The Institute for Transportation Research and Education (ITRE) is an inter-institutional center of the University of North Carolina System. Chartered by the North Carolina General assembly in 1978, ITRE carries out research, training and technical support activities in the area of surface transportation for a host of national, state, and local clients. Currently, ITRE is organized into six program areas covering highway systems, municipal technical services, North Carolina technical assistance, public transportation, pupil (school) transportation, and transportation and the environment. This report summarizes ITRE’s principal activities this year as well as highlights the capabilities for new activities based on prior accomplishments. More information about ITRE’s programs and staff are available through ITRE’s home page: http://www.itre.ncsu.edu

Summary of Technical Capabilities

Center for Transportation and the Environment
As a U.S. Department of Transportation university transportation center of excellence, the Center for Transportation and the Environment (CTE) conducts research, education, and technology transfer activities that seek to mitigate the impacts of surface transportation on the environment. CTE’s mission is national in scope, although CTE co-sponsors activities and makes its services available at the local, state, and regional levels as well. CTE has provided over a decade of service to transportation and environmental professionals and has played a pivotal role in developing the next generation of professionals who will be charged with meeting future mobility needs in an environmentally sound manner. CTE provides:

- Research consulting (in the areas of transportation-related environmental stewardship, environmental streamlining, context-sensitive solutions)
- Meeting facilitation
- Special event planning and logistics
- Web site design and development
- Web site hosting
- Web streaming (digitized video/audio files)
- Satellite broadcasting
- Video production and editing (digital and analog)
- Web and print publication of conference proceedings, workshop summaries, and other special events

Highway Systems Program
The Highway Systems Group spun out of the early research and development efforts in the 1980’s on projects for the Division of Highways of NCDOT. Today’s efforts expand upon that base of knowledge to include focus areas such as: Transportation Policy, Traffic Operations, Work Zone Safety, Maintenance Operations, Professional Development Training, and Professional Engineering Review. Some of the projects include:

- Pavement Management Systems
- Pavement Repair Procedures, Crew Size, Equipment and Productivity Rates
- Transportation Policy Studies
- Transportation Funding Analyses
- Investigation of Technical Training Needs
- Development of Training Courses
- Development of Training Materials
Municipal Technical Services Program
The Municipal Technical Services Program (MTSP) at ITRE is made of 4 technical staff that provides a wide range of technical services to state and local governments throughout the Mid-Atlantic region. Some of our services include:

- Comprehensive selection of training workshops, technology implementation services, a technical outreach program that extends our knowledge to clients
- ArcView GIS training: Geographic Information Systems (GIS) and Global Position Systems (GPS) training services
- Technical service projects: help municipal organizations implement, expand or refine GIS databases
- Private sector partnerships with pavement management: Developing and implementing pavement management systems for municipalities, including the implementation of a pen-top computer application for field data collection inventories.
- GIS-linked pavement survey systems: this GIS linkage allows for further spatial analysis, such as certain pavement failures compared with subsoil or geologic phenomena.

NC Local Technical Assistance Program
The North Carolina Local Technical Assistance Program was established by the Federal Highway Administration (FHWA) in 1982. The NC LTAP center plays a leading role in helping state and local government agencies assess and apply new transportation technologies through a broad spectrum of highway research, training and transportation planning activities. North Carolina’s LTAP Program offers four primary types of assistance:

- Training Workshops
- Technical Materials
- Technical Information Services
- Quarterly Newsletters

Public Transportation Program
Overall Public Transportation activities have been conducted for public transit, passenger rail, taxicab, and bicycle and pedestrian sponsors at the national, state and local levels. Planning activities have encompassed:

- Transit: organizational coordination/consolidation, operations, technology implementation, financial, and human resource management
- Rail: service expansion/improvement

Operations activities have involved:

- Transit: scheduling and dispatch, maintenance, policies and procedures
- Rail: policies and procedures
- Taxicab: excellence in customer service
- Bicycle and Pedestrian: regulations, policies and procedures

Training activities include:

- Transit: scheduling and dispatching software, effective management using database and spreadsheet techniques
- Taxicab: effective use of technologies, maintenance, marketing, and risk management

