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About the Covers

Pictured on the front cover are an Otis Personal Rapid Transit, Duke University Medical Center, Durham, NC; a Boeing 737; a General Motors diesel locomotive; and an off-shore oil drilling ship. On the back cover are pictures from North Carolina’s transportation history: a 1919 Anderson, Winston-Salem; the Wright Brothers’ pusher aircraft, Kitty Hawk; a 1917 Baldwin locomotive, Blowing Rock; and the Elizabeth II, Manteo.

DEBRA BUTTERWORTH, Editor
ROSELINE NEVILLE, Technical Assistance
PATRICIA C. MARTIN, Artwork
KEN GEORGE, Photography
GLENN SANDERSON, University Graphics, Printing
Transportation research, planning and education are critical to our state, region, and nation. Programs in these areas are being provided by the University of North Carolina Institute for Transportation Research and Education (ITRE). ITRE was created in the Office of the President in 1978. Since then, the Institute has evolved into one of the major university transportation institutes in the country.

The Institute is headquartered in the Research Triangle Park and provides research, training, and planning assistance to state agencies and local governments. It also provides leadership in a wide range of transportation-related programs for public and private universities and their not-for-profit affiliates. To expand service to local governments within the state, ITRE opened an office this year at the University of North Carolina at Charlotte.

The Institute's involvement in transportation programs includes not only research and development in the planning, design, construction and operation and maintenance of highways, but also the operation and maintenance of vehicle fleets, and the effect of transportation systems on the communities they serve.

In 1984-85, Institute projects and programs focused on a variety of areas. With assistance from other agencies and organizations, they included: pavement condition surveys for state and municipally-maintained highways; coordination of a maintenance training program for the State Division of Highways; car and van care clinics to test motor vehicles; assistance to local governments in improving solid waste collection productivity; computer-assisted routing and scheduling of school buses in local districts; and internship and apprenticeship programs to provide work and learning opportunities for students in transportation fields.

Work will continue in these and other areas as ITRE continues to be a leader in transportation research and education.

William C. Friday
President
Trends in Transportation Research

Throughout its history, but primarily during this century, our nation has invested tremendously in a number of transportation systems that are in most cases the best in the world. Investment in our highway infrastructure has been estimated at about $3 trillion. Other modes have also received huge investments. For example, a $100 billion infrastructure in ports and marine terminals has been developed. Maintenance costs of the existing transportation infrastructure in its current condition has been estimated at about $1.8 trillion over the next 20 years. About 80 percent of that maintenance backlog is needed for highways.

Planning and development of new transportation facilities take from 20 to 40 years or more depending on the systems being built. Similar to the time required for the planning-design-construction sequence, major technological advances take between 15 and 30 years for research results to be fully implemented. Consequently, it often takes half a century for major innovations to come into widespread use. The airplane is an example of this in the field of transportation.

Important research needs are currently before us in order to develop new technologies and provide improved systems available to more efficiently, economically, and safely move increasing volumes of passenger and freight traffic. New systems are needed in order to carry our nation into the forefront of transportation technology during the next century. If we do not take the lead in this, other nations will. Each of these areas—systems maintenance, research, and innovation—suggest an urgent, critical need for increased emphasis on transportation research and development.

New research initiatives are currently underway nationally as the result of a growing recognition that transportation research funding in the past two decades has not been sufficient to address many of our most critical long-term needs. Three major programs that promise to have a significant impact on transportation research during the next five to 10 years are identified below.

These programs suggest areas in which the UNC Institute for Transportation Research and Education (ITRE), utilizing the resources of universities and other research organizations in North Carolina and elsewhere, needs to be involved during the next several years. These areas are:

1. The Strategic Highway Research Program, a proposed five-year, $150 million research program in applied highway research, coordinated through the American Association of State Highway and Transportation Officials;

2. A new initiative by the Engineering Directorate of the National Science Foundation...

ITRE's Role

Created eight years ago as an organization designed to be of service to the state, region, and nation, ITRE now finds itself at a critical juncture. The emphasis at ITRE during the period of 1978 to 1985 has been focused on applied research, technology transfer, and technical assistance to state agencies and local governments within North Carolina. ITRE's overall research and training program has reached approximately $1.5 million annually.

