

CONNECTICUT TRANSPORTATION INSTITUTE



2004 - 2005
ANNUAL REPORT

Message from the Director



As I reflect upon another exciting and successful year at CTI, a single focus seems to unify the work of this diverse team in transportation: community growth and development. We often confuse these words to mean lots of construction - making our communities physically larger. The focus at CTI is the role of transportation in making communities stronger and better, but not necessarily bigger.

Our research efforts this year have spanned from traffic safety to asphalt technology to tail-pipe emissions for both light duty vehicles and transit buses. The researchers' methods have been motivated by a strong belief that the details of street design and its context, including the surrounding land use design, profoundly impact the safety and environmental effects of transportation in our communities.

Over the last year, the Technology Transfer Center (T2) expanded to embark on two new critical need areas for communities. First, "The Leadership Institute" is being developed with stakeholder input. This program will bring formal leadership training to community leaders. Second, T2 has continued to be a very strong voice for transportation workforce development.

CTI professionals are dedicated to building transportation systems for stronger communities. Our staff and faculty have been called to serve many national and regional leadership roles in transportation (for example, FHWA-LTAP, TRB, and NETTCP). In the coming year we will focus our efforts on serving a greater number of groups and agencies throughout Connecticut. Given the challenges our communities face, Connecticut needs a stronger university-based hub for transportation research and education. CTI is the natural location for this growth.

Sincerely,



Lisa Aultman-Hall, Director and Associate Professor

Message from the Dean



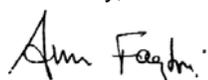
Dear Friends,

The Connecticut Transportation Institute continues to evolve into an institution of inestimable value to Connecticut communities, towns and residents. CTI is transforming itself into an active member of every community by improving the transportation system, including multimodal traffic, educating policy makers and highway personnel and introducing a new generation to transportation issues and careers.

Research remains an integral part of CTI's focus. Its studies of auto and transit bus emissions, driver behavior and route design, congestion patterns and countless other investigations are helping to change the landscape of Connecticut. But the Institute's role in educating tomorrow's transportation workforce and community leaders, its perspective on the interactions among vehicles, roadways and people as they impact quality of life issues, and its commitment to a more informed transportation culture in the 21st century make it an irreplaceable resource for the region.

It is my privilege to be associated with this outstanding organization. I invite you to browse this report and acquaint yourself with the outstanding work CTI is doing for you and your communities.

Sincerely,



Amir Faghri
Dean and United Technologies Endowed Chair Professor in Thermal Fluids Engineering
School of Engineering



Provided 32 training programs to 3,000 participants from local municipalities, state agencies and the private sector who are involved in transportation planning, construction and maintenance.

Hosted the **Technology Transfer Expo** on campus for 550 visitors.



Co-hosted the **CT Construction Career Days** for 1,200 high school juniors and seniors.



Established a new **Connecticut Creative Solutions Award** Program to recognize innovative thinking by public agency transportation personnel.

Received a New England University Transportation Center education grant to develop a curriculum for the **Safety Town** Loan Program. The program teaches elementary school children various aspects of pedestrian safety, bicycle safety and school bus safety.

Established a successful partnership with the University of Connecticut's NEAG School of Education to assess the need for a quality transportation **Leadership Training Program** in Connecticut.

Participated in several national task forces established by the Federal Highway Administration to contribute to the growth of the National Local Technical Assistance Program.

Co-hosted the national AASHTO Research Advisory Council (RAC) Conference.

**Message from
Donna Shea, Program Director
CT Technology Transfer Center
www.t2center.uconn.edu**



Over the past year, in addition to providing quality training, technical resources and outreach programs to local and state agencies, we have been focusing on the future of the transportation workforce. We are developing programs that can nurture and grow strong leaders and ensure the sharing of best practices among the members of the Connecticut transportation community.

