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Appendix I: Summary of Program Groups ............................................................................................... 28-30
Message from the Director

To friends and clients of ITRE, I am pleased to submit our 2011 Annual Activity Report. We have strived to make this report both informative and pleasant to read. We hope to have achieved both objectives in this year’s edition. I am happy to report that ITRE continues on a path of growth and recognition both nationally and internationally. We also continue to experience the effects of the economic slowdown, resulting in a reduction in funding levels, an area which continues to be a challenge.

Financially ITRE is on a good footing. We have maintained the integrity of our operating staff, been able to keep up with technology for our research and education needs, and are developing a national presence in the competitive research arena. Our in-house expenditures dropped slightly by 2.75% this year. In addition, ITRE is no longer passing through NCDOT research dollars to NC State University and other state universities, thus artificially decreasing our overall expenditures by a significant $1.5M. Starting next year, we will only report trends for in-house expenditures. On the positive side of the ledger, we have increased our expenditure share of federal dollars from 9% to 12% this year. And despite the slight drop in expenditures, the overhead dollars generated by our projects increased by nearly 10%.

This report is replete with statistics and graphics, and I will refrain from summarizing them in this limited space. However, I want to highlight a few key initiatives we continue to aggressively pursue as an Institute.

- **International outreach to sister universities**, resulting in the formulation and signing of Memoranda of Understanding (MOU) this year between NC State and IIT-Delhi in India, and Stellenbosch University in South Africa, with ITRE representing NC State.

- **Leading major national proposals**; our Center for Transportation and the Environment (CTE) is leading a Tier-1 Consortium proposal for the US DOT (currently under review); ITRE has also partnered with the Civil Engineering Department on a pre-proposal to the National Science Foundation in the area of Sustainable Transportation under the NSF Partnership for International Research and Education (PiRE), also under review.

- **Integrating graduate students within the ITRE environment**. This year we have had the largest number of supported graduate students in ITRE’s history, helping us to fulfill one of our key goals of capacity building in the transportation area in the University.

- **Improving our visibility at the TRB Annual meeting**. Our efforts are clearly paying off. In January 2012, we will have over 30 scheduled events and presentations that involve our staff, students and affiliated faculty.

In conclusion, I trust the reader will concur that ITRE is on a positive path towards growth and quality. It also goes without saying that this success could not be possible without an administrative staff that is second to none, and an incredibly motivated technical staff that always strives to do better than the year before!

Nagui Rouphail, Director

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One reason for our success this past year is our increasing win-rate of federally and other out-of-state funded projects...
This report summarizes ITRE’s activities for the year 2011 and provides background information on the Institute’s history, mission, goals, and objectives. It also provides an overview of ITRE’s finances, personnel, and technical activities during the year. As in years past, the Institute has maintained and in some instances expanded 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 surface and most recently air 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 transportation issues through fostering 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 1) Highway Systems; 2) Visual Analytics, Modeling and Simulation (VAMS); 3) North Carolina Local Technical Assistance Program (NC LTAP); 4) Public Transportation; 5) Pupil (school) Transportation; and 6) the Center for Transportation and the Environment (CTE). A high-level organizational chart is shown in Exhibit I. Our programs are guided and monitored by an Advisory Council whose membership has recently been increased. The current ITRE Advisory Council membership is shown in Exhibit II.

Summary of ITRE Goals

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

- Increase national visibility
- Conduct and disseminate research that impacts the transportation community
- Sustain and enhance educational opportunities to improve the knowledge and skills of transportation professionals
- Strengthen the relationship with, and gain recognition within, the University system
- Provide superior technical assistance

These goals are currently being achieved through various objectives, such as increasing national exposure through conference presentations, publishing research, outreach efforts, and increased national project awards. Additionally, the Institute continues its training efforts on a national, regional, and state level, while promoting collaboration with faculty in the department of Civil, Construction, and Environmental Engineering at North Carolina State University and at other UNC system institutions.

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 Website: http://www.itre.ncsu.edu.
Exhibit III data shows the most recent Fiscal Year, July 1, 2010 through June 30, 2011, for which complete financial information is available. Expenditures are broken down by the funding source.

Overall, about 7% of all FY 10/11 ITRE expenditures represent State Appropriated Funds related to administration, with additional operations support of 4% coming from Indirect Cost Return. Both have slightly increased from FY 09/10.

State of North Carolina and Federal Contracts total 65% of all activity. Those figures have increased 13% compared to 52% for the FY 09/10.

Sales and Service activity at 10% has increased with more attendees and from registration fees for workshops.

Pass-through projects to other departments at NCSU (1%) and other UNC universities (2%) have significantly decreased in volume from the previous year (20%). NCDOT now has separate master agreements with all NC universities.

Other Contracts (11%) which includes project activity primarily for municipalities, and may include funding from other states, has not changed from the previous fiscal year.

Exhibit IV shows how ITRE’s FY 10/11 expenditures are allocated by program area. As has been the case in the past few years, the Highway Systems program continues to be our largest generator of expenditures, accounting for nearly 33% of all ITRE expenditures.

This is followed by the CTE (at 14%) and Public Transportation (at 13%) groups. Other groups and administration contribute at various rates that are below 12%.

The “Institute” expenditures include state appropriations, facilities and administrative receipts, professional development and other accounts managed by the Institute as a whole.
Exhibit V shows the distribution of expenditure sources by program area. This chart serves to highlight where each group primarily expends its funds. We have categorized those funds as State, Federal, Other, and Other Federal. The category of “Other-Federal” is comprised of projects where ITRE is a subcontractor to a private company who is the prime on a federally funded project.

The “Other” category includes expenditures from contracts we have with other states, not-for-profit organizations, the private sector and from course registrations. This exhibit highlights the fact that ITRE is still predominantly funded from NC state and local funds, although there are some significant variations across program areas.

