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ITRE Background

In its twelfth year, The Institute for Transportation Research and Education (ITRE) serves as a catalyst for transportation research in the state, region, and nation. Equally important is the technical assistance ITRE provides to state and local governments through individual projects.

It was in 1977 that the North Carolina General Assembly recognized the need for an institute to provide leadership for North Carolina's university transportation research and education programs. The following year ITRE was established in the office of the president of the University of North Carolina. As a unit of the UNC General Administration, ITRE draws on the resources of all 16 campuses of the UNC system and Duke University in a true interdisciplinary program. In 1988, ITRE was elected to represent a number of universities in the southeast as the lead institution for the Southeastern Consortium of University Transportation Centers. In that capacity, ITRE provides administrative coordination for additional cooperative research and teaching activities at the universities of Florida, Kentucky, Tennessee and Vanderbilt.

Through this unique relationship, ITRE staff members and affiliated campus faculty join together in transportation research, training, and technology transfer programs.

Credits
Kathryn P. McDermott, Editor
Kelly L. Horn, Copy Editor
ITRE, Photography

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3,800 copies of this public document were printed at a cost of $2,877.00 or $0.76 per copy.
ITRE continues to experience a considerable growth in revenue. During fiscal year 1990 those revenues reached $3.6 million. These funds support activities on many campuses in North Carolina and throughout the southeastern region as well as supporting activities among ITRE’s own professional staff.

As can be seen from the charts, major funding comes to ITRE from the North Carolina Department of Transportation, the USDOT, and the North Carolina Department of Public Instruction. An important part of ITRE’s outreach is also exhibited by project work with cities and counties. Although constituting only 6 percent of total revenue, the projects directly or indirectly involved 100 cities and 30 counties.

Commensurate with the increase in revenue (41.5 percent) is a 13.5 percent increase in staff and student activities (and an increase in subcontracted work) that are integral to carrying out the many ITRE projects.
Southeastern Consortium of University Transportation Centers (SECUTC)

In 1978, as ITRE was in its first year, a number of leading universities from throughout the nation established the Council of University Transportation Centers (CUTC). The purpose of ITRE's involvement as the representative of the UNC system was to help spotlight the contributions and needs of university transportation research and educational programs. One of the direct results of that effort, which was a joint effort of CUTC, the US Congress, the USDOT, and other constituents and participants in our transportation programs, was the establishment of a Regional University Transportation Center in each of the ten federal regions.

Several universities in the Southeast are members of SECUTC, a consortium that is open to other institutions in the Southeast that are interested in developing collaborative programs. Dr. Charles Wallace of the University of Florida is executive director of SECUTC. Dr. B. J. Campbell of The University of North Carolina is acting director of the Regional Transportation Center grant from the USDOT.

An important activity of SECUTC has been the establishment of the Southeast Transportation Roundtable, an association of industry, government, and academia that is aimed at forging workable solutions to the region's current and future transportation problems. The Roundtable first met in Nashville, TN, in 1989. The outcome of that session was the development of the research theme of the southeastern transportation research center: "Mobility 21: Managing Mobility in a High Growth Region in the 21st Century." The Roundtable convened again in Atlanta, GA, in March 1990 to explore issues that affect the preparation of engineers and other professionals for their future roles.

SECUTC's challenge for the next two years is to demonstrate that it can address the "theme" of managing mobility with a meaningful research agenda and innovative educational programs. During the initial year of the University Transportation Center Grant, important new initiatives have been undertaken in transportation research. The overall grant, which was funded at $500,000 per year during the first two years, has been increased to $1 million for the grant year just begun.

Current Projects of SECUTC

- Highway Accessibility & Economic Development
  Dr. Alfred W. Stuart, The University of North Carolina at Charlotte
- Apprenticeship and Internship Programs in North Carolina
  Dr. John E. Tidwell, ITRE
- Apprenticeship Programs in Urban and Rural Transit Properties
  Dr. L. Milton Gissson, North Carolina A&T State University
- Transportation Information Management System
  Derek Graham, ITRE
- Intercity Travel and Analysis
  Dr. Eric Pas, Duke University
- Duo-Mode Bus System Analysis
  Dr. John Stone, North Carolina State University
- Geographic Information Systems
  Dr. Woodrow Nichols, North Carolina Central University
- Integration of Social Scientific Knowledge into Mobility Management with Special Reference to Travel Demand in High Growth Regions
  Dr. Eric Pas, Duke University
- Pedestrian Accidents Related to Mass Transit: Characteristics and Solutions
  Dr. Charles Zegeer, University of North Carolina at Charlotte
- Modeling Land Use Options for Successful Fixed Guideway Transit
  Dr. John Stone, North Carolina State University
- A Study of Motorcycle Crash Injuries
  Dr. Jane Stuts, University of North Carolina Highway Safety Research Center
- Analysis of Transportation Logistics and Industry Competitiveness  
  Dr. Roger Calantone, University of Kentucky