ITRE's professional staff includes individuals with backgrounds and experience in transportation planning, engineering, geography, economics, administration, management, and computer science. The Research Triangle Park offices of the Institute house 22 professional and supporting staff. In addition, a permanent project office with four personnel and headed by one of ITRE's eight assistant directors, is located on the campus of the University of North Carolina at Charlotte. An additional six personnel are part of a North Carolina Department of Transportation project team based in Raleigh, for a total ITRE personnel complement of about 32 persons. Based on current staffing, ITRE's major strengths lie in the areas of highway engineering, particularly pavement management, and energy-related studies. Other staff will be added as needed to meet project commitments.

During a given year, an additional 40 to 50 faculty, staff, and graduate students from...
private industry. Subjects of workshops held during this past year include roadway maintenance, scheduling and routing of school buses, operational improvements for urban solid waste collection and disposal, and microcomputer usage in transportation.

In its technology transfer program, the Institute has worked with more than 60 municipalities in the area of pavement maintenance management. ITRE has provided analyses and suggestions for operational improvements for municipal and county sanitation departments to more than 30 local governments. It has also worked with 15 local education agencies on developing computer-assisted approaches to school bus scheduling and routing. ITRE has worked with six local governments in Emergency Medical Services operational planning and budgeting.

Future Challenges

ITRE’s future challenge is to utilize staff research skills and to collaborate with researchers and educators from the UNC campuses and Duke University. It would also appear important to organize and manage project teams to write proposals and conduct research programs and projects in at least one of the three major research programs identified above. Careful study, planning and collaboration with research directors, administrators, and faculty during the next several months need to take place in order to determine which of these areas, among others, would provide the best opportunities. ITRE must be flexible enough to adapt to changing conditions and work in partnership with private industry and other organizations. In parallel with this, since ITRE’s people are its most valuable resource, efforts will be made to utilize the strengths and capabilities of the staff, recognizing that excellence stems directly from the efforts of those who make up any organization.

"ITRE has another emerging role to play in our university community: there is an urgent need to attract young people to the transportation research and education professions."

ITRE’s management must be able to provide the proper amount of direction and supervision while at the same time encouraging individual initiative on the part of the staff and individual researchers throughout The University.

ITRE, along with other transportation research organizations throughout the country, must be able to encourage creativity and innovation since these are much needed elements in reaching the goal of improved transportation system performance. To assist in accomplishing this, the ITRE staff will continue to be encouraged to maintain close contact with our constituents, the users of transportation research and informational services.

ITRE has another emerging role to play in our university community: there is an urgent need to attract young people to the transportation research and education professions. Reversing a decade-long decline in university enrollment in transportation programs, more students are entering graduate level transportation programs nationwide. Still, ITRE needs to "sell" the transportation industry to more students seeking an exciting and challenging career.

The parallel between ITRE’s direction and the search for excellence in our nation’s transportation research and training programs dictates a need to be willing to adjust and adapt to rapid change in the way that our research and training programs may be conducted during the next several years. ITRE will maintain its dedication to making sound but timely decisions, and continue its active leadership among the UNC constituent institutions, Duke University and other research organizations.

ITRE will continue to collaborate with transportation research institutes and centers nationwide in addressing these diverse and complex issues as part of several new initiatives in transportation research, training, and technology transfer.
UNC Institute For Transportation Research and Education and Campus-Based Affiliates
Transportation Research and Education Programs 1984-85

The University of North Carolina Institute for Transportation Research and Education's (ITRE) programs over the past year have continued to focus on a variety of transportation areas, including planning, highway maintenance and safety, energy use and conservation, personnel training, and computer-assisted vehicle scheduling and routing, among others.

Administrative changes during the past year include the appointment of Robert L. Martin, P.E., as an Associate Director for the Institute.

ITRE staff continued work in more than 14 major program areas including municipal sanitation improvements, pavement maintenance management, transportation personnel training, transportation surveys and planning projects, and computer-assisted school bus scheduling and routing. Some of these programs were carried out under the Energy Extension Service, sponsored by the North Carolina Division of Transportation Research and Development program, a training program for the Public Transportation Division of the NCDOT; and the development of EMS planning models for the North Carolina Office of Emergency Medical Services.

New training and technical assistance programs begun in 1984-85 are as follows:

Technology Transfer Program

Since the collection and evaluation of research materials and current publications is a time-consuming activity, managers and engineers may give these tasks low priority and never review some documents. ITRE has begun a two-year program to develop procedures to collect and disseminate this information for the NCDOT. Newsletters, abstracts and computer networks will be investigated to determine the most effective way to provide personnel with concise and pertinent technical information related to their jobs.