Exhibit VI tracks ITRE’s annual expenditures over the past five years. The total expenditures include all pass-through projects to entities outside ITRE.

ITRE’s total expenditures have decreased in FY 10/11 compared to the previous cycle. This is primarily due to a reduction of close to $1,500,000 experienced in pass-through funding to other NCSU departments and UNC universities as a result of the changes in contracting policies with NCDOT. In a review of strictly ITRE-staffed projects, the decrease is only 2.77%, also attributed to a reduction in pass-through expenditures incurred at ITRE.
Exhibit VII summarizes ITRE’s productivity trends over the past five years. 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 continues to be well above the indicated 4.0 minimum threshold cited in the UNC Office of the President Report (lower line).

Even in these difficult economic circumstances, ITRE is demonstrating itself to be a valuable and cost-effective asset to the state of North Carolina with a productivity ratio of over 13:1.

Exhibit VII shows that ITRE continues to generate Facilities and Administrative (F&A) funds for its operations, as well as for NCSU.

In the last fiscal year we generated nearly $900,000 of F&A dollars from our local, state, and federal projects, an 11% increase over the previous FY. Even though overall expenditures were slightly lower, ITRE generated increased F&A through projects bearing higher F&A return. For example our full-overhead federal contracts account for 12% of expenditures this year, compared to 9% last year.

In the past, between 33-35% of the F&A funds were returned to help operate the Institute and provide incentives for improving our national visibility, but now only 27% is being returned due to a new allocation formula.
Summary of Project Activities

The following list summarizes ITRE’s research and education projects at the national, state, and local levels for FY 10/11. Class descriptions and online registration information is available on the ITRE website.

Federal and International Research and Development

National research efforts at ITRE continue to be quite significant in terms of numbers and funding levels.

Sponsor: Kittleson & Associates, Inc. and FHWA (N. Rouphail)

Sponsor: Western Michigan University and NIH (N. Rouphail)

Center for Transportation and the Environment Tier II UTC, 2005-2011
Sponsor: US Department of Transportation (J. Martin)

Sponsor: National Science Foundation (N. Rouphail/C. Frey)

Eisenhower Graduate Fellowship for Zachary Bugg, 2011-2012
Sponsor: Federal Highway Administration (N. Rouphail)

Establishing Monitoring Programs for Travel Time Reliability, 2009-2012
Sponsor: National Academy of Science, SHRP-2, L02 (N. Rouphail/G. List/B. Williams)

FHWA Co-Sponsorship of the 2011 International Conference on Ecology and Transportation (ICOET)
Sponsor: Federal Highway Administration (J. Martin)

FHWA Air Quality Resource Center Sponsorship of TRB Conference, 2011
Sponsor: Federal Highway Administration (J. Martin)

Field Evaluation of Double Crossover Diamond Interchanges, 2010-2014
Sponsor: US Department of Transportation, FHWA (J. Hummer/B. Schroeder/C. Cunningham/D. Findley)

Framework for Mobile Source Emission Inventories, 2010-2013
Sponsor: US Environmental Protection Agency (N. Rouphail/C. Frey)

Sponsor: US Department of Agriculture, Forest Service (J. Martin/E. Murray)

Incorporation of Travel Time Reliability into the Highway Capacity Manual, 2011-2012
Sponsor: Kittleson & Associates, Inc. and SHRP-2 L08 (N. Rouphail/B. Schroeder)

NCHRP 20-63B, Performance Measurement Tool Box and Reporting System for Research Programs and Projects
Sponsor: ICF International/NAS (R. Foyle)

NCHRP 25-25 Task 69 Defining Community Context in Transportation Project Planning and Development Process
Sponsor: Louis Berger Group, Inc./NAS (L. Lane)

NCHRP 25-36 Impacts of Land Use Strategies on Travel Behavior
Sponsor: University of North Carolina - Chapel Hill (J. Huegy)

NCHRP 3-96 Analysis of Managed Lanes for Freeway Facilities, 2009-2011
Sponsor: University of Washington and NCHRP 3-98 (N. Rouphail)

NCHRP 3-98 Guidelines on the Use of Auxiliary Through Lanes at Signalized Intersections
Sponsor: Kittleson & Associates, Inc. (N. Rouphail)

ITRE’s data collection equipment deployed at the new Pullen/Hillsborough roundabout collects data for blind pedestrian accessibility studies funded by NIH.

The NCHRP 25-36 project is studying the impact of development patterns on travel behavior in small communities and rural areas. Shown here are commuting areas used for a cluster analysis to develop a typology of rural areas for the project.
Although single point interchanges are primarily useful to decrease vehicular delay by converging ramp movements into a single point, pedestrians should also be considered while designing and constructing these interchanges. As shown in the picture, the researchers found that refuge areas are particularly beneficial for providing pedestrians with protection while making a multiple stage crossing on the bridge across I-85 at NC16 (Brookshire Blvd) in Charlotte, NC.