- Feeder Bus Service for Downtown People Mover  
  Dr. Fasil T. Najafi, University of Florida

- Enhancement of Traffic Signal Retiming Methodology  
  Dr. Kenneth G. Courage, University of Florida;  
  Dr. Charles E. Wallace, University of Florida

- Brokerage and Electronic Marketing of Truck Service in an Unregulated Environment  
  Dr. Richard Bellock, University of Florida

- Integration of Transportation Planning and Traffic Operations Methods  
  Dr. Gary Long, University of Florida

- Developing Procedures for Night Operations of Transportation Construction Projects  
  Dr. Ralph Ellis, University of Florida  
  Dr. Zohar Herbsman, University of Florida

- Optimum Analytical Design Procedures  
  Dr. Kenneth Courage, University of Florida

- Transportation Construction  
  Dr. Ralph Ellis, University of Florida

- Development of Generic Rural and State Transit Microcomputer Information System  
  Dr. Fred J. Wegmann, University of Tennessee  
  Dr. Robert E. Stammer, Jr., Vanderbilt University

- Guidelines for Selecting Roadway Cross-Sections in Developing Urban/Suburban Areas  
  Dr. Stephen H. Richards, University of Tennessee

- Investigation of Lead Paint Removal Procedures for Highway Bridges  
  Dr. James H. Deatherage, University of Tennessee

- Long Term Effects of Latex Additive on Asphaltic Concrete  
  Dr. Moore, University of Tennessee

- Development Length and Lateral Spacing Requirements of Prestressing Strand for Prestressed Concrete Bridges  
  Dr. James H. Deatherage, University of Tennessee

- Improved Transportation Noise Analysis and Control Techniques  
  Dr. William Bowlby, Vanderbilt University

- Expert System for Warranting Roadside Safety Hardware  
  Dr. Malcolm H. Ray, Vanderbilt University

- Expert System for Spill Control from Transportation Systems  
  Dr. Roger L. Wayson, Vanderbilt University

- Performance Evaluation of the Narrow Conn. Impact Attenuation System  
  Dr. Carney, Vanderbilt University

- Advanced Institute for Education and Research  
  Dr. William Bowlby, Vanderbilt University

- Suburban Mobility: A Challenge for Public Transportation  
  Dr. Fred Wegmann, University of Tennessee

- Economic Opportunities Through Mobility Option -- The Long Distance Commute  
  Dr. Fred Wegmann, University of Tennessee

- Cost-Effective Public Transportation for Small Urban Areas  
  Dr. Fred Wegmann, University of Tennessee
Highway and Transportation Engineering Research

For twelve years, ITRE has been providing and administering transportation related research and training activities for the North Carolina Department of Transportation. Last year's $1.32 million program shows the continued support from NCDOT to ITRE, NCSU, and Duke researchers to perform high quality, useful research for the department.

This past year ITRE staff worked on eight projects for the NCDOT. The major subject areas for this work included geographic information systems, pavement and maintenance management, civil engineering principles and design methodologies, pavement marking materials, various bicycle program activities, and upper management training. The GIS project is especially exciting because it involves the development of query packages to access multiple sets of databases to analyze questions that would take too long using other techniques. All the query packages are designed within the ARC/INFO software program. NCDOT is primarily focusing on traffic engineering, pavement management, and land use applications of various databases. One of the main problems to date has been the input of data. NCDOT is making a strong push to digitize the state highway system in all 100 counties to get the system fully operational. This effort will take at least one more year.

Another project that was continued this year was video-based management training for emerging NCDOH managers. This type of training is fast becoming one of the most effective tools to use when training and evaluating people in management principles. Three topic areas of management techniques are presented to the participants, and then they create a job situation to practice their development of the skill in using the techniques. The participants are videotaped during their practice and then critiqued, thereby providing immediate feedback on their skill level using that technique. A total of 50 NCDOH employees were trained using this technique.

Professors at North Carolina State University continue to provide a high degree of research support for the NCDOT. Ten projects were conducted on the campus of NCSU involving eight professors and numerous research assistants. General subject areas included asphalt and aggregate materials for pavements, performance of different flexible pavement designs, monitoring a tieback wall, forecasting service life of culverts, bridge management, characteristics of subgrade soils blended with aggregate, shoreline monitoring at Oregon Inlet, and alternatives for repair and protection of coastal highways.

