Foreword

Nagui M. Rouphail, PhD
ITRE Director

To ITRE staff, clients and friends,

It is amazing how quickly time has gone by since we completed our last annual activity report almost one year ago. In many ways, 2006 was a year of transition as well as constancy -- transition because several of our senior managers have (or will have) moved on to other opportunities in the private sector this year. These individuals include Janet D’ignazio (CTE), Leta Huntsinger (TRM), Carl Furney (VAMS), and Lisa Gullette (Communications). We are thankful to all of them for their significant contributions to ITRE over the years, and we wish them well in their new adventures. We hope their experience at ITRE and CTE has helped prepare them well for what’s ahead. CTE has also transitioned successfully this year into a full-fledged Tier-II University Transportation Center authorized by the USDOT for the next four years. While we are pleased CTE has been re-authorized, there are bound to be structural changes that will reflect the reduced level of federal funding associated with the Tier-II designation.

There has also been constancy in our performance as an Institute. We continue on an upward trajectory both in terms of annual expenditures, and national visibility and activities. Our overall annual expenditures have, for the first time in ITRE’s 28-year history, exceeded $10.5 million. Our in-house expenditures (excluding pass-through projects) are close to $8 million, a 38-percent increase from the previous year. We continue to be active on the national scene, through successful proposal funding from national sources, an increasing number of publications in refereed journals, and contributions to the profession through service on national panels and committees. Next January, our staff will be involved in 12 presentations at TRB, continuing the strong showing that began a couple of years ago.

Furthermore, we continue to fulfill our mission of training and educating the transportation workforce in the state of North Carolina and the nation, from flagmen to senior executives. Over the past two years, and excluding the CTE national broadcast series, which attracts thousands of participants nationwide, we saw more than 10,000 trainees go through ITRE’s various short courses and seminars.

Again, I would like to thank our staff from top to bottom for their dedication and professionalism in making ITRE what it is today. Without your persistent efforts and abilities, this outstanding level of performance would not have been achieved.

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Nagui M. Rouphail, PhD
ITRE Director

12/2006
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Annual Activity Report - 2006

Institute for Transportation Research and Education (ITRE)
North Carolina State University

This report summarizes ITRE’s activities for the year 2006. The report first provides background information on the Institute’s history, mission, goals and objectives. This is followed by an overview of the status of ITRE finances, personnel and technical activities conducted over the past year. Overall, despite the continuing decline in state support funds in the past few years, ITRE has been able to maintain and expand its programmatic activities.

Center Description
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 to address the nation’s critical transportation issues. ITRE is committed to leadership in the study of surface transportation issues through the fostering of analytical thinking, integrating technology in education and research, serving as a catalyst for problem solving, and cultivating professionals and students dedicated to excellence in transportation.

Currently, ITRE is organized into six program groups covering highway systems; visual analytics, modeling and simulation; North Carolina local technical assistance; public transportation; pupil (school) transportation; and the Center for Transportation and the Environment. An updated high-level organizational chart is shown in Exhibit I.

Summary of ITRE Goals:
ITRE’s strategic plan, developed in 2002, has set forth five major institute-wide goals:

1. Increase national visibility.
2. Conduct and disseminate research that impacts the transportation community.
3. Sustain and enhance educational opportunities to improve the knowledge and skills of transportation professionals.
4. Strengthen the relationship with, and gain recognition within the University System.
5. Provide superior technical assistance.

These goals are currently being achieved through various objectives, such as increasing national exposure through conference presentations, publishing research and outreach efforts, increased national project awards, continuing training efforts on a national, regional and state level, and promoting collaboration with the department of Civil Engineering faculty at North Carolina State University and the UNC System.

This report provides a glimpse of this year’s activities and accomplishments in reaching these goals and objectives. More information about ITRE’s programs and staff are available through ITRE’s Web site: www.itre.ncsu.edu
Dr. Nagui Routhail  
**Director**  

Robert Foyle  
**Associate Director and Director**  
Highway Systems  

Linda Lancaster  
**Director**  
Finance and Contracts  

Dr. E. Downey Brill  
**Director**  
Center for Transportation and the Environment  

James Martin  
**Director**  
North Carolina Local Technical Assistance  

Dr. Ronald Hughes  
**Director**  
Visual Analytics, Modeling and Simulation (VAMS)  

Debra Collins  
**Co-Directors**  
Thomas Cook  
Public Transportation  

Jeffrey Tsai  
**Director**  
Pupil Transportation  

*New name of group which includes previously named programs of Commercial Vehicles and Safety, GIS, Pavement Management, Municipal Technical Services and incorporates spatial data, visual simulation and modeling.*
Summary of ITRE's Finances
For the most recent Fiscal Year (05/06) for which complete figures are available, expenditures are broken down by the funding source, as shown in Exhibit II below.

Exhibit II - Expenditures by Source, FY 05/06

Overall, about 4% of all expenditures came from State Appropriated funds to ITRE related to administration, with additional operations support of 3% coming from Indirect Cost Return. These figures compare to 5 and 3% of all expenditures last year, respectively, indicating a continuing decline in flexible funds as a share of ITRE's overall operations.

State and Federal Contracts comprise 50% of all activity, with state expenditures (33%) limited to those projects with North Carolina State Government agencies.

Sales and Service activity (8%) derive mostly from registration fees for workshops.

Pass-Through projects to other departments at NCSU (26%) and other UNC universities (6%) are lower in volume from the previous year (38% combined). A listing of these projects is provided on page 17 of this document.

Other Contracts (3%) include project activity primarily for municipalities and also include funding from other states.
Exhibit III tracks ITRE’s annual expenditures over the past six years. Following the trends observed in the last two years, our expenditures continue to be on an upward trajectory. In fact, ITRE passed another set of milestones this year: in-house expenditures increased by 38% from the previous year; overall expenditures exceeded $10 M/year ($10.528M) for the first time in ITRE’s history.

