dr. Hyeon-Shic Shin, has been studying objective ways to develop nationwide freight zones for data provision and modeling. The project was funded by the USDOT through the New England University Transportation Center.

**PI: Dr. Lisa Aultman-Hall**

**Vehicle-Derived Tailpipe Emissions**

CTI research on light-duty vehicle emissions is relatively unique because of the group’s interest in real-world, on-road data collection. A collaborative team comprised of faculty and graduate students from both the transportation and the environmental groups at UConn has been collecting tailpipe emissions data while volunteer drivers travel in our instrumented vehicle. The vehicle is monitoring exhaust particles and vehicle gases using a special tailpipe adapter built by Yingge Qu. GPS, engine scan tools and accelerometers are operated by Eric Jackson.

**PI: Dr. Britt Holmén**

**Sealing of Small Movement Bridge Expansion Joints**

Sealing of bridge expansion joint systems is important to protect the structural components below the pavement surface from damage due to water, salt, and other roadway debris. The main objective of this research is to develop a durable joint sealing material design for small expansion joints. A new elastomeric foam-type joint sealant was developed using laboratory tests that simulated the effects of exposure to New England weather conditions. The foam sealant showed greater resistance to fatigue with tensile deformation cycles, and its stress relaxation rate was greater than that of commercial sealant. No leakage was observed through the sealant and joint interface.

**PIs: Drs. Ramesh B. Malla and Montgomery Shaw**
Since 1991 the United States Department of Transportation has funded a series of University Transportation Centers (UTC) throughout the nation to advance technology and expertise in transportation through combined efforts of research, education and technology transfer. The unique research activities at the Connecticut Transportation Institute (CTI) led to UConn being named as a center in August 2005 in the federal legislation SAFETEA-LU. The academic year 05-06 has been filled with careful planning and stakeholder discussions to select a UTC theme and establish activities. A strategic plan will soon be submitted to USDOT from CTI.

Under the theme Transportation for Smart Growth, the UTC at CTI proposes to pursue four new activities:

1. **Transportation Lab**  
   Simulation-based research and public promotion of transportation engineering.

2. **Professional Development Courses and Workshops**  
   To develop awareness and skills for smart growth.

3. **Summer Transportation Institute**  
   One-week workshop designed to introduce students in grades 8 or 9 to transportation careers.  
   *(starts in summer 2008 – includes deliberate diversity focus)*

4. **Competitive Research Grant Program**  
   Proposals within the following theme areas will be considered from all UConn faculty:

   a. Development of “smart growth” planning tools that can evaluate alternative traffic management strategies and land use patterns that minimize the negative social and environmental impacts of transportation.

   b. Plans for understanding the transportation system and land use design changes required to increase bicycle and pedestrian trips.

   c. Studies of travel behavior that quantify the infrastructure needs that will allow vehicles with cleaner, less-polluting fuels to attain maximum market penetration.

   d. Characterization of mass transit systems that can succeed in suburban environments.
The Connecticut Cooperative Highway Research Program (CCHRP) has been a joint venture of the University of Connecticut and the Connecticut Department of Transportation since 1962.

This year’s Council members included:

Connecticut Department of Transportation
- H. James Boice
- L. Brian Castler - Vice Chair
- Arthur W. Gruhn
- Keith R. Lane

University of Connecticut
- Lisa Aultman-Hall - Chair
- John T. DeWolf
- Ian Greenshields
- Michael Accorsi

James M. Sime - Council Secretary

Final Reports issued in 05-06:


CTI FUNDING AND EXPENDITURES

Total External Funding = $1.8 Million

2005-2006 Expenditures by CTI Program

2005-2006 Expenditures by Funding Source
MISSION STATEMENT

The mission of the Connecticut Transportation Institute (CTI) is to conduct integrated multidisciplinary research, education and related services that promote safety and efficiency in multimodal passenger and freight transportation systems and, in turn, enhance livable communities, sustainable economies and the environment.

ADVISORY COMMITTEES

Technology Transfer Center

Kathleen Bradford
General Supervisor
ConnDOT

Barbara Breslin
Assistant Transportation Planner
FHWA

Robert Brown
Senior Engineer
ConnDOT

Barbara Buddington
Executive Director
Windham Regional Council of Governments

Mark Carlino
Public Works Director/Town Engineer
Town of Manchester

David Demchak
Vice President, Alternative Risk and Business Development
Connecticut Interlocal Risk Management Agency (CIRMA)

David Gofstein
Public Works Superintendent
Town of Bloomfield

Thomas G. Hozebin
Program Manager
CT Department of Labor Division of Occupational Safety and Health

George F. Kain
Assistant Professor
Division of Justice and Law Administration
Western Connecticut State University

Faith Gavin Kuhn
Director of Public Information
Connecticut Construction Industries Association

Daniel B. LeGeyt (Vice Chair)
Highway Superintendent
Town of New Hartford

Richard Miller
City Engineer
City of New Haven

David Monckton
Public Works Director
Town of Woodbury

Brian Natwick
Project Engineer
ConnDOT

Dionysia F. Oliveira
Transportation Engineer III
ConnDOT

Susan Prosi
Senior Transportation Planner
South Western Regional Planning Agency

James M. Sime
Manager for Research
ConnDOT

Frederick G. Thumm, P.E. (Chair)
Public Works Director
Town of East Haddam

Mark M. Zessin, P.E.
President
Anchor Engineering Services, Inc.
ADVISORY COMMITTEES cont’d.

CAP Lab
Lisa Aultman-Hall
Director
Connecticut Transportation Institute

Stephen J. Cooper
Pavement and Materials Engineer
FHWA

Alan R. Craig
Consultant

Ernest Herrick
Executive Secretary
CT Asphalt and Aggregate Producers Association

Ranald P. Jones
Manager, Paving and Transportation
Tilcon Connecticut, Inc.

Colleen A. Kissane
Pavement Management Engineer
ConnDOT

Keith R. Lane
Director, Research and Materials
ConnDOT

Fred Mello
Account Representative
Consultant to BASF Corporation

Walaa Mogawer
Associate Professor
UMass Dartmouth

Peter Montenegro
Program Director
Technology Transfer Center

Ray Oneglia
Vice Chairman of the Board
O&G Industries, Inc.

Leo P. Picard, Jr.
President
Massachusetts Aggregate & Asphalt Pavement Association

Jack Stephens
Professor Emeritus and Special Technical Advisor
CAP Lab

Leo Stevens, Jr.
Consultant

Terri Thompson
Transportation Supervising Engineer
ConnDOT

Andrew Tierney
Director of Public Works
Town of Hebron

CONNECTICUT TRANSPORTATION INSTITUTE NEWS AND EVENTS

NEUTC Fellowship Recipients Recognized at Transportation Graduate Student Award Reception

The annual Transportation Graduate Student Award Reception was held November 1, 2005 at the CTI offices. The reception followed a seminar entitled “Fuel Cells and Transportation,” presented by Trent Molter, Research Scientist and Business Development Officer with the Connecticut Global Fuel Cell Center, a School of Engineering center of excellence.

Three civil engineering graduate students were recognized for receiving New England University Transportation Center (NEUTC) fellowships for the 2005-06 academic year. Stephanie Mather is majoring in Transportation and Urban Engineering. Her advisor is Dr. Lisa Aultman-Hall. Joshua Olund and Alan Cardini are majoring in Structural Engineering and are working with Dr. John DeWolf on his bridge monitoring project.

Stephanie Mather, Joshua Olund and Alan Cardini