CT Advanced Pavement Laboratory



**James Mahoney,
Program Director
and Head Research Engineer**



During the past year, the CAP Lab has been involved in several exciting research projects with the potential to significantly improve the durability of asphalt pavements. The CAP Lab also conducted several courses for the New England Transportation Technician Certification Program. These courses covered a wide range of topics, including asphalt and soils testing. The lab technicians also performed mix designs for research focused on demonstrating that asphalt pavements can be used in high stress load intersections.



www.caplab.uconn.edu

CAP Lab Research Briefs

Correlation of Nuclear Density Readings with Cores Cut from Compacted Roadways



In cooperation with ConnDOT and FHWA, the CAP Lab conducted a two-year study using a nuclear density gauge to compare the in-place density of asphalt pavements with the density of cores cut from the pavement. The research has generated a procedure for establishing a correction factor used to adjust the nuclear density gauge readings of in-place asphalt to more closely approximate the densities found in cut cores.

Evaluation of Pavement Crack Treatments - Hot Pour vs. Emulsified Materials

In cooperation with ConnDOT and the Connecticut Cooperative Highway Research Program, the CAP Lab investigated the effectiveness of hot-pour and emulsified crack treatments. These evaluations were conducted on material that had been placed in previous years on both limited access highways and secondary roads.



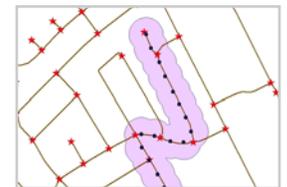
Describing Modal Operating Events for Light Duty Vehicle Emission Models



Researchers at CTI are collecting real-world PM tailpipe emissions with an on-board condensation particle counter (CPC) for a single automobile and 20 different drivers while concurrent acceleration, velocity and position within the transportation network are measured by GPS, a scantool and accelerometers. Gas emissions are being measured with a 5-gas analyzer. Researchers hope to use these data to understand tailpipe emission differences between drivers, locations in the transportation network and vehicle operating conditions. Drs. Aultman-Hall and Holmén, PIs

Increasing the Accuracy of Trip Rate Information from Passive Multi-Day GPS Travel Datasets

With the availability of GPS receivers to capture vehicle location, it is now feasible to easily collect multiple days of travel data automatically. However, GPS-collected data are not ready for direct use in trip rate or route choice research until trip ends are identified within large GPS data streams. In this research, 12 10-day real-world GPS travel datasets were used to develop, calibrate and compare three methods to identify trip start points in the data stream. They correctly identified 94% of trip ends. Dr. Lisa Aultman-Hall, PI



Development of an Optimal Nationwide Freight Planning Zone System



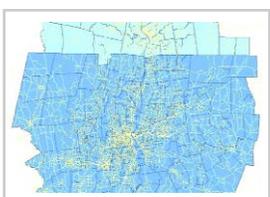
The objective of this work is to use GIS spatial analysis capabilities to establish an optimal national zone system for freight planning. Although to date most freight transportation planning analyses have been undertaken at the state or metropolitan scale, the need to evaluate the intermodal network and pursue modal substitution has necessitated that planners start to focus on nation-scale analyses. The work is funded through the New England University Transportation Center and the USDOT. Dr. Lisa Aultman-Hall, PI

Investigation of a New Approach for Representing Traffic Volumes in Highway Crash Analysis and Forecasting

This project is investigating a new approach for modeling the relationship between crashes and traffic volume that will both preserve the possibility of estimating a crash risk per unit exposure and account for the non-linear effect of traffic volume on crash incidence. The model form proposed will predict crashes to account for three distinct effects that volume has on crash incidence: the number of trials (or exposure), the number of crash opportunities (or vehicle interactions), and the traffic flow state, along with a function of the roadway characteristics that will represent the risk of the highway location after controlling for the effects of volume. Dr. John N. Ivan, PI



Network-Based Highway Crash Prediction Using Geographic Information Systems



The objectives of this project are to estimate network-based crash prediction models that will predict expected crash experience in any given geographic area as a function of the highway link, intersection and land use features observed in the area. The result will be a system of GIS programs that permit a polygon to be drawn on a map, or a set of links and intersections to be selected, and then predict the number of crashes expected to occur on the selected traffic facilities. Expected values can then be compared with observed values to identify locations that are particularly dangerous and require attention for improving safety. Dr. John N. Ivan, PI

Accuracy of GPS Receivers for Vehicle Tracking



CTI researchers have teamed up with UConn researchers from Natural Resources and the CT Department of Transportation to conduct field research on GPS accuracy for vehicle tracking. Vehicles with three different GPS receivers are being repeatedly driven in cruise, acceleration and deceleration patterns at the Consumer's Union test track in Connecticut. These results will be useful for ongoing tailpipe emissions research as well as the DOT's photologging and inventory work using the ARAN van (pictured).
Scott Zinke, Research Engineer