Exhibit III - Tracked ITRE Expenditures in 6-year period
With state resources increasingly subject to freezes and reductions, it is important that state-supported institutes and centers demonstrate that they are providing a good return on the state investment. One way to measure the return on investment is by using the ratio of annual expenditures divided by the amount of state support. Currently, the UNC Office of the President desires a ratio of 4.0 or higher. ITRE's ratio over the last six years is graphed below.

**Exhibit IV** shows three lines. The top line represents the ratio of total annual expenditures divided by ITRE's state appropriation. Total expenditures include all pass-through research projects (internal to NCSU and external to other universities) and our portion of collected indirect costs distributed back to ITRE based on the previous year's expenditures. The middle line excludes all pass-through projects from annual expenditures when calculating the ratio, basically reflecting the value of in-house research activities. In both cases, the ratio is well above the indicated 4.0 minimum threshold (lower line) and in the past year exceeding 15:1 and 21:1 for in-house and all expenditures, respectively.
Exhibit V shows ITRE’s contribution to F & A (Facilities and Administration) dollars received by the University from ITRE grants and contracts. These contributions have exceeded $900,000 in the last fiscal year. F & A funds returned to ITRE amounted to about 30% of F&A generated.
Summary of Personnel Activities

In the year 2006, ITRE created 1 new position and hired a total of 6 personnel. ITRE had 40 staff members at the end of 2006. Exhibit VI outlines the personnel changes for 2006 by program group.

Exhibit VI - Personnel Activities in 2006

<table>
<thead>
<tr>
<th>Program Group</th>
<th>New positions</th>
<th>New hires</th>
<th>New Program Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Administration</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>CTE</td>
<td>1</td>
<td>4</td>
<td>None</td>
</tr>
<tr>
<td>Highway Systems</td>
<td>None</td>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>NC LTAP</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>VAMS*</td>
<td>None</td>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>Public Transportation</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Pupil Transportation</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1</strong></td>
<td><strong>6</strong></td>
<td><strong>None</strong></td>
</tr>
</tbody>
</table>

*Visual Analytics, Modeling and Simulation*
Summary of Technical Activities
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:
www.itre.ncsu.edu/ITREmain/research/index.html
www.itre.ncsu.edu/ITREmain/education/index.html

ITRE’s active research and education activities at the national, state and local levels are listed below for the calendar year 2006.

National Research and Development
Research efforts at ITRE are quite significant. There are 34 national-level projects listed below that were carried out by various program groups at the Institute.

- **2006 Eisenhower Graduate Fellowship**
  Sponsor: USDOT  *Prime sponsor*: FHWA (N. Routhail; Bastian Schroeder, fellow)

- **2006 LTAP Non-Program Workshops**
  Sponsor: Rutgers University  *Prime sponsor*: USDOT (T. Baughman)

- **AASHTO/ FHWA Context Sensitive Solutions**
  Sponsor: AASHTO (J. Martin)

- **Assessing Indirect and Cumulative Effects (ICE) of Transportation Projects in N.C.**
  Sponsor: Louis Berger Group  *Prime sponsor*: USDOT (J. Martin)

- **Blind Pedestrians’ Access to Complex Intersections**
  Sponsor: Western Michigan University  *Prime sponsor*: NIH (N. Rouphail)

- **Center for Transportation and the Environment Continuing Operations**
  Sponsor: NCDOT  *Prime sponsor*: USDOT (J. Martin)

- **CTE Tier II UTC**
  Sponsor: USDOT (J. Martin)

- **Context Sensitive Solutions Graduate Course**
  Sponsor: NCDOT  *Prime sponsor*: FHWA (J. Martin)

- **EPA Support of the 2005 ICOET**
  Sponsor: EPA (K. McDermott)

- **FHWA/ AASHTO CSS Strategic Planning Research**
  Sponsor: NCDOT  *Prime sponsor*: FHWA (L. Lane)

- **FHWA CSS Activities**
  Sponsor: NCDOT  *Prime sponsor*: FHWA (J. Martin)
FHWA Sponsorship of the 2005 International Conference on Ecology and Transportation (ICOET)
Sponsor: FHWA  Prime sponsor: USDOT (K. McDermott)

FHWA Sponsorship of the 2007 ICOET
Sponsor: FHWA  Prime sponsor: USDOT (K. McDermott)

FTA RTAP National Program Multi-Part Study and Analysis of Rural Transit Characteristics
Sponsor: RLS & Associates, Inc. (T. Cook)

FTA Teleconferences
Sponsor: Federal Transit Administration (J. Martin)

Local Technical Assistance Program (LTAP)
Sponsor: NCDOT  Prime sponsor: FHWA (J. Martin)

National Community Impact Assessment Course Delivery
Sponsor: NCDOT  Prime sponsor: FHWA (J. Martin)

NCHRP Project 3-70: Multimodal Arterial Level of Service

NCHRP Project 3-78: Crossing Solutions for Roundabouts and Turn Lanes for Pedestrians with Vision Disabilities
Sponsor: NCHRP (R. Hughes)

NCHRP Project 3-83: Low-Cost Improvements for Recurring Freeway Bottlenecks

NCHRP Project 8-36 Task 66: Improved Methods for Assessing Social, Cultural and Economic Effects of Transportation Projects
Sponsor: Cambridge Systematics  Prime sponsor: NCHRP (L. Lane)

NCHRP Project 25-30: Temporary Bridging to Avoid or Minimize Impacts to Waters and Wetlands During Highway Construction
Sponsor: Mulkey, Inc.  Prime sponsor: National Academies of Science (J. Martin)