Participants in a LTAP Flagger Training Workshop practice flagging in an emergency situation.
To improve visibility of pavement markers in wet weather, 3M developed a new all-weather paint that maintains retroreflective properties while covered in water. The key to this technology is specially developed elements that are dropped onto the paint along with glass beads. These unique elements retroreflect light in both dry and wet conditions. After the 3M All-Weather Paint is sprayed on the road surface, 3M bonded core elements are dropped, followed by a second drop of conventional glass beads.
Staff Honors and Recognitions in 2011

State and National Committee and Panel Participation

TRB Committees

ABG50: Transportation History (D. Findley, member)
ADC10: Environmental Analysis in Transportation (D. Brill, member)
ADC30: Ecology and Transportation (J. Martin, member)
ADD00: Section - Social, Economic, and Cultural Issues (L. Lane, chair)
ADD10: Transportation and Economic Development (L. Lane, member)
ADD20: Social and Economic Factors of Transportation (L. Lane, member)
ADD20: Social and Economic Factors of Transportation (A. Hartell, member)
ADD30: Transportation and Land Development (L. Lane, member)
ADD40: Transportation and Sustainability (L. Lane, member)
ADD50: Environmental Justice in Transportation (L. Lane, A. Hartell, members)
AHB25: TRB Signal Systems Committee (Z. Bugg, friend)
AHB40: Highway Capacity and Quality of Service Committee (R. Foyle, friend; B. Schroeder, member)
AHB55: Work Zone Traffic Control (T. Baughman, friend)
AHB70: Access Management Committee (C. Cunningham, friend)
AHB65: Operational Effects of Geometrics (C. Cunningham, friend)
AHD15: Maintenance and Operations Personnel (J. Martin, member)
ANB40: Traffic Law Enforcement Committee (C. Cunningham, member)
ANB70: Truck and Sub Safety (R. Hughes, friend)
ANF10: Pedestrian Committee (S. O’Brien, friend)
ANF20: Bicycle Transportation Committee (S. O’Brien, friend)
APO55: Rural Public and Intercity Bus Transportation Committee (T. Cook, friend)
APO60: Paratransit Committee (Kai Monast, member; T. Cook, friend)
APO85: Ferry Transportation Committee (J. Tsai, member; T. Cook, friend)
TRB Subcommittees

ABJ95: Visualization in Transportation (R. Hughes, chair)
ADD20: Research Subcommittee (A. Hartell, chair)
AHB40: Traffic Simulation Applications Subcommittee (B. Schroeder, member)
AHB40: Research Subcommittee (B. Schroeder, secretary)
AHB40: Freeway and Multilane Highways Subcommittee (N. Rouphail, B. Schroeder, members)
AHB40: Signalized Intersections Subcommittee (N. Rouphail, member)
ANB10_6: School Transportation Subcommittee (J. Tsai, member)
Health and Transportation Joint Subcommittee (A. Hartell, member)

TRB Task Forces and Panel Participation

Transportation Research Board: Task Force on Roundabouts, (B. Schroeder, member)
FHWA Project Panel: Work Zone Traffic Analysis - Applications and Decision Framework, (B. Schroeder, member)
Transportation Research Board: Committee Communication Coordinator Council, (D. Findley)
Task Force on Context Sensitive Design/Solutions (CSD/CSS), (L. Lane)
NCHRP 01-17: Pedestrian and Bicycle Transportation Along Existing Roads (S. O’Brien, panel member)

Special Awards

Outstanding Paper Award, Institute of Transportation Engineers:

Best Paper Award, TRB Work Zone Traffic Control Committee, 2011:
Schroeder, Bastian and Rouphail, N. Estimating Operational Impacts of Freeway Work Zones on Extended Facilities

Other Organizations

American Society of Civil Engineers (J. Smith, member)
National Committee on Uniform Traffic Control Devices, (T. Baughman, member)
National Education Logistics Users Forum (M. Michael, member)
North Carolina Section of ITE (NCSITE) (R. Foyle, C. Cunningham, B. Schroeder, D. Findley, J. Huegy, members)
NCSITE: Simulation and Capacity Analysis User Group (B. Schroeder, chair)
NCSITE: Traffic Engineering Council (C. Cunningham, member)
NCSITE: Transportation Planning Council (C. Cunningham, member)
NCSITE: Big Box Centers Trip Generation Task Force (C. Cunningham, member)
North Carolina NCWISE Users Advisory Board (M. Michael, member)
North Carolina NCWISE Gen 2 Advisory Board (M. Michael, member)
Women’s Transportation Seminar (J. Smith, A. Hartell, members)

A paper co-authored by Dr. Nagui M. Rouphail, director of ITRE, was selected to receive the Institute of Transportation Engineers (ITE) Traffic Engineering Council Best Paper Award. ITE is an international educational and scientific association of transportation professionals that provides a forum for the exchange of professional information for more than 17,000 members.

The Transportation Founders Fund (TFF) named Thomas Chase as the recipient of the 2011 Graduate Scholarship. The award was presented to Chase on April 14 at the TFF Speaker Series event held on the Centennial Campus at North Carolina State University (NCSU). TFF is an outreach activity of ITRE and the Department of Civil, Construction and Environmental Engineering at NCSU.
Based on research conducted in 2011, ITRE staff are scheduled to make presentations and to preside at various meetings of the Transportation Research Board (TRB) at the Annual Meeting in January 2012. Many of the 32 presented papers will also be considered for publication in upcoming issues of the Transportation Research Record.