Applied research has resulted in the development of products including:

- Transit: software to assist in scheduling, billing, and reporting
- Rail: assessment of state safety programs now in place
- Taxicab: educational videos promoting effective regulatory practices and benefits to independent contractor drivers for providing excellent customer service
- Bicycle and Pedestrian: compilation of best practices in state laws and regulations, and educational seminars on developing effective local bicycle and pedestrian practices
Pupil Transportation Program
The mission of the Pupil Transportation Group is to apply transportation engineering principles and technology to the operation and management of school buses in order to provide for safe and efficient transportation of school children. The key to the success of the pupil transportation group is its partnership with local education agencies, state agencies, universities, national associations, and private industries. Areas of partnership and capabilities include:

- Research and analysis of multi-modal of school transportation systems
- Computer assisted school bus routing and scheduling
- Application of the Intelligent Transportation System technologies to school transportation
- Land use studies
- School population analysis and forecasting
- Optimization of school locations
- Optimization of school attendance boundaries
- Optimization of school bell times

Summary of Activities in the Academic Year 2001-2002

In the 2001-2002 Academic Year, ITRE had approximately 40 people on staff and generated over $7M in expenditures. ITRE maintained and broadened the ongoing research and educational activities under the direction of Dr. Nagui Rouphail, who was appointed as permanent ITRE Director in January 2002.

In addition, ITRE's Web site includes research and training directories that enable the user to search for specific ITRE activities. To explore our Web site for these activities go directly to each of these directory pages:

http://www.itre.ncsu.edu/ITREmain/research_directory.html

http://www.itre.ncsu.edu/ITREmain/training_directory.html

ITRE's current research and education activities at the national, state and local levels are listed below:

National Level Research and Development
Research efforts at ITRE are quite significant. There are twenty-six national-level projects listed below that are carried out by various program groups at the Institute.

AASHTO Center for Environmental Excellence: Business Plan Development
Sponsors: American Association of State Highway and Transportation Officials and the Federal Highway Administration (J. Martin)

AASHTO Environmental Stewardship Demonstration Program
Sponsors: American Association of State Highway and Transportation Officials and the Federal Highway Administration (J. Martin and J. Myers)
http://www.stewardship.transportation.org

AASHTO Expert Team Selection
Sponsors: American Association of State Highway and Transportation Officials and the Federal Highway Administration (J. Martin)

Advanced Public Transportation Systems for Rural Areas “Where Do We Start?” “How Far Should We Go?” TCRP Project B-17
Sponsor: National Academy of Sciences (A. Nalevanko)
Complex Computer Models Evaluation  
Sponsors: National Institute for Statistical Sciences and National Science Foundation  
(N. Rouphail)

CONVERGE—Where Transportation and the Environment Meet:  
Public Education Project That Chronicles the Transportation/Environmental Relationship  
Throughout American History  
Sponsors: USDOT, FHWA, USEPA, Office of Transportation and Air Quality  
(J. Martin and J. Myers)  
http://www.converge.ncsu.edu

CTE National Teleconference Series (& Web Simulcasts)  
Sponsors: USDOT in cooperation with other governmental and non-governmental organizations  
(J. Martin)  
http://www.itre.ncsu.edu/cte/cte-teleconference.html

Design and Operations of Shared-Use Paths  
Sponsor: FHWA (J. Hummer - CE Dept. NCSU; N. Rouphail and J. Milazzo)

Driver Education Video  
Sponsor: Taxicab, Limousine and Paratransit Association (T. Cook)

Environmental Research in Progress Web Database  
Sponsors: USDOT in cooperation with the Transportation Research Board Committee on  
Environmental Analysis (J. Martin)  
http://www.itre.ncsu.edu/cte/envripmenu.htm

International Conference on Ecology and Transportation (ICOET)  
Sponsors: Federal Highway Administration (FHWA) in cooperation with other governmental and  
non-governmental organizations (J. Martin)  
http://www.itre.ncsu.edu/cte/icoet