Sponsor: NCHRP (L. Lane)

New Jersey Division of Highway Traffic Safety 2006 Program
Sponsor: Rutgers University  Prime sponsor: USDOT (T. Baughman)
Ohio Technical Assistance Program (OTEC), 2005; 2006  
Sponsor: RLS & Associates, Inc.  
Prime sponsor: Ohio Department of Transportation (T. Cook)

Planning Phase for the TDOT Statewide Environmental Management System (SEMS)  
Sponsor: Dye Management  
Prime sponsor: TDOT (J. D'Ignazio; J. Martin)

Regional Development, Population Trend and Technology Change Impacts on Future Air Pollution Emissions  
Sponsor: UNC-Chapel Hill  
Prime sponsor: Environmental Protection Agency (N. Rouphail)

Statewide Work Zone Safety Campaign for South Carolina Department of Transportation  
Sponsor: Fisher Communications Hill  
Prime sponsor: SCDOT (T. Baughman)

Task Order No. 1: Maintenance of the Ohio Transit Listserv  
Sponsor: RLS & Associates, Inc.  
Prime sponsor: Ohio Department of Transportation (T. Cook)

Testing the Feasibility of a Video-Image Processing System For Tracking Signalized Arterial Traffic  
Sponsor: University of Idaho (N. Rouphail)

USDA Forest Service Support of the 2005 International Conference on Ecology and Transportation  
Sponsor: USDA Forest Service (K. McDermott)

Washington State DOT Support of the 2005 ICOET  
Sponsor: Washington DOT (K. McDermott)

White Papers on Impacts of Global Climate Change on Hydraulics and Hydrology and Transportation  
Sponsor: University of South Alabama  
Prime sponsor: USDOT (J. Martin)

Work Zone Safety Training for South Carolina Department of Transportation  
Sponsor: Fisher Communications, Inc.  
Prime sponsor: SCDOT (T. Baughman)

Web site hosting and maintenance for 2 nationally recognized agencies:

National Association for State Directors of Pupil Transportation Services: www.nasdpts.org

National Congress on School Transportation: www.ncstonline.org
2006 National & International Committee and Panel Participation

Committees and Task Force Participation

TRB Committees
- Bicycle Transportation, ANF20 (M. Meletiou)
- Ecology and Transportation, ADC3OT (J. Martin)
- Environmental Analysis in Transportation, ADC10 (J. Martin)
- Environmental Justice in Transportation, ADD50 (L. Lane)
- “Friend of” Environmental Analysis in Transportation, ADC10 (D. Brill)
- Highway Capacity and Quality of Service, AHB40 (R. Foyle)
- Maintenance and Operations Personnel, AHD15 (J. Martin)
- Paratransit, AP060 (T. Cook)
- Social and Economic Factors in Transportation, ADD20 (L. Lane)
- Traffic Law Enforcement, ANB40 (C. Cunningham)
- Transportation Planning Applications, ADB50 (L. Huntsinger)
- Transportation Planning for Small and Medium Sized Communities, ADA30 (L. Huntsinger)
- Transportation Safety Management, ANB10 (J. Tsai)
- Work Zone Traffic Control, Secretary, AHB55 (T. Baughman)

TRB Subcommittees
- Community Impact Assessment, ADD10(1) (L. Lane)
- Community Impact Assessment, ADD10(1) (T. Townsend)
- School Transportation, ANB10(6) (J. Tsai)
- Signalized Intersections, AHB40(3.1) (N. Rouphail)

TRB Task Force
- Context Sensitive Design/Solutions, AFB50T (L. Lane)
- Roundabouts, Unpublished Number (B. Schroeder, R. Hughes)
- Visualization in Transportation, ABJ95T (R. Hughes)

TRB Panel Participation
- NCHRP Project 3-75, Analysis of Freeway Weaving Sections, (N. Rouphail)
- NCHRP Project 15-37, Revision of the AASHTO Guide for the Development of Bicycle Facilities (M. Meletiou)
- NCHRP Project 20-5, Synthesis of Highway Practice 36-04, “Visualization for Project Development” (R. Hughes)
- NCHRP Project 25-25, Quick Response Research for the Environment (J. D’Ignazio)
- NCHRP 3-78A, Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities (R. Hughes)
- TCRP Project A-28, Guidebook for Mitigating Fixed-Route Bus-and-Pedestrian Collisions (M. Meletiou)
- TCRP Project B-31, Benchmarking Productivity Performance of Demand Responsive Transit Services (T. Cook)
Other National-International Group Participation

- Coordinator, Modelers Group, Next Generation Simulation (NGSIM), FHWA (N. Rouphail)
- CUTC Review Committee of 2006 Pikarsky Award – Service and Technology (N. Rouphail)
- Edulog International Pupil Transportation Software Development Focus Group (M. Michael)
- Hybrid Electric School Bus Advisory Group (J. Tsai)
- I-95 Corridor Coalition Commercial Vehicle Operations (R. Hughes)
- National Committee on Uniform Traffic Control Devices (T. Baughman)
- NCUTD, Temporary Traffic Control Team Committee (T. Baughman)
- Scientific Committee for 7th Congress on Advances in Civil Engineering, Istanbul, Turkey (N. Rouphail)
- Scientific Review Board, Great Cities Initiative, UAB (N. Rouphail)
- UNC Coastal Studies Institute Board of Directors (the Board membership is drawn from national audience even though it is part of UNC) (J. D’Ignazio)
State of North Carolina and Local Research & Development

Statewide projects in North Carolina were conducted mostly in conjunction with the NC Department of Transportation (NCDOT) and with local municipalities. These ongoing activities include 35 different projects excluding pass-through projects to other universities.