Vehicle-Derived Particulate Matter

New research on transit bus and light-duty vehicle emissions is relatively unique because of the researcher's interest in real-world, on-road data collection. For example, we have designed sampling systems to enable real-time measurement of particle emissions from diesel and Connecticut's first two diesel hybrid-electric transit buses as the buses drive actual routes in Hartford. Three different bus routes, two fuels and the effects of diesel particulate filters on the particle emissions are being compared to help transit agencies evaluate the best solution for meeting tightening air quality standard emission targets. Dr. Britt A. Holmén, PI



Bridge Monitoring in Connecticut



The University of Connecticut and the Connecticut Department of Transportation have been involved in monitoring bridges in the state during the past two decades. We have learned how different bridges behave, provided information needed to determine current conditions and provided guidance for renovations. Currently, the research is implementing continuous bridge monitoring systems on a variety of bridges. The results will provide information that can assist in the management and safety of the state's bridge infrastructure. Dr. John T. DeWolf, PI

Methodology to Predict the Safety Performance of Rural Multilane Highways

The primary product of this research will be a methodology for estimating the safety performance of rural multilane highways and a toolkit for applying the methodology. The toolkit will be comprised of a suite of crash prediction models for different types of applications, different severities and different entity types, the best available information on crash modification factors for road design applications and detailed illustrations and instructions for applying the methodology. Dr. John N. Ivan, PI *Project under subcontract with the Texas Transportation Institute.*



Fulbright Research on Transportation and Urban Planning in Jamaica



This research examines the role of transportation in fostering sustainable development and environmental stewardship in Jamaica, with a focus on public transportation in Kingston. The study documents the process of collapse and recovery of the transit system as a case study in understanding the role of local government and the international lending agencies in promoting different transportation and land use strategies.
Dr. Norman W. Garrick, PI



Connecticut Cooperative Highway Research Program

Joint Highway Research Advisory Council



The Connecticut Cooperative Highway Research Program (CCHRP) is a joint venture of the University of Connecticut and the Connecticut Department of Transportation. The competitive research program funds projects proposed by faculty from departments throughout the university and places a high priority on funding graduate student research.

2004-2005 Final Reports:

"A Laser-based 3D Data Acquisition System for the Analysis of Pavement Distress and Roughness," Javidi, B., Kim, D. and Kishk, S., December 2004, Report JHR 04-300, Project 03-2.

"Incorporating Truck Flows into the State-wide Planning Traffic Model," Aultman-Hall, L., Guo, F., O'Brien, C., Padlo, P. and Hogge, B., November 2004, Report JHR 04-299, Project 02-1.

"Factors Affecting Young Driver Safety," Aultman-Hall, L. and Padlo, P., November 2004, JHR 04-298, Project 03-5.

"Developing a Methodology to Evaluate the Safety of Shared-Use Paths: Results from Three Corridors in Connecticut," Aultman-Hall, L. and LaMondia, J., June 2004, JHR 04-297, Project 02-2.



New England Transportation Consortium

CTI provides management functions for the New England Transportation Consortium, a joint undertaking of the six New England states. Visit www.netc.uconn.edu.

2004-2005 Final Reports:

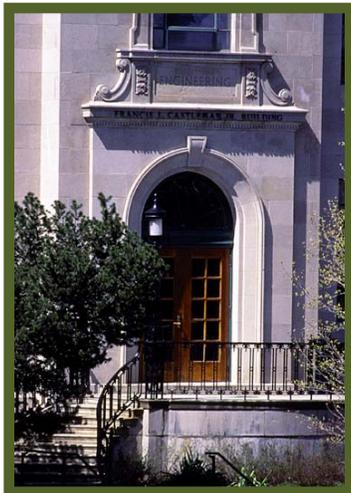
"A Complete Review of Incident Detection Algorithms and Their Deployment," Parkany, E. and Cie, C., February 2005, NETCR 37.

"Feasibility Study of an Erosion Control Laboratory in New England," Long, R. and Demars, K., December 2004, NETCR 49.