A Comparative Empirical Analysis of Eco-Friendly Routes During Peak Hours, Margarida Coelho/Jorge Baval/Dario Carvalho/Asad Khatkak/Nagui Rouphail
Agent-Based Modeling and Simulation; Simulation Modeling in a Transportation Context: Common Paradigms, George List/Montasir Abbas
Application and Validation of HCM2010 Freeway Facilities Methodology for Work Zone Operations, Bastian Schroeder/Soheil Sajjadi/Nagui Rouphail/Tyler Fowler
A Rationale for Incorporating Queue Discharge Flow into the HCM Freeway Facilities Analysis Procedure, Bastian Schroeder/Jia Hu/Nagui Rouphail
Calibrating Time-Dependent Car-Following Models Based on Vehicle Trajectory Data: A Dynamic Time Warping Approach, Jeff Taylor/Xuesong Zhou/Nagui Rouphail
Comparative Evaluation of Reported Speeds from Corresponding Fixed-Point and Probe Based Detection Systems, Thomas Chase/Billy Williams/Nagui Rouphail/Sangkey Kim
Comparing Temporally-Stitched and Simultaneous Route Travel Times at Various Aggregation Intervals, Thomas Chase/Billy Williams/Nagui Rouphail
Defining Community Context in the Transportation Project Planning and Development Process, Leigh Lane/Ann Hartell/Teresa Townsend
Deterministic Approach to Modeling Managed Lanes on Extended HCM Freeway Facilities, Bastian Schroeder/Seyedbehzad Aghdashi/Nagui Rouphail/Xiaoyue Liu/Yinhai Wang
Establishing Monitoring Programs for Travel Time Reliability (SHRP Reliability Project L02), George List
Estimating Work Zone Performance from Point Sensors: Challenges and Lessons Learned, Tyler Fowler/Bastian Schroeder/Nagui Rouphail/Soheil Sajjadi
Guidance for Simulation-Based Modeling of Auxiliary Through Lanes (ATLs), Zachary Bugg/Bastian Schroeder/Nagui Rouphail
Impact of Pedestrian Impedance on Vehicular Capacity at Multi-lane Roundabouts with Consideration of Crossing Treatments, Bastian Schroeder/Nagui Rouphail/Katayoun Salamati/Zachary Bugg
Implementing Auxiliary Through Lanes (ATLs) in a Highway Capacity Analysis Context, Eisenhower Fellow Presentation, Zachary Bugg/Bastian Schroeder/Nagui Rouphail
Institutionalizing Sustainability at the State DOT Level: A Quantitative Assessment of Transportation Sustainability Plan Quality, Ted Mansfield/Ann Hartell
Investigating Traffic Mobility Impact of Mileage-based User Fees on Traveler Route Choice Behavior and Network Performance: A Planning-level Traffic Equilibrium-Based Approach, Anxi Jia/Xuesong Zhou/Nagui Rouphail
Monthly Service Profiles for Rural Demand Response Transportation, Kai Monast/Anna Jackson
Operational Performance and Speed-flow Relationships For Basic Managed Lane Segments, Timothy Thomson/Xiaoyue Liu/Yinhai Wang/Bastian Schroeder/Nagui Rouphail


Planning-Level Approach to Estimating User Cost for Freeway Work Zones, Soheil Sajjadi/Bastian Schroeder/Nagui Rouphail/Tyler Fowler

Quantifying Cross-weave Impact On Capacity Reduction For Freeway Facilities With Managed Lanes, Xiaoyue Liu/Yinhai Wang/Bastian Schroeder/Nagui Rouphail

Rationale for Incorporating Queue Discharge Flow into the HCM Freeway Facility Analysis Procedure, Bastian Schroeder/Jia Hu/Nagui Rouphail

Simulator Study of Driver Responses to Pedestrian Treatments at Multilane Roundabouts, Katayoun Salamati/Bastian Schroeder/Nagui Rouphail/Chris Cunningham/Yu Zhang/David Kaber

Social and Economic Factors of Transportation in International Contexts, Ann Hartell

Structural and Safety Investigation of Statewide Weathered Steel Beam Guardrail Performance in North Carolina, Daniel Findley/Chris Cunningham/Chris Vaughan/Tyler Fowler

Suggestions on How Agencies Should Apply the Highway Capacity Manual to Two-Lane Road Curves, Charles Zeeger/Carl Sundstrom/Joe Hummer/William Rasdorf/Daniel Findley

Temporal Stability of Freeway Macroscopic Traffic Stream Models, Chenhao Liu/Billy Williams/Nagui Rouphail

The Intersection of Health and Transportation: What We Know, What We Don’t Know, and How We Can Better Integrate Health Considerations into Transportation Decisions, Leigh Lane/Eloisa Raynault/Jamie Rayman

The Use of “Your Speed” Changeable Message Signs in School Zones - Experience from the North Carolina Safe Routes to School Program, Sarah O’Brien/Carrie Simpson

Transportation History: Chicago Skyway, California Planning, and Swedish Nationalism, Daniel Findley

Value of Life Cycle in Explaining Trip Making Behavior and Improving Temporal Stability of Trip Generation Models, Leta Huntsinger/Nagui Rouphail

The poster above presents a planning approach to estimate user cost impacts on freeway work zones in an HCM context.

This poster shows the implementation of ATL use prediction models into the HCM signalized intersection methodology, specifically allowing for the interaction of ATL users and actuated signal control.

This poster reflects a new method of reporting route travel times that simulates vehicle trajectories.
Conference and Workshop Attendance, Participation and Exhibits in 2011 (by program or group)

Center for Transportation and the Environment (CTE)


International Conference on Ecology & Transportation (ICOET), Seattle, WA, August 2011 (J. Martin, A. Hartell, E. Murray, N. Bailey, W. Thomas)

Finding Common Ground Through Context Discovery, Delaware Bypass CSS Workshop, Dover, DE, September 2011 (L. Lane, presenter)

So Just How Do You Develop a Sustainability Plan, National Local Technical Assistance Program Meeting, Boston, MA, August 2011 (L. Lane, presenter)

Using Performance Measures/Indicators to Calculate the Triple Bottom Line, Conference on Performance Measures for Transportation and Livable Communities, Austin, TX, September 2011 (L. Lane, presenter)

Livability Roundtable Meaning of “Livability”: Different Perspectives, Transportation Research Board Summer Meeting, Boston, MA, July 2011 (L. Lane, presenter)

Highway Systems

NCSITE 2011 Mid-year Meeting, Asheville, NC (R. Foyle)


NCSITE 2011 Annual Meeting, Raleigh, NC (R. Foyle, attended; C. Cunningham, B. Schroeder, session moderators)