Wildlife, Fisheries, and Transportation Web Gateway  
Sponsors: USDOT (K. McDermott)  
http://www.itre.ncsu.edu/cte/gateway/index.html

Wildlife Research Web Database  
Sponsors: USDOT (K. McDermott)  
http://www.itre.ncsu.edu/cte/wildlife.htm

In-Vehicle Energy and Emissions Information System  
Sponsor: National Science Foundation (N. Rouphail and Chris Frey, CE Dept, NCSU)

Listserv Moderation for the Ohiotransit and Ohiomaintenance lists  
Sponsors: Ohio Department of Transportation, Office of Transit (T. Cook)

Local Technical Assistance Program  
Sponsors: Federal Highway Administration (FHWA) and NCDOT (J. Martin)

Multi-Modal Level of Service for Urban Streets  
NCHRP proposal under review- in cooperation with Dowling and Associates et al. (N. Rouphail)
Multiple Technical Service Projects
Several projects that help municipal organizations implement, expand, or refine GIS databases.
Sponsors: individual municipalities (D. Grantham)

National Association for State Directors of Pupil Transportation Services (NASDPTS) Web Site
Sponsors: NASDPTS (L. Vandiford-Hobbs)

National Cooperative Highway Research Program Project 25-24:
Monitoring, Analyzing, and Reporting on Environmental Streamlining Pilot Projects
Environmental Streamlining Pilot Projects—NCHRP 25-24
Sponsors: Vannasse Hangen Brustlin (prime), National Academy of Sciences
(J. Martin and J. Myers)
http://www.TransStreamNet.org

Pedestrian Analysis and Modeling at Roundabouts
Sponsor: UNC-CH Highway Safety Research Center, National Institute of Health (NIH)
(N. Rouphail)

“Strategies to Increase Coordination of Transportation Services for the Transportation Disadvantaged” TCRP Project H-30
Sponsors: Multi-systems, Inc. (prime), National Academy of Sciences (T. Cook)

Summer Scholars Program
Sponsors: USDOT and NCDOT (J. Martin)
http://www.itre.ncsu.edu/cte/SmrScholar.html

“The Role of Private-for-Hire Vehicle Industry in Public Transit” TCRP Project B-16
Sponsor: National Academy of Sciences (G. Gilbert)

TRB Environmental Stewardship Workshops
Sponsors: Transportation Research Board Committee on Environmental Analysis in Transportation, Federal Highway Administration, American Association of State Highway and Transportation Officials (K. McDermott)
http://www.itre.ncsu.edu/A1F02/documents4.htm

Variability Sensitive Measure of Effectiveness
Sponsor: U.S. Bureau of Transportation Statistics (N. Rouphail)
State Level Research and Development

Statewide projects in North Carolina were conducted mostly in conjunction with NC Department of Transportation and with local municipalities. This year was a particularly successful year for attracting sponsored research from state agencies. Some of these activities include:

**Analysis of North Carolina Guidelines and Criteria for Establishing School Walk Zones**  
Sponsors: NCDOT (J. Tsai)

**Analysis of the governance of Metropolitan Planning Organizations**  
Sponsor: NCDOT Highway Program (L. Goode, J. Milazzo II)

**Annual updates to the alternative-fuel, low emissions bus purchase plan**  
Sponsor: NCDOT PTD (T. Cook)

**Best Practices Managing School Campus Carpool**  
Development that included an interactive web based decision tree system  
Sponsors: NCDOT Governor’s Highway Safety Program (J. Tsai)

**Created the North Carolina Special Needs Policy Steering Committee and developed “A Guide for the Transportation of Preschoolers and Children with Disabilities”**  
Sponsors: NCDOT Governor’s Highway Safety Program (J. Tsai)

**Developing a proposal to serve as the Regional Service Bureau for the Triangle Regional Model (TRM). The proposal is currently under review by the TRM Executive Committee.”**

**Developed conceptual statement for School Transportation Research as one of the major UNC research initiative**  
Combined efforts among ITRE, UNC-Highway Safety Research Center, and UNC-Charlotte-Office for Transportation Policy Studies  
Sponsors: NCDOT Governor’s Highway Safety Program, NCDPI (J. Tsai)