**Benefit-Cost Analysis Software for Transportation Planning**
Sponsor: NCDOT (R. Foyle)

**Bicycle and Pedestrian Planning and Design Training for NCDOT**
Sponsor: NCDOT (T. Cook)

**Context Sensitive Solutions Training (2006-2007)**
Sponsor: NCDOT (J. Martin)

**Context Sensitive Solutions Training for Construction, Operations and Maintenance**
Sponsor: NCDOT (J. Martin)

**Context Sensitive Solutions Training for Planning and Pre-Construction Staff**
Sponsor: NCDOT (J. Martin)

**Economic Impact of North Carolina Airports**
Sponsor: NCDOT Division of Aviation (R. Foyle)

**Ecosystem Enhancement Program (EEP) Technical and Scientific Support**
Sponsor: NCDOT (J. Martin)

**Ecosystem Enhancement Program (EEP) 2005**
Sponsor: NCDENR (J. Martin)

**Effectiveness of Traveler Information Tools**
Sponsor: NCDOT (N. Rouphail)

**Hillsborough Street Roundabout Modeling and Simulation**
Sponsor: Kimley Horn and Associates *Prime sponsor: City of Raleigh (N. Rouphail)*

**I-95 Corridor Coalition Study: Feasibility Study for Wireless Inspections of Commercial Motor Vehicles (Phase I)**
Sponsor: NC Department of Crime Control & Public Safety (R. Hughes)

**Integrated Planning for School and Community***
Sponsors: 18 Individual School Systems in NC and SC (J. Tsai)
*These are 18 different projects conducted separately for each county/city school system – see list on page 33.

**Integrating Systems Planning and Project Development**
Sponsor: NCDOT (J. Martin)
Motor Carrier Size and Weight Technical Support to NCSHP  
Sponsor: NC Crime Control and Public Safety (R. Hughes)

North Carolina Department of Transportation Maintenance Technical Assistance Program (2005-2006)  
Sponsor: NCDOT (T. Baughman)

North Carolina Training and Technical Assistance Support for Child Transportation and Children with Special Needs  
Sponsor: NCDOT-GHSP (J. Tsai)

Sponsor: NCDOT (R. Hughes)

Performance Based Budgeting for NC Transit Systems  
Sponsor: NCDOT (T. Cook)

Phase II Technical Support for the NCDOT Division of Bicycle & Pedestrian Transportation  
Sponsor: NCDOT (T. Cook)

Sponsor: NCDOT (T. Brown)

Sponsor: NCDOT (D. Collins)

Sponsor: NCDOT (T. Cook)

Research Implementation, Technical Assistance and Outreach Support  
Sponsor: NCDOT (R. Foyle)

Research Support for Commercial Vehicle Enforcement FY 2005; 2006  
Sponsor: NC Dept. of Crime Control & Public Safety/NCSHP (R. Hughes)

Shortage of Long-Haul, Heavy-Duty Truck Drivers in North Carolina  
Sponsor: NC Trucking Association, Inc. (T. Cook)

Support for NCDOT Safe Routes to School Program  
Sponsor: NCDOT (T. Cook)

Sponsor: NCDOT (T. Falkie and T. Brown)

Technical Assistance to the State Board of Education in the Support of the Transportation Information Management System (TIMS) 2005-2006; 2006-2007  
Sponsor: NC Department of Public Instruction (J. Tsai)
Technical Support Services for the NCDOT Bicycle & Pedestrian Transportation
Sponsor: NCDOT (T. Cook)

Traffic Operational Impacts of Contemporary Multi-Pump Island Fuel Centers
Sponsor: NCDOT (R. Foyle; C. Cunningham)

Traffic Signal Inspection Course Development and Presentation
Sponsor: NCDOT (R. Foyle)

Triangle Regional Model Service Bureau at ITRE
Sponsor: NCDOT, TTA, Durham-Chapel Hill-Carrboro MPO, CAMPO (L. Huntsinger; R. Foyle)

URS Merger 01 Training
Sponsor: URS Corporation Prime sponsor: NCDOT (J. Martin)

Web site hosting and maintenance:
North Carolina Section of the Institute for Transportation Engineers (NCSITE): www.ncsite.org
Active Pass-Through Projects to Other Universities

Analysis and Testing of a Bridge Deck Reinforced with GFRP Rebars  
Sponsor: NCDOT (UNCC, Gergely)

Development of an Earth Pressure Model for Design of Retaining Structures in Piedmont Soils  
Sponsor: NCDOT (UNCC, Anderson)

Ecological Assessment of a Wetlands Mitigation Bank – Phase III, Assessment of Restoration  
Sponsor: NCDOT (UNC-Asheville, Moorhead)

Economic Impact of Traffic Incidents on North Carolina’s Interstate Facilities  
Sponsor: NCDOT (UNC-CH, Khattak)

Evaluation and Implementation of BMPs for NCDOT’s Highway and Industrial Facilities  
Sponsor: NCDOT (UNCC, Wu)

Evaluation of Design and Construction of HPC Deck Girder Bridge in Stanley County, North Carolina  
Sponsor: NCDOT (UNCC, Gergely)

Evaluation of Nutrient Loading Rates and Effectiveness of Roadside Vegetative Connectivity for Managing Runoff from Secondary Roadways  
Sponsor: NCDOT (UNCC, Wu & Allen)

Evaluation of Manufactured Stormwater Best Management Practices  
Sponsor: NCDOT (UNCC, Wu & Allan)

Material Property and Quality Control Specifications For Elastomeric Concrete Used at Bridge Deck Joints  
Sponsor: NCDOT (UNCC, Ogunro)