An Overview of NCHRP Report 674, International Roundabout Conference, Carmel, IN., May 2011 (B. Schroeder)

Modern Roundabout Operations in VISSIM: Calibration Guidance and Evaluation of Pedestrian Crossing Treatments, PTV Users Group Meeting, New York, NY, September 2011 (B. Schroeder)

Empirically-Derived Guidance for Modeling Auxiliary Through Lanes (ATLs) at Signalized Intersections in VISSIM, PTV Users Group Meeting, New York, NY, September 2011 (B. Schroeder)

Corridor-Based Forecasts of Work-Zone Impacts for Freeways, NCDOT Training Workshop, Raleigh, NC, February, 2011, (B. Schroeder)

Access to Uncontrolled Crosswalks by Individuals Who Have Visual Impairments: Roundabouts, Channelized Turn Lanes and Driver-pedestrian Interactions, The Eye and the Auto Conference. Detroit, MI. September 2011 (B. Schroeder)

NCHRP Report 674 Overview - Crossing Solutions for Pedestrians with Vision Disabilities at Roundabouts & Channelized Turn Lanes. Webinar co-sponsored by TRB and Easter Seals Project Action, August 2011 (B. Schroeder)

Freeway Facilities Methodology in HCM2010, Webinar sponsored by TRB, July 2011 (B. Schroeder)

Western North Carolina Transportation Alliance, Economic Development & Transportation Infrastructure in WNC: The 7 Portals Study, Keynote Address, June 1, 2011 Asheville, NC, (D. Findley)

ITRE Director

Addressing Operational, Pricing and Intelligent Transportation Systems Strategies for the I-40 Corridor Using DYNASMART-P, NCDOT Training Workshop, ITRE, Raleigh, NC, January 2011 (N. Rouphail)

Establishing Monitoring Programs for Travel Time Reliability (SHRP L-02), Project Presentation, San Diego, CA, February 2011 (N. Rouphail)

CTE’s work was featured in Leigh Lane’s presentation, “Using Performance Measures/Indicators to Calculate the Triple Bottom Line”, which wove together findings from two research projects to showcase the relationship between performance measures that deliver sustainable and livable outcomes and the calculation of triple bottom line results for transportation investments.

Daniel Findley addressed the Western North Carolina Transportation Alliance as Keynote Speaker at the Spring 2011 meeting. Findley’s presentation focused on the relationship between transportation infrastructure and economic development.
**A Research Program on Vehicle Activity and Emissions**, Seminar Presentation at Indian Institute of Technology, Delhi, Delhi, India, March 2011 (N. Rouphail)

**Pedestrian Accessibility: Issues, Framework and Treatments**, Seminar Presentation at the Central Road Research Institute, Delhi, India, March 2011 (N. Rouphail)

AIMSUN Micro-Simulator Model Demonstration to NCSU Chancellor, Civil, Construction and Environmental Engineering Department, Raleigh, NC, May 2011 (N. Rouphail)


**Measuring Pedestrian Accessibility at Complex Intersections: Examples and Treatments**, Presentation at the Instituto Superior Tecnico, Technical University of Lisbon, Lisbon, Portugal, July 2011 (N. Rouphail)

**Framework for Accessing Blink Pedestrian Accessibility to Complex Intersections**, Dept. of City and Regional Planning, UNC-CH, November 2011 (N. Rouphail)

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**NC Local Technical Assistant Program (NC LTAP)**

APWA-NC State Chapter Conference and Equipment Show, Asheville, NC, June 2011 (L. Collier, B. Woods)

APWA-NC Combined Equipment Services and Streets Divisions Conference, Concord, NC, September 2011, (L. Collier, B. Woods)

International Conference on Ecology and Transportation (ICOET), Seattle, WA, September 2011 (J. Martin, L. Collier, B. Woods)

Southern Transportation and Air Quality Summit (STACS), Raleigh, NC, July 2011 (J. Martin, L. Collier, B. Woods)

LTAP Region 4 Meeting, Huntsville, AL, May 2011 (L. Collier, B. Woods)

LTAP National Conference, Boston, MA, August 2011 (J. Martin, B. Woods)

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**Public Transportation**


Three Scheduling Software Peer Group meeting presentations on **Robeson County Zone-Based Scheduling** at the North Carolina Public Transportation Association Conference Wilmington, NC, May 2011 (K. Monast, D. Zorio)

Americans with Disabilities Act Workshops, Raleigh and Hickory, NC, April 2011 (D. Collins, K. Monast)

NTI Paratransit Management and Operations, Conway, SC, June 2011 (D. Zorio attended)

NTI NTD Rural Reporting Webinar, November 2011 (K. Monast attended)


OREd conducted Integrated Planning for Schools and Community projects for 16 school systems during 2011 (highlighted in red). OREd assists school systems with long-range school planning through the use of mathematic modeling and optimization algorithms.

Each year the TIMS staff takes “Buster” (the remote-controlled talking school bus) to the state fair to help educate children on school bus safety.