One of these projects is a study of the performance of different designs for flexible pavements. This is the third year of this ten-year project to investigate the long term performance of materials used in flexible pavement construction. Test sections and instrumentation have been installed at a test site near Siler City on US 421 Bypass. To obtain accurate input data, the researchers have specially loaded NCDOT trucks drive over the pavement during one week out of every two months. The results of this project will allow new equations and strength coefficients to be generated for pavements in North Carolina. This will provide better long term performance from the pavements in being able to carry the traffic loads.

At Duke University, researchers are studying portland cement concrete made with marine limestone coarse aggregate. This project highlights the research activities of the NCDOT to search for and investigate potential uses of materials which may have been overlooked in the past because of the availability of other materials. As existing material resources become more scarce, innovative ways need to be found to use other readily available materials to maximize highway construction and maintenance dollars.

An 18,000 lb rear axle loaded NCDOT truck passes over strain and pressure gauges under the pavement test site as NCSU researchers monitor results. Dr. N. Paul Khosla (not shown), NCSU, is principal investigator for this project.

This graphic shows highway segments in a portion of Pitt County with moderate alligator cracking. Figure produced by GIS Development Team.
Current Research Projects

- Maintenance Technical Assistance
  James B. Martin, ITRE
- Career Development Program
  Robert S. Foyle, ITRE
- A Comparative Study of Performance of Different Designs for Flexible Pavements
  Dr. N. Paul Khosla, North Carolina State University
- CTES and Technical Services
  Dr. N. Paul Khosla, North Carolina State University
- Technical Training Needs Study
  Robert S. Foyle, ITRE
  Steve A. Martin, Inc.
- Maintenance Organization Study
  James B. Martin, ITRE
- Repair and Protection Alternatives for Coastal Highways Vulnerable to Storm Damage, Shoreline Erosion, and Sea Level Rise
  Dr. John R. Stone, North Carolina State University
  Dr. Margery F. Overton, North Carolina State University
  Dr. John S. Fisher, North Carolina State University
- Geographic Information Systems Development
  Bobby R. Harris, ITRE
- HCM Workshop for Planning and Environmental Branch
  Robert S. Foyle, ITRE
  Dr. Paul D. Cribbins, North Carolina State University
  Dr. Clinton L. Heimbach, North Carolina State University
- Team Building Seminars
  Steve A. Martin, Inc.
- Management Training Program
  Robert S. Foyle, ITRE
  Steve A. Martin, Inc.
- In-Service Testing of Pre-Mixed and Plain Traffic Paints
  Robert W. Attaway, ITRE
  Robert S. Foyle, ITRE
- Evaluation of Chemical and Structural Properties of Portland Cement Concrete Made with Marine Limestone Coarse Aggregates
  Dr. Minmay Biswas, Duke University
- Curriculum Guide for a Standard Program for Bicycle Safety Education for 4th-6th Grade Students
  Bicycle Federation of America
- Large Sized Aggregate Asphaltic Mixtures -- A Design Approach and Performance Evaluation
  Dr. N. Paul Khosla, North Carolina State University
- Weed Control Management Plan for Wildflower Plant Beds
  Dr. W. A. Skroch, North Carolina State University
- Workshop on Stormwater Management Systems
  Dr. H. Rooney Malcom, North Carolina State University
- Local Area Bicycle Mapping Projects
  Bikecentennial, Inc.
  Margaret B. Pierce
- Bicycle Facility Planning and Design Guidelines
  Bikecentennial, Inc.
- Instrumentation and Monitoring of the Permanent Tieback Wall Along the CBD Loop in Fayetteville, NC
  Dr. Philip C. Lambe, North Carolina State University
- A Study of Stiffness and Strength Characteristics of Subgrade Soils Blended with Aggregate
  Dr. N. Paul Khosla, North Carolina State University
  Dr. Philip C. Lambe, North Carolina State University
- Forecasting Service Life of Culverts in North Carolina
  Dr. H. Rooney Malcom, North Carolina State University
- Bridge Management System Development
  Dr. David W. Johnston, North Carolina State University
- Shoreline Monitoring at Oregon Inlet Terminal Groin (Phase 1)
  Dr. John S. Fisher, North Carolina State University
  Dr. Margery F. Overton, North Carolina State University
Since ITRE's formation, technology transfer has been a prime part of its operation. Training and technical assistance has been provided to many governmental agencies in various areas of transportation. ITRE is committed to helping transportation professionals keep up to date with the latest technical information and its practical application. ITRE's in-house staff possesses expertise in many areas such as pavement management, pavement design and maintenance, traffic engineering, work zone safety, pavement markings, computerized routing, and recycling, among others. ITRE, as a part of the UNC system, has access to and often utilizes faculty members from the university campuses.