Monitoring, Prioritizing, and Assessment of Ocean Outfalls of Stormwater in Dare Co., North Carolina  
Sponsor: NCDOT (UNC-CH, Noble)

North Carolina Vehicle Crash Analysis-Profiles Involving Fatal and “A” Injuries (200-2004) and STAA Dimensioned Vehicles off the National Network (2001-2005)  
Sponsor: NCDOT (UNC-CH, Pulugurtha)

Relationship Between Pavement Macrotexture and Crash Incidence for NHS Routes  
Sponsor: NCDOT (UNCC, Kane)

Signal Replacement with an Interchange  
Sponsor: NCDOT (UNCC, Kane)

Subgrade Stabilization to Lime and Cement  
Sponsor: NCDOT (UNCC, Janardhanam)

Transportation and Cost Impacts of School Locations and School Travel  
Sponsor: NCDOT (UNCC, Kane)
TRB Presentations

12 presentations will be made at the January 2007 meeting of the Transportation Research Board (TRB). Many of the papers will also be considered for publication in an upcoming Transportation Research Record.

A Framework for Evaluating Pedestrian-Vehicle Interactions at Unsignalized Crossing Facilities in a Microscopic Modeling Environment (07-1023)
TRB, Washington, DC, 2007
Bastian J. Schroeder, ITRE, North Carolina State University
Nagui M. Rouphail, ITRE, North Carolina State University

Context-Sensitive Solutions, Value Engineering, and Asset Management: Creating and Maintaining Value, Improving Accountability, and Reaching for Sustainability (07-2698)
Marie Venner, Venner Consulting, Inc.
Sergio J. Ostrica, ICF Consulting
Jeffrey Ang-Olson, ICF Consulting
Janet Letts D'Ignazio, North Carolina State University

Current Department of Transportation Environmental Management System Development Efforts: Examples from Construction, Maintenance, Project Development, and Planning (07-2549)
Marie Venner, Venner Consulting, Inc.
Michael DeWit, ICF International
Rodney Todd Conciennie, Texas Department of Transportation
Sonal Sanghavi, Maryland State Highway Administration
Julie Hunkins, North Carolina Department of Transportation
Janet Letts D'Ignazio, North Carolina State University
Will Gibson, ICF International

Development of Delay Adjustment Factors for Intersections with Low Lane Utilization (07-2592)
TRB, Washington, DC, 2007
Jae-Joon Lee, The Korea Transport Institute
Nagui M. Rouphail, ITRE, North Carolina State University
Joseph E. Hummer, North Carolina State University

Exploratory Analysis of Pedestrian Signalization Treatments at One- and Two-Lane Roundabouts Using VISSIM Microsimulation (07-2655)
TRB, Washington, DC, 2007
Bastian J. Schroeder, ITRE, North Carolina State University
Nagui M. Rouphail, ITRE, North Carolina State University
Ron Hughes, ITRE, North Carolina State University

Integrating Context Sensitive Solutions in Day to Day Activities: Information from a Post Training Survey (07-1541)
TRB, Washington, DC, 2007
Leigh Lane, North Carolina State University
Brian Byfield, North Carolina State University
Ann Hartell, ITRE, North Carolina State University
Integrating CSS Into Management, Planning, and Design (07-2653)
TRB, Washington, DC, 2007
Marie Venner, Venner Consulting, Inc.
Janet Letts D'Ignazio, North Carolina State University
Wendy L Messenger, ICF International

Investigation of University Students’ Activity Patterns (07-2862)
TRB, Washington, DC, 2007
JinKi Eom, North Carolina State University
John Stone, North Carolina State University
Sujit Ghosh, North Carolina State University

Manual Traffic Allocation for Small Town Networks (07-1808)
TRB, Washington, DC, 2007
Han, Yang, North Carolina State University
John Stone, North Carolina State University
Leta F. Huntsinger, ITRE, North Carolina State University

Methodological Challenges of Environmental Justice Assessments for Transportation Projects (07-0186)
TRB, Washington, DC, 2007
Ann Hartell, ITRE, North Carolina State University

Modeling and Comparison of Real-World Fuel Consumption for Diesel- and Hydrogen-Fueled Transit Buses (07-1201)
TRB, Washington, DC, 2007
H. Christopher Frey, North Carolina State University
Nagui M. Rouphail, ITRE, North Carolina State University
Haibo Zhai, North Carolina State University
Tiago Farias, Technical University of Lisbon
G. Goncalves, Technical University of Lisbon

Simulation and Analysis of Freeway Lane Reversal for Coastal Hurricane Evacuation (07-3103)
TRB, Washington, DC, 2007
Billy M. Williams, North Carolina State University
Nagui M. Rouphail, ITRE, North Carolina State University
Anthony P. Taglieferri, North Carolina State University
Stephen S. Meinhold, University of North Carolina at Wilmington
Joseph E. Hummer, North Carolina State University
Published Refereed Journal Papers *


Hughes, Ronald, (2005), “Research Agenda for the Application of Visualization to Transportation Systems”, Transportation Research Record: Journal of the Transportation Research Board, #1937, 145-151, Transportation Research Board of the National Academies, Washington, DC

Hummer, Joseph E, N. Rouphail, R. Hughes, S. Fain, J. Toole, R. Patten, R. Schneider, J. Monahan and A. Do, (2005), “User Perceptions of the Quality of Service on Shared Paths”, Transportation Research Record: Journal of the Transportation Research Board, #1939, 28-36, Transportation Research Board of the National Academies, Washington, DC


* Appeared in 2006.
Tsai, Jeff and M. Miller, (2005), “Integrated Planning for School and Community”, Transportation Research Record: Journal of the Transportation Research Board, #1922, 111-117, Transportation Research Board of the National Academies, Washington, DC