Triangle-wide Pedestrian Education and Enforcement Campaign Task Force Meetings (S. O’Brien, K. Jackson)


Move More Scholars Institute, May 9-12, 2011, Pine Knoll Shores, NC (S. O’Brien, participant)

NC Speed and Safety Symposium, October 11, 2011, Raleigh, NC (S. O’Brien and K. Jackson attended)

Association of Pedestrian and Bicycle Professionals’ Professional Development Seminar, October 24-27, 2011, Charlotte, NC (S. O’Brien)

**Pupil Transportation**

TIMS and BSIP Data Analysis, North Carolina Pupil Transportation Association Conference, July, 2011, Asheville, NC (B. Sluder)

TIMS and MS Office Open Lab, North Carolina Pupil Transportation Association Conference, July, 2011, Asheville, NC (B. Sluder)

TIMS Open Lab, North Carolina Pupil Transportation Association Conference, July, 2011, Asheville, NC (B. Sluder)

North Carolina Pupil Transportation Association District 9 Summer Mini-Conference, August, 2011 New Bern, NC (B. Sluder)

North Carolina NCWISE Coordinators’ Summer Conference, August, 2011 (M. Michael, B. Sluder)

North Carolina State Fair School Bus Safety Booth, October, 2011 (M. Michael)

**Visual Analytics, Modeling and Simulation (VAMS)**

GIS Implementation for Motor Carrier Enforcement Decision Support, GIS-T Symposium, Hershey, PA, March 2011 (G. Ferrara, presenter, J. Scott attended)

Map Visualization as Building Blocks for Motor Carrier Enforcement Decision Support, North Carolina GIS Conference, February, 2011, Raleigh, NC (G. Ferrara, presented; T. Russell, B. Foley, J. Scott, attended)

Map Visualization as Building Blocks for Motor Carrier Enforcement Decision Support, North Carolina GIS Conference, August, 2011, Charlotte, NC (G. Ferrara, presenter)

TRB’s 6th International Visualization in Transportation Symposium, August 2011 (R. Hughes, G. Ferrara)

Congestion and the Movement of Freight in the Charlotte Region North Carolina Trucking Association (NCTA) Western Carolina Summit, Fall 2011 (R. Hughes)

Visualizing Commercial Motor Vehicle Enforcement Data as an Aid to Improved Operational Effectiveness, Transportation Research Forum, Long Beach, CA, 2011 (R. Hughes)

Freight Data Visualization: A ‘Pivotal’ Point in the Development of Visualization Applications in Transportation, Transportation Research Forum, Long Beach, CA, 2011 (R. Hughes)

Some Thoughts, and Some Real World Examples, of Data Visualization in the Context of a Regional Freight Mobility Planning Effort, TRB International Symposium on Visualization in Transportation, Chicago, 2011 (R. Hughes)
Published Refereed Journal Papers


Liu, Xiaoyue, Bastian Schroeder, Timothy Thomson, Yafeng Yin, Nagui Rouphail and Yinhai Wang, (2011), *Analysis on Operational Interactions Between Freeway Managed Lanes and Parallel General Purpose Lanes*. In Press, Transportation Research Record: Journal of the Transportation Research Board.


CTE partnered with NCSU’s Department of Civil, Construction and Environmental Engineering on a project to integrate storm event modeling, infrastructure systems and community conditions. The model and resulting metrics help identify infrastructure links and investment priorities to improve community resilience. The map above shows the study area with the locations of transportation infrastructure and a levee.

Thanks to a recently published report by ITRE staff, crossing complex intersections just got a lot safer for blind pedestrians. The research behind this report addresses questions and concerns of visually-impaired pedestrian accessibility when crossing modern roundabouts and channelized turn lanes.


Similar to “Booze It and Lose It” and “Click It or Ticket,” the TACT program aims to decrease aggressive driving behavior in and around heavy vehicles through education and enforcement. This project looked at the before and after effects of the program enforced by NCSHP. Shown here are three scenarios: 1) Restricted Lane Compliance, 2) Following Too Close (FTC) Behavior, and 3) Aggressive Lane Changes.

Rural Enforcement Corridor: Still image of side view video detection algorithm/setup with an FTC (following too close) event. The speed detector will capture vehicle speeds and classifications.

I-40 Enforcement Corridor: Shown here is a still image of overhead video detection algorithm. The image includes an FTC event detected using hidden functions attached to detectors overlaid on the video image.


Recent bicycle crashes that occurred in the Winston-Salem area prompted NCDOT to determine that similar crash types, patterns, and rates are occurring on a statewide basis, and that pedestrians are also vulnerable. As a result, the Bicycle and Pedestrian Program at ITRE was tasked with creating a process to discern the top priorities in addressing bicycle and pedestrian safety in North Carolina.
Student Support

Support for Scholars and Students

ITRE research and technical assistance projects continue to engage and support a large number of students from various disciplines and universities. The adjoining tables summarize our record of accomplishments in providing student support, indicating increased graduate student participation in ITRE research. In 2011, we had the highest number of supported research graduate students in our history (20). More importantly, much of the graduate student support has come from federal research dollars from agencies such as the National Science Foundation, the National Cooperative Highway Research Program (NCHRP), the Strategic Highway Research Program (SHRP-2), the Federal Highway Administration and the Environmental Protection Agency. Many of the graduate students at ITRE have received full Research Assistantship support. We also provided meaningful research experiences for our undergraduate students, primarily in the areas of transportation systems, rail operations and a variety of other fields. For the first time, ITRE also recruited a high school student, Kaitlyn Tsai, from the Academy of Information Technology (AOIT) program, Apex High School, Apex, NC.

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2011 Supported Graduate Students

- Seyedbehzad Aghdashi
- Abseen Anya
- Zachary Bugg
- Thomas Chase
- Burke Foley
- Tyler Fowler
- Federico Gontaruk
- Anxi Jai
- Sangkey Kim
- Paul Ku
- Issac Kumar
- Bo Ling
- Chenhao Liu
- Ted Mansfield
- Louis Marais
- Soheil Sajjadi
- Katy Salamati
- Hassan Swidan
- Guilhermina Torrão
- Yulin Liu

2011 Supported Undergraduate Students

- Gary Adams
- Jamie Bort
- Hunter Brown
- Jeff Chang
- Michael Corwin
- Anthony Encarnacion
- Brooks Hester
- Dylan Horne
- Kyle Hovey
- Anna Jackson
- Mark Julis
- Ethan Mabry
- Luke Perkins
- Elizabeth Scott
- Kaitlyn Tsai
- Jon Skinner
- Andy Wagner
- Kagure Wamunyu

Post-Doctoral Fellows and Visiting Scholars

Dr. Dae-Seop Moon, Visiting Scholar, who is in charge of the Transportation and Logistics Department at the Korea Rail Research Institute, was hosted at ITRE from February 2010 through March 2011.