ITRE provides training to 70 rating teams for NCDOT's pavement condition survey conducted on some 65,000 miles of paved roads in the state. Training manuals and technical bulletins are prepared for roadway maintenance personnel.

More than 95 cities and towns in North Carolina now utilize a pavement management system developed and implemented for them by ITRE. This program titled PMS-ITRE allows for cost-effective planning, budgeting and scheduling of pavement maintenance and resurfacing programs. PMS-ITRE is a tool to be used by the municipality to manage more efficiently their street maintenance funds.

Many government agencies have used ITRE's expertise in computerized routing. Agencies have saved money by developing optimal routes for sanitation vehicles, transit, school buses, and meter readers. This continues to be a growing area of technology transfer, especially for local governments.

ITRE has four of the federally funded Rural Technical Assistance Program (RTAP) special projects. Seven training videotapes on road maintenance activities have been developed and are currently being distributed nationally as part of Pavement Structure Repair Techniques (RTAP 46A). In addition, an interactive videotape training program was developed on the same maintenance activities.

Nationally taught short courses were developed under RTAP 54: Traffic Operations Training Courses for Rural and Small Urban Areas. These courses provide traffic engineering expertise to areas that previously may not have had the benefit of a bona fide traffic engineer.

The Bridge Posting and Evaluation Handbook (RTAP 809) provides guidance for identifying and posting bridges in poor structural condition. Certainly this has been helpful as the conditions of bridges across the country continue to decline.

As a part of Work Zone Safety for Rural Local Agencies (RTAP 812), a complete training course has been developed and is being taught nationally. A seven-part training videotape was also prepared and can be used as part of the course or as a stand-alone product.

ITRE is one of 46 Technology Transfer Centers funded nationally by the Federal Highway Administration. Originally founded in 1986, the Technology Transfer (T²) Center allows ITRE to expand its role in providing training and technical assistance as well as to enhance and expand its ongoing program of technology transfer to local governments throughout the state.

The T² center offers four primary types of assistance: training workshops, technical materials, technical information services, and a quarterly newsletter, Transportation Tracks, which is distributed to more than 3000 contacts statewide. More than 35 workshops were conducted in 1990. Technical materials such as magazines, research reports, and videotapes are made available upon request. A resource staff is available to answer questions or refer inquiries on transportation questions.
Current Technology Transfer Projects

- Technology Transfer to Local Transportation Agencies
  Kathryn P. McDermott, ITRE
  James B. Martin, ITRE

- Traffic Operations Training Courses for Rural and Small Urban Areas (RTAP 54)
  Dr. H. Douglas Robertson, University of North Carolina at Charlotte

- Pavement Structural Repair Techniques (RTAP 46A)
  James B. Martin, ITRE

- Bridge Postioning and Evaluation Handbook (RTAP 809)
  Dr. David W. Johnston, North Carolina State University

- Work Zone Safety for Rural Local Agencies (RTAP 812)
  Dr. John E. Tidwell, ITRE
  Robert W. Attaway, ITRE

- Municipal Pavement Management Systems
  James B. Martin, ITRE
  James E. Hester, ITRE

- NCDOT Pavement Management Program
  James B. Martin, ITRE

- NCDOT Maintenance Manual Volume II
  James B. Martin, ITRE

- NCDOT Career Development Program
  Robert S. Foyle, ITRE
  Dr. Steve A. Martin, ITRE

- PE and EIT Review for Local Governments
  Robert S. Foyle, ITRE

- Highway Capacity Manual Workshops
  Dr. Paul D. Cribbins, North Carolina State University
  Dr. Clint Heimbach, ITRE

- Public Transportation Programs
  Robert L. Martin, ITRE
  Bettie Rabb, ITRE

- Geographic Information Systems for Transportation
  Larry W. Minor, ITRE

- School Bus Scheduling and Routing
  Derek S. Graham, ITRE

- Vehicle Maintenance Program
  Robert L. Martin, ITRE
  Kathryn P. McDermott, ITRE
  Independent Garage Owners of North Carolina

- Solid Waste Management Program
  Larry W. Minor, ITRE

- North Carolina Recycler Database Development
  Larry W. Minor, ITRE

- Site Impact Traffic Evaluation
  Dr. John R. Stone, North Carolina State University