Other Publications


McDermott, K.P. et al, editors. (2006), Results of the FHWA Domestic Scan of Successful Wetland Mitigation Programs, Federal Highway Administration, Washington, DC


Conference Attendance, Participation and Exhibits in 2006

Center for Transportation and Environment
- EDUCAUSE 2006, Dallas, TX, October 2006 (E. Murray, attended)
- National CIA Conference, Denver, CO, July/August 2006 (L. Lane, T. Townsend, participated)
- Council of University Transportation Centers, Blue Sky, MT, June 2006 (D. Brill, attended)
- 9th Annual Mitigation and Conservation Banking Conference, Portland, OR, April 2006 (D. Robinson, attended)

Highways
- NCSITE Annual Meeting, Raleigh, NC, November 2006 (C. Cunningham, B. Schroeder, attended)
- NCSITE Mid-Year Meeting, Wilmington, NC, June 2006 (B. Schroeder, participated)
- New Jersey Work Zone Safety Conference, Princeton, NJ, April 2006 (T. Baughman, participated)
- Annual North Carolina Airports Association Conference, Sunset Beach, NC, April 2006 (R. Foyle, participated)
- NCSITE Student-Led Meeting, Raleigh, NC, March 2006 (R. Foyle, D. Findley, attended; B. Schroeder, participated)
- NCUTCD Conference, Washington, DC, January 2006 (T. Baughman, participated)
- Transportation Research Board Annual Meeting, Washington, DC, January 2006 (R. Foyle, S. Fain, C. Cunningham, D. Findley, B. Schroeder, participated; T. Baughman, attended)

ITRE
- 7th International Congress on Advances in Civil Engineering, Istanbul, Turkey, October 2006 (N. Rouphail, participated)
- Southeastern Conference on College Cost Accounting, Atlanta, GA, October, 2006 (L. Lancaster, attended)
- Nordic Seminar on Level of Service, Copenhagen, Denmark, September 2006 (N. Rouphail, participated)
- 5th International Symposium on Highway Capacity and Quality of Service, Yokohama, Japan, July 2006 (N. Rouphail, participated)
- NCSU Research Administration Retreat, Wrightsville Beach, NC, February 2006 (L. Lancaster, C. Lull, attended)
- Transportation Research Board Annual Meeting, Washington, DC, January 2006 (N. Rouphail, participated)

NC Local Technical Assistance Program
- NCAPWA Streets Maintenance Meeting, Greenville, NC, October 2006 (L. Collier, R. Williams, participated; K. Trapp, J. Oklevitch, attended)
- National APWA Congress, Kansas City, MO, September 2006 (J. Martin, attended)
- Second International Symposium on Transportation Technology Transfer, St. Petersburg, FL, August 2006 (L. Collier, attended)
- NC APWA Annual Meeting, Asheville, NC, June 2006 (L. Collier, attended; R. Williams, participated)
- LTAP Region 4 Meeting, Greenville, SC, May 2006 (L. Collier, J. Martin, participated)
- Southeastern Local Roads Conference, Chattanooga, TN, May 2006 (J. Martin, participated)
Public Transportation Group
- APTA Webinar, “Strategic Long-Range Planning”, June 2006 (J. Lawrie, participated)
- National Transit Institute T-Class “Strategic Planning and Management in Transit Agencies: TCRP Synthesis #59”, Raleigh, NC, March 2006 (J. Lawrie, participated)
- Transportation Research Board Annual Meeting, Washington, DC, January 2006 (T. Cook, participated)

Pupil Transportation Group
- NC Prepared Conference, Raleigh, NC, September 2006 (J. Tsai, attended)
- Annual Southeastern States Pupil Transportation Conference, Hampton, VA, July 2006 (J. Tsai, participated)
- North Carolina Pupil Transportation Conference, Sunset Beach, NC, June 2006 (M. Michael, B. Cash, participated)
- 1st School Transportation Leaders Conference, Las Vegas, NV, April 2006 (M. Michael, participated)
- 11th Annual Edulog Conference, Las Vegas, NV, April 2006 (M. Michael, participated; M. Perez, attended)
- 2006 Symposium, Greensboro, NC, March 2006 (B. Cash, M. Michael, M. Perez, participated; J. Tsai attended)
- North Carolina Association of School Business Officials, Greensboro, NC, February, 2006 (J. Tsai, participated)
- Transportation Research Board Annual Meeting, Washington, DC, January 2006 (J. Tsai, participated)

Triangle Regional Model Service Bureau
- TRB Transportation Planning for Small and Medium Communities, Nashville, TN, September 2006 (L. Huntsinger, participated)
- North Carolina Statewide Model Users Group Bi-annual Meeting, Charlotte, NC, September 2006 (L. Huntsinger, participated; N. Bhave, attended)
- WTS Seminar “Are we the Next Atlanta? Transportation and the Environment in the Triangle”, Raleigh, NC, April 2006 (L. Huntsinger, E. Runey, participated)
- North Carolina Statewide Model Users Group Bi-annual Meeting, Raleigh, NC, April 2006 (L. Huntsinger, B. Mei, E. Runey, participated; M. Ingram, attended)
- Memphis, Tennessee Model Peer Review, Memphis, TN, March 2006 (L. Huntsinger, participated)
- Transportation Research Board Annual Meeting, Washington, DC, January 2006 (L. Huntsinger, B. Mei, E. Runey, participated)