Dr. Hyejung Hu, who defended her doctoral dissertation in December 2008 was given a Post-Doctoral appointment to support research projects that required transportation modeling skills at the meso-scopic level, which was part of her dissertation research at ITRE through May 2011.

Dr. Margarida Coelho, PhD, Post-Doctoral Fellow (University of Aveiro, Portugal) has continued her collaboration with ITRE this year, involving the staff in a study funded by the Lisbon Municipality on modeling access control alternatives to downtown Lisbon, and testing their air quality impacts.
Summary of Continuing Education Activities

More than 7,800 transportation professionals - from flaggers to professional engineers - received the benefit of ITRE’s education activities during 2011, an increase of 8% over last year. The Transportation Founders Fund also offered a well-attended seminar in April 2011 on the future of logistics in North Carolina. Exhibit IX lists training areas, workshops and summary statistics, including for the first time, a separate listing of ITRE’s Distance Learning training.

### Exhibit IX
Continuing Education Activities

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<th>Program</th>
<th>Training/Workshops in 2011</th>
<th>Instruction Hours per Session</th>
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### Program: Pupil Transportation

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<th>Training/Workshops in 2011</th>
<th>Instruction Hours per Session</th>
<th>Sessions Offered</th>
<th>Total Hours</th>
<th>Attendees</th>
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<td>Elluminate—EMU &amp; System Administration</td>
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<td>Open Lab</td>
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<td><strong>Pupil Transportation Totals</strong></td>
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<td>29</td>
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</table>

Photos at left show the sequence of events that was only 13 seconds away from a potential disaster. Thanks to 2009 legislation, videos from stop arm cameras can now be used to positively identify automobiles and drivers in order to prosecute violators in the courts.
Marketing/Public Relations

As ITRE works to position itself as a world-class transportation research center, the Institute continues to focus its efforts on increasing national visibility. Whether making presentations at conferences and seminars - both nationally and abroad, receiving awards and recognition for contributions to the field, establishing collaborations with universities in foreign countries, or working to solve transportation problems and educate transportation professionals, ITRE staff work toward the achievement of this goal.

Sharing the accomplishments and successes brought about by these efforts has been the focus of marketing and public relations for 2011. ITRE staff members provide services to support the goals and objectives of ITRE that relate to marketing and public relations.

- ITRE produced and published the ITRE Technical Expertise and Capabilities report in October 2010. Updates are recorded quarterly.

- On the ITRE Website:
  - Activities, events, programs, and research were featured in ITRE Directions, a quarterly online newsletter available on the “News and Events” page.
  - The number of news items featured on the home page increased.
  - Several programs were featured on a rotating basis in the “Of Interest This Month” section of the home page.
  - A listing of recent published reports was updated in the “Research” section.
  - “ITRE in the News,” stories and features from news outlets, was added to the “News & Events” Section.
  - Research papers continue to be made available through either source links or PDF files from a searchable database in the “Research” section of the Website.
  - The Transportation Founders Fund Speaker Series for 2011 was promoted through a printed brochure and on the ITRE website prior to the event. Afterwards, a video of the event, including speaker presentations, was made available from the “Transportation Founders Fund” section of the site.
  - ITRE recognized staff who presented at the TRB Annual Meeting through a listing of session papers and photo gallery made available on the Website.
  - ITRE worked with its centers and program groups as well as other transportation-related organizations to maintain over 15 Websites.
  - ITRE has a fan page on Facebook. It is accessible through the Facebook button on the home page of the website.
Appendix I

Summary of Program Groups

Center for Transportation and the Environment (CTE)

As a US 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, though it co-sponsors activities and makes its services available at the local, state, and regional levels.

CTE has provided more than 15 years of service to transportation and environmental professionals and has a pivotal role in developing the next generation of professionals who will be charged with meeting future mobility needs in an environmentally sound manner. Funding is provided by USDOT, with matching funds provided by NCDOT.

NC Local Technical Assistance Program (NC LTAP)

The North Carolina Local Technical Assistance Program (NC LTAP) is one of the 59 LTAP centers nationwide. There is an LTAP program in each state, including Puerto Rico, and with several Native American centers. LTAP was established by the Federal Highway Administration in 1982. The North Carolina center was one of the first organized in 1986.

The mission of LTAP is to help local agencies tap into new technology, information, and training so they can operate more efficiently and safely. LTAP centers provide access to training and information that may not have otherwise been accessible. Centers are able to provide local road departments with workforce development services, resources to enhance safety and security, solutions to environmental, congestion, capacity and other issues, technical publications, and training videos and materials.

NC LTAP offers the following training and technical assistance:

♦ Roads Scholar and Advanced Roads Scholar programs
♦ Additional training courses covering maintenance, safety, traffic and management
♦ Email discussion list—NCROADS
♦ Quarterly newsletter—Transportation Tracks

Highway Systems Group

The Highway Systems Group was developed in the early 1980s to assist the North Carolina Department of Transportation (NCDOT) with pressing surface infrastructure challenges. Many research and development projects conducted for maintenance, construction, and central office staff have helped provide implementable solutions to pressing needs. Group staff are also engaged in many national research projects under FHWA, NCHRP, and SHRP2 research programs.

Today, public and private sectors nationwide look to the group to conduct research and provide solutions for surface and air issues including the following.