- Utility Meter Reading Routing Projects for Local Governments
  Larry W. Minor, ITRE

- Roadway Evaluation for State Parks in North Carolina
  James B. Martin, ITRE
  James E. Hester, ITRE

- North Carolina Recycling Market Development
  Strategic Plan Project
  Larry W. Minor, ITRE

- Integrated Solid Waste Collection Service
  Improvements Projects for Local Governments
  Larry W. Minor, ITRE

- Solid Waste Routing Projects for Local Governments
  Larry W. Minor, ITRE

1990 Technology Transfer Workshops

- Asphalt Pavement Maintenance [3 locations]
- Asphalt Pavement Management Systems
- Asphalt Pavement Recycling
- Asphalt Pavement Technology and Inspection
- Basic Stormwater Drainage Design (w/ South Carolina T3)
- Case Study Applications in Site Impact Traffic Evaluation [2 locations]
- Concrete Solution to Municipal Problems [2 locations]
- Construction Inspection in Public Works (w/ APWA)
- Geographic Information Systems for Transportation [2 locations]
- Geosynthetics

- Getting Your Message Understood: Communicating with Decision Makers, Citizens, and the Media
- Introduction to Microcomputers [2 locations]
- Introduction to Site Impact Traffic Evaluation [2 locations]
- Management and Supervisory Skills [2 locations]
- Snow and Ice Control (w/ South Carolina T3) [2 locations]
- Stormwater Detention Basin Design (w/ South Carolina T3)
- Vegetation Control
- Work Zone Traffic Control [3 locations]
In 1982, the State Board of Education funded a project through which ITRE conducted a comparative analysis of computer-assisted school bus routing and scheduling programs. That study concluded that there are potential efficiencies to be gained by using such technology. At the end of 1990, over eight years later, 99 of the state's 134 school systems were involved in the Transportation Information Management System (TIMS) project. The remainder are required by a legislative mandate to implement the program by July 1, 1992. TIMS is a microcomputer-based system which allows local education agencies (LEAs) to manage their bus routes and schedules and to generate a series of maps and reports. The TIMS Optimization Module allows for "what if" analyses through which computer generated bus routes and schedules may be produced.

TIMS is a program of the North Carolina Department of Public Instruction, with funding provided by the Energy Division, North Carolina Department of Economic and Community Development. ITRE's TIMS Installation Project is the mechanism through which this system has been made available to the LEAs. From project offices in Raleigh and at UNC-Charlotte, the TIMS staff provides data preparation, training, and "help desk" services to the participating LEAs. It is the responsibility of the project team to ensure that each unit has the training needed to successfully install the program. Through the GIS portion of the TIMS program, maps are digitized at ITRE, and the geocode is thoroughly edited in this very important aspect of technical assistance.

Results have been very promising, thus far. Many applications of generating new bus routes with TIMS have occurred in areas of major change. For instance, when school attendance areas are changed or schools are reorganized, a new transportation plan must be developed. Calculating savings in such cases is difficult. In other cases, though, savings are significant and measurable. In one instance, seven busses were eliminated with a 17 percent savings in driver time and mileage in one attendance area. In another, a 14 percent reduction in time was achieved.

At this writing, the price of fuel for school buses in the state has increased by over 50 percent from the budgeted amount. There is also a renewed emphasis by the DPI on efficiency in pupil transportation. The past several years of technical assistance through ITRE have put the LEAs in a position to use the system to deal with these important planning tools for local school administrators.

One of the most valuable spin-offs of the TIMS program is the capability to analyze the composition of school attendance areas. Students have to be located for the transportation portion of TIMS, but these locations can also be analyzed geographically. For instance, one TIMS add-on module available to school districts will assist in the generation of school attendance areas subject to several constraints, including distance from school and racial balance. In one project of technical assistance, the Durham County Board of Education contracted with ITRE to use the school boundary optimization programs to produce optimal school attendance areas for one new and two existing high schools in an attempt to minimize the overall travel time for students. ITRE staff then used TIMS to make modifications to the boundaries as suggested by LEA representatives to generate statistics on the final attendance areas.
SECUTC Policy Board, Advisory Committee, and Technical Coordinating Committee

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Purpose: Recommends policies for the operation of ITRE to the president of The University.

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Purpose: Assists the Council on Transportation Research and Education in ensuring that ITRE’s programs are responsive to user needs and that ITRE is meeting its program goals.

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Mr. Carl Wills

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Purpose: Provides advice to the ITRE director and coordinates with transportation research and educational programs.

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H. Rooney Malcom, Ph.D., P.E.
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