"Superpave for Low Volume Roads," Mogawer, W. and Mallick, R., December 2004, NETCR 51.

"Evaluation of Asphaltic Expansion Joints," Mogawer, W., Austerman, A., November 2004, NETCR 50.

Transportation Faculty and Graduate Studies



CTI-associated research funded 11 graduate students in the urban transportation and planning group, and an additional 11 graduate students on transportation-related structures or environmental engineering projects. The transportation research group began a new weekly seminar series this past year. In addition to speakers from outside the university, graduate students from different research areas presented their research results to each other in an effort to further develop multi-disciplinary learning in transportation.

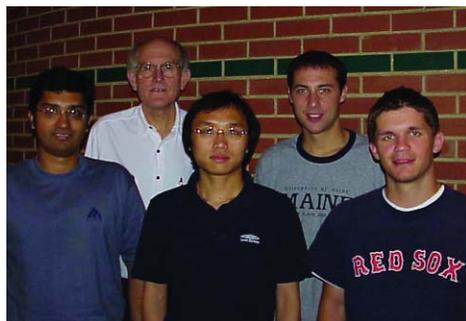
Bicycle Master Plan on the UConn Campus - ITE Student Chapter Received Campus Environmental Leadership Award

The Campus Bike Plan Team (ITE - Student Chapter) was recognized for environmental leadership (Special Projects category) at a ceremony held April 22, 2005. The award was presented by UConn President, Philip Austin.

The team worked on promoting a campus bike plan. Their “bicycle needs” survey received over 2,000 replies last fall. **Eric Jackson** and **Jeff LaMondia** organized a campus group bike ride in collaboration with the EcoHusky student group.



“Bridge Monitoring in Connecticut” Research Group - 20 Years Plus!



Graduate students currently conducting research on the project (L to R): Santanu Chakraborty, Dr. John DeWolf, Changyin Liu, Joshua Olund and Alan Cardini.

Over the past 20 years, 7 Ph.D. students and 16 M.S. level students have completed their degrees working on bridge monitoring research with Dr. John DeWolf. Three of these students completed their degrees in the past year.

The students’ work involves installation and operation of field monitoring equipment on bridges to measure and evaluate accelerations, strains, temperatures and tilts.

New England University Transportation Center (NEUTC) Fellowship Recipients



L-R: Wesley Marshall, Dr. John Ivan and Chris O'Brien

Christopher O'Brien - *Structures and Transportation*
Research Interest: Asphalt Binder Characterization

Wesley Marshall - *Transportation*
Research Interest: Sustainable Parking Systems

Ph.D. Student Wins TRB's Best Presentation Award

CEE Graduate Assistant, **Jianhe Du**, was one of 13 Ph.D. students to present their dissertation at a special seminar in the area of transportation planning at the Transportation Research Board Annual Meeting held in Washington, DC in January 2005. Her presentation, entitled "Investigating Route Choice and Driver Behavior Using GPS-Collected Data," was judged best in terms of quality, clarity and conciseness. Jianhe will graduate from UConn this summer. Her advisor is Dr. Lisa Aultman-Hall.



Outstanding Junior Faculty Award

Dr. Britt Holmén was presented with the Outstanding Junior Faculty Award at the School of Engineering's Annual Awards Banquet held on April 19th in UConn's Rome Ballroom. Dr. Holmén conducts transportation-related research on vehicle emissions and air quality.

New Graduate Course in Transportation Safety

This past spring semester, Dr. Aultman-Hall offered a new graduate course in Transportation Safety. Topics included both policy analysis and statistical analysis for the measurement of traffic safety. Areas of focus included driver performance versus driver behavior, highway design, safety education programs, alcohol-involved crashes and young drivers. Significant material on safety for pedestrians and bicycles was also included. Students developed formal research proposals and used real-world data to produce their final class projects.