**Developing the concept proposal for a UNC Institute for Disaster Studies**  
(N. Rouphail)

**Distinguished Speaker Series**  
Sponsors: US DOT and NCDOT (K. McDermott)  
http://www.itre.ncsu.edu/cte/DSS.html

**Enhancement of web-based interactive School Bus Safety Web site**  
Sponsor: NCDPI (J. Tsai)  
http://www.ncbussafety.org

**Effects of Increased U-Turns at Intersections on Divided Facilities and Median Divided versus Five-Lane Undivided Benefits**  
Sponsor: NCDOT (J. Hummer – CE Dept. NCSU; R. Foyle and J. Milazzo II)

**Expanding the Use of Photo Enforcement to Enhance Traffic Safety in North Carolina**  
Sponsor: NCDOT GHSP (J. Milazzo II)

**Facilitate NCDOT Research Administration**  
Sponsor: NCDOT (R. Foyle)
False Capacity for Lane Drops  
Sponsor: NCDOT (J. Hummer – CE Dept. NCSU; N. Rouphail)

Guidebook for Bike and Pedestrian Policies, Procedures, and Laws  
Sponsor: NCDOT Bicycle and Pedestrian Division (T. Cook)

Graduate Research Fellowship Program  
Sponsors: US DOT and NCDOT (J. Martin)  
http://www.itre.ncsu.edu/cte/CTEFELLOWSHIP99.html

Highway Safety Research Center (HSRC) Heavy Vehicle Crash Study  
Partnered with HSRC, UNC-CH  
Sponsors: NCDOT-DMV (D. Grantham)

Hillsborough Street Roundabout Modeling and Visualization  
Sponsor: NCDOT (N. Rouphail)

Identification of School Related Injuries  
Sponsors: NCDOT Governor’s Highway Safety Program (J. Tsai)

Incident Management Assistance Patrols: Assessment of Investment Benefits and Costs  
Sponsor: NCDOT  
(A. Khattak – Dept. of City and Regional Planning UNC-Chapel Hill; N. Rouphail)

Integrated Planning for School and Community  
For 9 of the counties in the North Carolina School System  
Sponsor: individual school districts (J. Tsai)

NCDOT Maintenance Technical Assistance Program  
Sponsor: NCDOT (T. Baughman)

NCDOT Technical Training Needs Research and Implementation Support  
Sponsor: NCDOT (R. Foyle)

North Carolina Air Quality Roundtables  
Sponsors: US DOT and NCDOT (J. Myers)  
http://www.itre.ncsu.edu/cte/NCAirQuality/index.html

North Carolina Level of Service Program  
Sponsor: NCDOT (J. Milazzo and N. Rouphail)

Outreach Support Activities for NCDOT Research  
Sponsor: NCDOT (R. Foyle)

Pedestrian Safety Roadshows  
Sponsor: NCDOT Bicycle and Pedestrian Division (T. Cook)

Phase IV Planning Assistance and Support Services to the NCDOT Rail Division  
Sponsor: NCDOT Rail Division (T. Cook)

Phase VI Planning Assistance and Support Services to the NCDOT Rail Division  
Attitudinal, traffic intercept and business surveys of possible Raleigh-Wilmington passenger rail service.  
Sponsor: NCDOT Rail Division (T. Cook)
Private Sector Partnerships with Pavement Management
Developing Pavement Management Systems, including the implementation of a pen-top computer application for field data collection inventories and a pavement condition and ranking system. ITRE offers a GIS-linked pavement survey system. Sponsors: State of North Carolina municipalities (D. Grantham)

Rail Intern Program
Sponsor: NCDOT Rail Division (T. Cook)

Reducing Aggressive Driving Through Education, Engineering, Enforcement, and Economics
Sponsor: NCDOT Governor’s Highway Safety Program (J. Milazzo II)

Reducing Incidents of Vehicles Passing Stopped School Buses in Coastal North Carolina
Sponsor: NC DPI (J. Tsai)