♦ Transportation Policy
♦ Traffic Operations
♦ Microscopic Traffic Simulation (or Microsimulation)
♦ Visually Impaired Pedestrians

In recent years, the Highway Systems Group has been heavily involved in research projects aimed at quantifying the benefits of alternative intersections and interchanges. Shown here, is a “Superstreet” intersection studied for safety and operational efficiency.
Emergency Evacuation
Airspace System Management (ITRE’s NGAT Center in Planning)
Economic Impact Assessment
Work Zone Safety
Road Maintenance Operations
Career Development Training
Professional Engineering Review

Staff also provide job-specific training and education for transportation professionals at every level along with supplementary reference materials. Public and private sector groups also take advantage of our technical assistance opportunities.

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; Triangle Transit; and NCDOT. The bureau helps support each agency’s needs in meeting the requirements in Section 134, Title 23, US Code; NC General Statutes 136-66; and the federal 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.

NextGen Air Transportation (NGAT) Center in Planning. The NGAT Center in Planning, approved by NCSU in July 2008, is focusing on the development and evaluation of improvements to existing and anticipated air traffic control, airspace management, flightdeck technologies for safety, airport and airspace systems capacity, and surface traffic management. Over 25 partners are currently listed on the Center’s Web site http://www.itre.ncsu.edu/ngat/index.html. Current efforts are exploring unmanned aircraft systems, an important element for military operations, along with the potential for significant commercial use.

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 both singularly and in multimodal settings: urban fixed-route and paratransit; rural demand-responsive transit; bicycle and pedestrian; passenger rail; and taxicab/livery.

The NCDOT Public Transportation Division is a primary client by providing opportunities to link applied research with ongoing technical and technology assistance. A passion for this group is pursuing practical applications that can have immediate benefits by increasing efficiencies in transit operations and positively impacting service and transportation choices for the traveler.

- Bicycle and Pedestrian Program. The Bicycle and Pedestrian Program has the distinction of a long-standing working partnership 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. In addition, program staff have provided guidance and assistance to the NCDOT Transportation Mobility and Safety Division’s Safe Routes to School program.

Recent “superstreet” research by the Highway Systems Group indicates that travel times improved significantly along the major road with small negative impacts to the minor street. Additionally, safety at unsignalized superstreets improved overall by 46%.

The Bicycle and Pedestrian Program focuses on improving the walk-ability and bike-ability of communities through planning assistance, dissemination of current best practices in facilities design, and training.
Pupil Transportation Group

ITRE is the only research center in the nation with a program group dedicated to addressing school travel safety and operation topics. Through the applications of transportation engineering principles, operations research, and technology to the operation and management of multi-modal school transportation, the Pupil Transportation Group conducts two major services:

- **Transportation Information Management Systems (TIMS).** The TIMS program area provides support and consultation of a GIS-based school bus routing and scheduling software system used by all public school systems in NC. Through the use of the software and support from the Pupil Transportation Group staff, school systems in NC were able to design and implement cost-cutting transportation plans during the recent difficult economic years.

- **OREd Program (www.itre.ncsu.edu/OREd).** The Operations Research and Education Laboratory (OREd) conducts population forecasts, land use studies, location optimization, and GIS analysis. By integrating schools and community planning data and goals, the ORED assists school systems in developing data-driven and policy-based facility and assignment plans.

The Pupil Transportation Group also provides Web site hosting and maintenance for three (3) nationally-recognized agencies: National Association for State Directors of Pupil Transportation Services (www.nasdpts.org); Transportation Research Board School Transportation Subcommittee (www.itre.ncsu.edu/anb10_6); and NC School Bus Safety (www.ncbussafety.org).

Visual Analytics, Modeling and Simulation Group (VAMS)

VAMS researchers continued their analysis and program evaluation support of the two major Highway Patrol motor carrier enforcement programs: Motor Carrier Safety Assistance Program (MCSAP) and Truck Size and Weight. These programs are funded by FMCSA and FHWA respectively. These programs provide the primary means for VAMS development of operational GIS-related capabilities.

VAMS’ analysis work for the NC State Highway Patrol (NCSHP) and NCDOT continues to provide an empirical basis for the consideration of safety and roadway infrastructure issues associated with the trucking industry’s push for “higher productivity (heavier, longer) vehicles” (HPVs). ITRE’s development of a Roadway Vulnerability Index has been in direct support of the infrastructure protection mission of the NCSHP Motor Carrier Enforcement program. In the analysis area, ITRE introduced its on-line CoverLab concept which represents an effort to integrate GIS, data visualization, and emerging business intelligence (BI) concepts.

During this past year, VAMS researchers continued efforts to elevate the level of analysis for truck safety to the carrier level and to focus on the operational mission of trucking to transport freight. This work also provides support of ITRE’s inputs to North Carolina’s development of a statewide logistics (freight) plan as well as efforts to support the state’s development of a Greensboro Logistics Plan. In the analysis area, ITRE introduced its on-line CoverLab concept which represents an effort to integrate GIS, data visualization, and emerging business intelligence (BI) concepts.

VAMS research staff also supported an effort co-funded by the VA and NC State Departments of Transportation which focused on the attributes of carriers involved in fatal combination unit truck (CUT) crashes. The results of the study documented the increased risk of fatal CUT-involved crashes for small carriers as well as the increased risk of fatal CUT-involved crashes on non-interstate roads in both states.
Websites Hosted by ITRE

- www.itre.ncsu.edu
- www.itre.ncsu.edu/ngat/
- www.icoet.net
- www.nccompletestreets.org
- www.cssnationaldialog.org
- www.converge.ncsu.edu
- www.ncbussafety.org
- www.nasdpts.org
- www.coverlab.org