NCDOT Professional Engineering Review Program

Faced with the need to upgrade existing positions and predict heavy retirements, the Division of Highways requested that ITRE develop and teach several training courses to aid in the professional development of engineers and technicians.

ITRE has developed both a professional engineering review and an engineer-in-training course. Both courses are being video taped for home study. It appears that this program will continue as weekend lecture courses or home study courses for NCDOT personnel and perhaps others that request these review courses.

Highway Engineering Concepts Program

Currently there are more than 1,000 high level technicians in the State Division of Highways. ITRE is also developing a course in basic science with engineering applications as a requirement for consideration for promotion from the NCDOT's technician to the engineering positions.

To be taught this fall and annually thereafter, this course has all of the elements of the engineering-in-training and professional engineer's examinations but at a more fundamental level. The passage of this course will be an excellent start for those who may want to later pursue professional engineering registration.

Highway Technology Program

One of the greatest training needs is for lower level technicians both in management and technical training. ITRE is developing a training program consisting of manuals for home study, examinations and other qualifying requirements for lower level techni-

Traffic Signal Management Program

Funded by the State Energy Division, the Institute began a two-year traffic signal management program in collaboration with the North Carolina Department of Transportation. Recent university and technical school graduates were recruited and will receive additional on-the-job training through this program. These apprentices will be working with NCDOT engineers in refining traffic signals at more than 750 intersections in the state. The benefits of this program will be reaped by the public through less fuel consumption, fewer delays, stops and vehicle emissions at critical locations.

Other New Programs

In the area of safety and personnel training, ITRE is providing assistance to the Public Transportation Division of the NCDOT with the 1985 North Carolina Bus Roadshow, a competitive test of an urban system bus driver's skills behind the wheel, and knowledge of safety regulations and equipment used.
Research and technical assistance were begun with the N.C. Department of Administration in developing transportation and parking plans for the State Government Complex, and with North Carolina State University to develop an overall campus parking and circulation improvement program.

ITRE also began development of a review course on the 1985 Highway Capacity Manual. A series of workshops on the new manual will be offered throughout the 1985-86 fiscal year.

Other programs administered by ITRE during the past year were assigned directly to project offices at UNC-Charlotte and at North Carolina State University, as described in the following sections of this report. ITRE also coordinated programs and regularly collaborated with an additional 11-affiliates on eight campuses. A description of these programs and projects completes the description of a coordinated transportation research and public service program of about $3 million annually at North Carolina's universities.

ITRE's UNC-Charlotte Office

In January, 1985, a permanent ITRE project office was opened at the University of North Carolina at Charlotte. Dr. Wayne Walcott was named as Assistant Director and Office Manager. Previous ITRE research had been conducted there prior to the formal establishment of a research office.

The four-member staff concentrates on solving school bus transportation problems of routing and scheduling. The school bus routing and scheduling project traces its origins to the State Energy Extension Service in Transportation in 1980 and 1981. In January, 1982, ITRE was asked by the North Carolina Board of Education, Transportation Division, to help devise ways to reduce costs and improve safety in the operation of the state's school buses. From the first phase of the project came the decision to develop computer-assisted school bus routing and scheduling models. Development of the second generation routing model has been ongoing for nearly 18 months and is almost complete.

The routing model should be capable of saving 10 to 12 percent of the fuel cost of operating the school system buses, and result in shorter rides for students. In addition, transportation coordinators should find that their time spent routing buses is cut drastically while also adding flexibility to the process of routing and saving additional time in the bookkeeping process associated with operating a school bus fleet.

In general, the Routing Assistance Model (RAM) is designed to find the set of routes that involve the least distance to transport a set of students from their pick-up points to a school and return them to those points at the conclusion of the school day. This general objective is subject to several constraints, mostly to reflect safety considerations. These include avoiding hazardous streets and pick-up points, minimizing the total time the students must ride, and avoiding overloading the buses.

The Scheduling Assistance Model (SAM) is designed to minimize the number of buses required to serve all routes and minimize the non-productive travel time between routes. The models work independently but in sequence to assist transportation supervisors to achieve solutions to their particular routing and/or scheduling problems. Training is also being provided to local school district personnel in the use of the computer programs.