“Regionalizing Public Transportation Services”
Sponsor: NCDOT Public Transportation Division (T. Cook)

Southern Region Workshop on Community Impact Assessment
Sponsors: Federal Highway Administration, Transportation Research Board, NCDOT (K. McDermott)
http://www.itre.ncsu.edu/cte/CIA/index.html

Technical support for the Transportation Information Management System (TIMS)
Sponsor: NCDPI (A. Michael)

Technology Transfer of NCDOT Environmental Research
Sponsors: US DOT and NCDOT (K. McDermott)
http://www.itre.ncsu.edu/cte/cterip.html

TOG/UTAP 2002-2003
Provides technical assistance, preparation and implementation of NC Technology Plan, and technical support to NC transit systems using scheduling software, a continuation of program efforts started in Fiscal Year 93-94. ITRE currently works with 103 systems on different levels of technology. Sponsor: NCDOT Public Transportation Division (D. Collins)

Traffic Signal Training and Testing Center Site Development
Sponsor: NCDOT GHSP (J. Milazzo II)

Transportation Demand Management (TDM)
A statewide TDM plan is being developed for the urban and rural commute-to-work activities. This effort is in response to Senate Bill 953 and the air quality reductions expected by Fiscal 2009.
Sponsor: NCDOT Public Transportation Division (D. Collins)

Transit System Accreditation Study
Sponsor: NCDOT Public Transportation Division (T. Cook)
Education/Training and Outreach

ITRE’s combined training activities educated more than 8,700 individuals this year. Some of the education opportunities included Work Zone Safety, offering 208 workshops; the Center for Transportation and the Environment's (CTE) National Teleconference Series; the Local Technical Assistance Program, offering more than 54 workshops to local government employees; and training classes through the Public Transportation Group, GIS and Pupil Transportation Group. The Public Transportation Group conducts approximately 30 courses at ITRE and additional classes off-site. The Highway Systems and Safety group provides training on Maintenance Technical Assistance, Professional Enhancement and Fundamentals of Engineering Principles program. These programs have always had a good track record and operate close to capacity. Software has been purchased in hopes of providing more distance education opportunities in the future. Several groups are learning the software now to prepare classes for next year. Training areas are as follows:

- Professional Engineering (PE) Review Course (*NCDOT, 112 hrs, yearly*)
- Fundamentals of Engineering (FE) Review Course (*NCDOT, 140 hrs, yearly*)
- Highway Engineering Concepts (HEC) Course (*NCDOT, 112 hrs, twice per year*)
- Fundamental Engineering Principles (FEP) Program (*NCDOT, 10 courses, various lengths, two sessions per year at 6 locations across the state, 300+ participants per 12-week session*)
- Development of Distance Learning Products
  - FEP Program (**NCDOT technicians**)
    - Mathematics CD (self-paced learning product that reduced time in course from 36 hrs to 24 hrs)
    - Working on developing self-paced learning modules for Physics, Horizontal and Vertical Alignment, and Fluid Mechanics (this fiscal year), and Solid Statics and Strength of Materials (next fiscal year)
- Beginner, Intermediate, and Advanced Work Zone Safety Courses (**NCDOT and other state DOTs**)
- Flagger Training and Certification (**NCDOT and other state DOTs**)
- A Variety of Technical Training Courses (**NCDOT**)
  - Construction Stakeout; Plane Coordinate Utilization and Transformation; Roadway Drainage Maintenance; Guardrail Installation and Repair
- Highway Capacity Manual (HCM) Workshops (**NCDOT and others**)
- Traffic Analysis Software Workshops (Synchro, aaSidra, CORSIM, HCS, HiCAP)
- Traffic Signal Timing – Isolated Signals Workshop (**NCDOT and others**)
- Traffic Signal Timing – Coordinated Systems Workshop (**NCDOT and others**)
- Modern Roundabout Design Workshop (**NCDOT and others**)

The NC LTAP at ITRE center offers various training courses throughout the year on topics such as:

- Work zone traffic control
- Asphalt pavement maintenance
- Tort liability
- Geographic information systems
- Management and supervisory skills
- Communicating with decision-makers, citizens and the media