Visual Analytics, Simulation and Modeling
- International Visualization in Transportation Symposium and Workshop, Denver, CO, October 2006 (R. Hughes, participated)
- NCSHP Motor Carrier Enforcement Strategic Planning, Wilmington, NC, September 2006 (R. Hughes, participated)
- I-95 Corridor Coalition, Commercial Vehicle Track, Greensboro, NC, September 2006 (R. Hughes, participated)
- Commercial Vehicle Safety Alliance Fall Conference, Toronto, ON, Canada, September 2006 (R. Hughes, participated)
• Institute of Transportation Engineers Annual Meeting, Milwaukee, WI, August 2006 (R. Hughes, participated)
• ESRI User Conference, San Diego, CA, August 2006 (J. Scott, attended)
• NCSHP Strategic Planning Retreat, Boone, NC, June 2006 (R. Hughes, participated)
• American Association of Motor Vehicle Administrators, Regional Meeting, Williamsburg, VA June 2006 (R. Hughes, participated)
• Commercial Vehicle Safety Alliance Spring Conference, Hartford, CT, April 2006 (R. Hughes, participated)
• Transportation Research Board Annual Meeting, Washington, DC, January 2006 (R. Hughes, participated)
Summary of Education/ Training and Outreach

ITRE's combined training activities reached more than 18,000 individuals in 2006. Some of the education opportunities included Work Zone Safety, offering 267 workshops; the Center for Transportation and the Environment's (CTE) National Teleconference Series and Context Sensitive Solutions Design classes; the Local Technical Assistance Program, offering the popular Road Scholar and Advanced Road Scholar Program courses to local government employees; and training classes through the Public Transportation Group, Pupil Transportation Group, and Visual Analytics, Modeling and Simulation (VAMS) Program. The Public Transportation Group and Highway Systems Group conduct courses at ITRE as well as off-site. The Highway Systems 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. The Transportation Founders Fund offered two well-attended seminars by nationally recognized speakers in 2006. Training areas are depicted in Exhibit VII.

Exhibit VII - Summary of Training Activities in 2006

<table>
<thead>
<tr>
<th>Program Area</th>
<th>Training/ Workshops in 2006</th>
<th>Instruction Hours per Session</th>
<th>Sessions Offered</th>
<th>Total Hours</th>
<th>Attendees</th>
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<td>Sessions Offered</td>
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<td>1139</td>
<td>820</td>
<td>5918</td>
<td>18354</td>
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</table>
Student Support
ITRE projects continue to involve and support a large number of students from various disciplines and universities. The table below summarizes our track record on student support, indicating continued graduate student participation in ITRE’s research.

<table>
<thead>
<tr>
<th>Year</th>
<th>Undergraduate</th>
<th>Graduate</th>
<th>Total</th>
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</thead>
<tbody>
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<td>1997-98</td>
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<td>7</td>
<td>13</td>
</tr>
<tr>
<td>1998-99</td>
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<td>2</td>
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<tr>
<td>1999-00</td>
<td>10</td>
<td>4</td>
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<tr>
<td>2000-01</td>
<td>21</td>
<td>10</td>
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<tr>
<td>2001-02</td>
<td>14</td>
<td>9</td>
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<td>2002-03</td>
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<tr>
<td>2003-04</td>
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<td>19</td>
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<td>2004-05</td>
<td>11</td>
<td>23</td>
<td>34</td>
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<td>2005-06</td>
<td>15</td>
<td>17</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>106</td>
<td>209</td>
</tr>
</tbody>
</table>

2006 Undergraduate
Hunter Brown
Richard Cranfill
Alissa Gill
Therese Guiadem
Susanna Immonen
Kati Koponen
Dylan Liverman

2006 Graduate
Zachary Clark
JinKi Eom*
Daniel Findley
Nicholas Georgiade
Yang Han*
Ann Hartell
Heijung Hu*
Mi Jin

* PhD Students

In 2006, students have come from the following degree programs:
Aerospace Engineering
Civil Engineering
Computer Engineering
Economics
Mechanical Engineering
Social Work
Technology Education Graphic Communications
Turf Grass Science
Urban and Regional Planning

Post-Doctoral Fellows and Visiting Scholars
ITRE and CTE have made a conscious effort to recruit, engage and support post-doctoral fellows in its research activities. For example, in 2006 CTE provided partial support for Dr. Xuesong Zhou (PhD, University of Maryland) on USDOT funded research. ITRE also provided full-time support for Dr. Kosok Chae, a recent NC State Graduate who is currently working on projects funded by the National Institutes of Health (NIH) and the National Institute for Advanced Transportation Technology (NIATT). CTE is also supporting Dr. Emily Zechman, a recent PhD from the CCEE Department at NC State, in a post-doctoral position.

During 2006, ITRE hosted two visiting scholars: Dr. Margarida Coelho from the University of Aveiro in Portugal (January 2006), and Dr. Zaher Kathib from the University of Sharjah in the UAE (August 2006). Both visits extended for a period of two weeks.
Marketing/Public Relations Outreach in 2006
Press releases/advisories/stories communicated to media:

- Total news releases sent including 3 media advisories: 49
- Press releases concerning research studies or activities at ITRE have resulted in a variety of media interest including top television news broadcasts, newspapers, online news periodicals, radio programs, Web sites, transportation magazines, and eNewsletters and Web logs.
- At least 61 news stories or articles were published citing ITRE, ITRE research, or an ITRE program/staff member. Not all reports correctly reported the facts, but ITRE was cited. More articles are likely to have been published citing ITRE that were not found or tracked.
- At least 22 news stories resulted directly from press releases sent from our office or information from our Web sites.