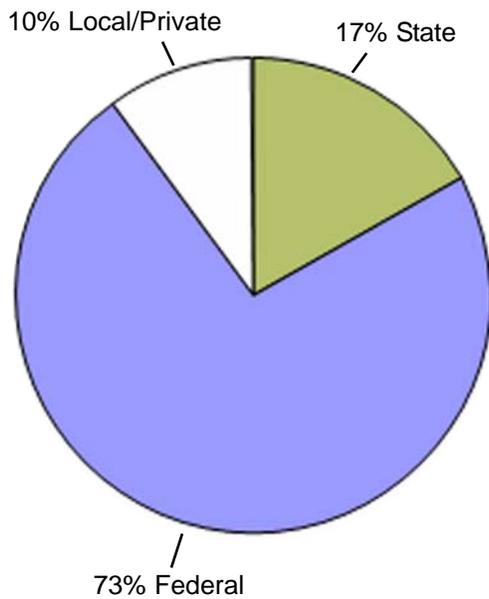


Mission Statement

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.

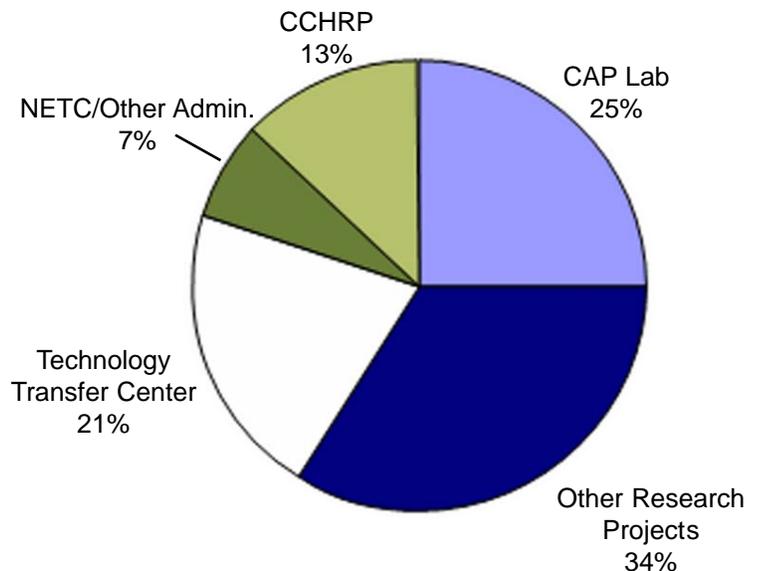
CTI Funding and Expenditures

2004-2005 Expenditures by Funding Source



Total External
Funding = \$2,100,000

2004-2005 Expenditures by CTI Program



CTI Steering Committee

Amir Faghri, Dean *School of Engineering* and Professor *Mechanical Engineering Department*
Lisa Aultman-Hall, Director CTI and Associate Professor *Civil and Environmental Engineering Department*
John DeWolf, Professor *Civil and Environmental Engineering Department*
Norman Garrick, Associate Professor *Civil and Environmental Engineering Department*
Ian Greenshields, Associate Dean for Academic Affairs *School of Engineering*
and Associate Professor *Computer Science and Engineering*
John Ivan, Associate Director CTI and Associate Professor *Civil and Environmental Engineering Department*
Kenneth Reifsnider, Professor *Mechanical Engineering Department* and Director *Connecticut Global Fuel Cell Center*
Donna Shea, Program Director *Connecticut Technology Transfer Center*

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City of New Haven
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Connecticut Department of Transportation
Barbara Breslin, Community Planner
Connecticut - Federal Highway Administration
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Connecticut Department of Transportation
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Town of Greenwich
Barbara Buddington, Executive Director
Windham Regional Council of Governments
Mark Carlino, Director/Town Engineer
Town of Manchester, Department of Public Works
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Town of Bloomfield, Department of Public Works
Stan Harris, Executive Assistant to the Chairman
Mashantucket Pequot Tribal Nation
Thomas Hozebin, Program Manager
Connecticut OSHA
Faith Gavin Kuhn, Director of Public Information
Connecticut Construction Industries Association
Daniel LeGeyt, Highway Superintendent
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Town of Woodbury, Department of Public Works
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Connecticut Department of Transportation
Dionysia F. Oliveira, Transportation Engineer III
Connecticut Department of Transportation
Susan Prosi, Senior Transportation Planner
Southwestern Regional Planning Agency
James Sime, Manager for Research
Connecticut Department of Transportation

Jack Stephens, Prof. Emeritus and Special Technical Advisor
Connecticut Advanced Pavement Laboratory (CAP Lab)
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Connecticut Department of Transportation
Andrew Tierney, Director of Public Works
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