Transportation Leadership Development Program

ITRE partners with Team, Inc. to provide a 12-week training program on leadership (defining who you are and developing your leadership) for transportation professionals in the southeast.
**Statewide Planning: RPO Training Workshops**
Developed and conducted training for state and local staff on policies and procedures of Rural Transportation Planning Organizations.
Sponsor: NCDOT Statewide Planning Branch (T. Cook)

**Providing work zone safety training programs**
Sponsor: State Departments of Transportation - N.C., S.C., N.J. (T. Baughman)

**Training in Managing the Transportation Information Management Systems (TIMS)**
Sponsor: NC Department of Public Instruction (A. Michael)

**NCDOT ArcView GIS training**
A detailed training workshop for each NCDOT districts across the state
Sponsor: NCDOT (D. Grantham)

**GIS / GPS Training Services**
A comprehensive suite of training workshops for GIS and Global Position Systems (GPS)
Sponsor: Various national, state, local and municipal organizations (D. Grantham)

**Recent Papers and Presentations**

Presentations have been made at various conferences and at the January meeting of the Transportation Research Board (TRB).

Presented a study on relative risk of school travel at the National Pupil Transportation Annual conference and Trade Show on National Academies of Sciences, in Nashville, TN in November 2001 (J. Tsai)

Presented “Alternative-Fueled/Low Emissions Bus Purchases in North Carolina” at the TRB meeting in Washington, DC in January 2002 (T. Cook)

Presented on school location and campus related traffic congestion management at the North Carolina School Facility Planner Annual conference in Raleigh, NC in February 2002 (J. Tsai)

Presented “Low-Tech, No-Tech Scheduling and Dispatching Solutions” at the Community Transportation Association of America conference, in Salt Lake City, Utah in May, 2002 (K. Monast)

Presentation to the North Carolina Public Transportation Association conference on findings from “Regionalizing Public Transportation Services in North Carolina" in May 2002 (T. Cook)

Conducted workshops during the North Carolina Pupil Transportation Association Annual conference in Wilmington, NC in June, 2002 (A. Michael, M. Perez)

Presented to the North Carolina Pupil Transportation Annual conference on state guidelines and criteria for establishing school walk zones, in Wilmington, NC in June 2002 (J. Tsai)

Presented “Regionalizing Public Transportation Services” at the 15th National Rural Public and Intercity Bus conference" in Huron, Ohio in October 2002 (T. Cook)
ITRE staff will be involved in six paper presentations at the TRB meeting in Washington DC, in January 2003. These presentations include:

Capturing Lane Performance at Signalized Intersections Using Current HCM Methods and Software (03-3693)
Jae-Joon Lee, North Carolina State University
Nagui Rouphail, North Carolina State University
Robert S. Foyle, North Carolina State University

Comparison of Capacity Models for Two-Lane Roundabouts (03-4525)
Ola Hagring, Lund University, Sweden
Nagui Rouphail, North Carolina State University
Henning Axel Sorensen, Denmark Road Directorate

Effect of Arterial Signalization and Level of Service on Measured Vehicle Emissions (03-884)
Alper Unal, North Carolina State University
Nagui Rouphail, North Carolina State University
Christopher Frey, North Carolina State University

Measured Distributions of Control Delay on Signalized Arterial (03-2084)
James Colyar, Federal Highway Administration
Nagui Rouphail, North Carolina State University

Consolidation of Rural Single-County into Multi-county Regional Transit Systems (03-4041)
Thomas J Cook, North Carolina State University
Judson J. Lawrie, North Carolina State University
Andrew J. Henry, North Carolina State University

Analysis of North Carolina Guidelines and Criteria for Establishing School Walk Zones (03-2665)
Jeffrey C. Tsai, North Carolina State University
Andrew J. Henry, North Carolina State University
Tori Rhoulac, North Carolina State University

ITRE is a state agency administered by North Carolina State University at which we are free to propose and partner on any project. Being a state agency, ITRE is subject to the laws of North Carolina in any contractual agreements.