In 2006, ITRE was cited in the following 35 media outlets and publications:

- Asheboro Courier-Tribune
- Better Roads Magazine
- Brunswick Beacon
- Bulletin Online
- Cable Community Access Channel
- Charlotte Observer
- Clayton News-Star
- Durham Herald-Sun
- Federal Highways Administration Newsletter
- Greensboro News-Record
- News Record Blog
- NCSU Alumni Magazine
- NCSU Civil Engineering News
- Public Roads Magazine
- Outer Banks Sentinel
- School Transportation News
- Smart Growth America Newsletter
- Technician
- TEMA Web site
- Time Warner Cable Channel 11
- The Apex Herald
- The Courier-Tribune
- The Daily Tarheel
- The News & Observer
- The News & Observer Blog
- The Pilot (Pinehurst area)
- The Robesonian
- The Sun Journal
- Triangle Business Journal
- TRB Online News Board
- TR News (Nat’l)
- Urban Transportation Monitor
- Winston-Salem Journal
- (JournalNow.com)
- WRAL-TV
Appendix - Summary of Program Groups

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. The federal transportation bill, signed into law by President George W. Bush in 2005, includes funding for CTE. The new bill, which finances the nation’s surface transportation programs, names CTE as a Tier II University Transportation Center.

Highway Systems Group

The Highway Systems Group developed 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: Highway Safety, Transportation Policy, Traffic Operations, Work Zone Safety, Maintenance Operations, Professional Development Training, and Professional Engineering Review.

- Triangle Regional Model Service Bureau

The purpose of the Triangle Regional Model Service Bureau is to provide transportation modeling expertise to the Capital Area Metropolitan Planning Organization, the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization, the Triangle Transit Authority, and NCDOT to support each agency’s needs in meeting the requirements in Section 134, Title 23, U.S. Code, NC General Statutes 136-66, and the 1990 Clean Air Act. This work includes, but is not limited to: (1) design and development of multimodal travel demand models; and (2) integration of GIS technologies into supply side forecasting, demand side forecasting, and transportation plan development.

Visual Analytics, Modeling and Simulation Group

The Visual Analytics, Modeling and Simulation (VAMS) Group is a new name of a group which includes previously named programs of Commercial Vehicles and Safety, GIS, Pavement Management, Municipal Technical Services and incorporates spatial data, visual simulation and modeling. It is the parent ITRE group for programs specializing in Spatial Data: Research, Training, and Technical Assistance, Commercial Vehicles Enforcement, Safety, and Security and Visual Simulation and Modeling. This program provides specialized expertise in the areas of 3D/4D visualization as well as research on the performance needs of visually impaired pedestrians.

- Spatial Data Program

The Spatial Data, Research, Training, and Technical Support Program represents the area formerly under ITRE's Municipal Technical Services Program. It provides Geographic Information Systems (GIS) technical support to other ITRE projects in addition to outside customers. It is also a source of ESRI-certified GIS training. This program has been given broader program responsibilities in terms of expectations for the development of a more research-oriented program group.
• **Commercial Vehicle Enforcement, Safety, and Security Program**

The Commercial Vehicle Enforcement, Safety, and Security Program provides data analysis and program evaluation support to the Motor Carrier Safety Assistance Program (MCSAP) of the NC State Highway Patrol (NCSHP). Staff in this area are involved in collaborative research and development efforts with government, industry, and domain specific organizations.

• **Visual Simulation and Modeling Program**

The Visual Simulation and Modeling Program represents a new and emerging thrust for ITRE, made possible largely through the addition of Dr. Hughes to the staff. Its present work is primarily through the TRB Visualization Task Force, modeling and simulation work being conducted on the NIH grant and NCHRP 3-78 project, and on efforts to establish an NCSU Visualization Center of Excellence in Transportation.

**NC Local Technical Assistance Program**

The Federal Highway Administration established the North Carolina Local Technical Assistance Program (LTAP) 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, and Quarterly Newsletters.

**Public Transportation Group**

The Public Transportation Group is responsible for research, training, and technical assistance in the area of public transportation. Activities focus on the following transportation modes: urban fixed-route and paratransit, rural demand-responsive transit, bicycle and pedestrian, trucking, taxicab and livery, and passenger rail. This group pursues practical applications that can have immediate benefits to increasing efficiencies in transit operations and positively impact service and transportation choices for the passenger.

• **Bicycle and Pedestrian Program**

The Bicycle and Pedestrian Program has the distinction of long-standing working partnerships with NCDOT’s Division of Bicycle and Pedestrian Transportation, one of the oldest comprehensive bike programs in the country. This partnership works closely together on research and technical assistance projects.

**Pupil Transportation Group**

The mission of the Pupil Transportation Group is to apply transportation engineering principles and technology to the operation and management of multi-modal school transportation 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.

• **OR/Ed. Lab Program**

The Operations Research/Education Laboratory (OR/Ed. lab) has developed a system of Integrated Planning for School and Community (IPSAC), which fully integrates community and regional data, 10-year economic and demographic forecasts, demographic and land use studies, digitized pupil and school location files, and mathematical optimization algorithms. The lab uses the modern tools of
management science helping educators and public administrators to make decisions wisely, to evaluate policy alternatives thoroughly, and to allocate resources efficiently.

2006 sponsors for IPSAC research include the following school 18 systems: Asheboro City, Burlington City-Alamance County, Chapel Hill/Carrboro, Chatham County, Craven County, Elizabeth City-Pasquotank County, Granville County, Harnett County, Johnston County, Nash-Rocky Mount, Onslow County, Randolph County, Rock Hill, Pitt County, Stokes County, Union County, and Wake County, NC; Rock Hill South Carolina School District #3, SC; Tupelo Public Schools, MS.

- **Transportation Information Management Systems Program (TIMS)**

  The TIMS Program provides support and consulting for the Computer Assisted Routing Program used in every secondary school system in North Carolina. The Transportation Information Management System is a joint project activity among the North Carolina Department of Public Instruction, Institute for Transportation Research and Education, and the Urban Institute at UNCC.