Continuing 1984 Programs At RTP Office

- Research and Technical Training with the Division of Highways, NCDOT
- Pavement Maintenance Management Systems for North Carolina Municipalities
- Vehicle Maintenance Program, Phase II
- Sanitation Division Operational Improvements Program
- Transportation Management Internship Program
- Public Transportation Apprenticeship Program
- School Bus Scheduling and Routing Program
- Technical Assistance to the Campuses of the UNC System
Center For Transportation Engineering Studies

The Center for Transportation Engineering Studies (CTES) at North Carolina State University completed its fourth year of operation as a project office for ITRE with continued emphasis on applied research and technical service related to transportation engineering. This Center is led by Civil Engineering Department Head Dr. Paul Zia who has been assisted by Dr. Paul Khosla as Associate Director since July 1, 1985. CTES coordinates and conducts basic and applied research; provides short-term professional services of various NCSU faculty members in response to specific requests for technical assistance from the North Carolina Department of Transportation; and develops continuing education programs concerning research findings. Earlier highway research at NCSU had been conducted in the NCDOT Highway Research Program which was expanded in 1980 to create CTES.

During 1984-85, CTES received funding for four continuing and four new projects. This represented a 22 percent increase in highway projects and research funding over the previous year. Emphasis of these research projects continued to be on the maintenance problems of highway systems, including landscape maintenance schemes, load capacity of bridges, bridge inspection data analysis, investigation of flexible pavement distress and rehabilitation planning, and a study of bond characteristics of epoxy coated prestressing strand.

Participating in these projects were seven faculty members and 10 graduate students. Their efforts resulted in 12 publications and seven conference presentations. Responding to NCDOT's requests for technical services, CTES provided assistance in bridge girder production problems, and in the assessment of pavement conditions.

For 1985-86, seven continuing and four new projects with a total budget of about $400,000 were provided through ITRE to fund CTES research. New projects include research on bridge maintenance level of service policy and prioritization, properties of high strength concrete, plastic pavement marking materials, construction of "top down" retaining walls, analysis of compact pole-type footings, and use of the dilatometer for measuring lateral soil response. In addition, a research contract for $375,000 in the area of composites technology in the design and construction of bridges received multi-year funding from the Federal Highway Administration.

Department of Mechanical and Aerospace Engineering

Transportation research into diesel engines and environmental noise pollution continued at the Mechanical and Aerospace Engineering Department at North Carolina State University, under the direction of Department Head Dr. John A. Bailey.

A parametric study was carried out on a single cylinder research diesel engine to determine the effect of engine operating variables such as water content in the emulsion, engine speed and load, and air charge temperature on the combustion performance and exhaust emission characteristics. The results of this investigation showed that increasing the water content in the emulsion effectively reduced nitrogen oxide (NOx) and soot emission.

Unfortunately, the ignition delay and the brake specific fuel consumption as well as the unburned hydrocarbon and carbon monoxide emissions were adversely affected by the increase of water content in the emulsified fuel. While heating the intake was instrumental in reducing the ignition delay and thus improving the combustion characteristics of the engine, it was found that it has an unfavorable effect on nitrogen oxide and soot emissions. It is expected that turbocharged and adiabatic engines may benefit from the use of water/oil emulsions in diesel engines.

Work has also continued into tire/pavement interaction noises, a project funded by the U.S. Department of Transportation. Research at NCSU will continue in this area until 1987 with total funding reaching $420,000. Areas of study include tire noise, tire vibration, vehicle safety and energy dissipation.

The noise generated by large truck tires rolling at high speeds is responsible for the major portion of surface transportation noise that contributes to our nation's overall environmental noise pollution problem. Previous research has identified the tire's dominant sound generation mechanism to be tire-surface vibration resulting from tire/pavement interaction.

The ultimate goal of this research is to be able to accurately predict tire/pavement interaction noise levels once the road surface profiles and tire tread pattern are known. The information obtained from this investigation is also used to determine the trade-offs between tire noise reduction and pavement safety factors for various highway pavements.
Transportation research within the Department of City and Regional Planning on the UNC-Chapel Hill campus during recent years has focused on urban passenger transportation, particularly the efficiency and regulatory aspects of transit, taxicabs, and special paratransit services for the handicapped.

Primarily funded by the U.S. Department of Transportation and headed by Professor Goman Gilbert, these research efforts have all been national in scope. Three specific projects illustrate the broader transportation research focus within the department. These include studies of the regulation of taxicabs by local government; the operating characteristics of the U.S. taxi industry; and the regulation of airport ground transportation services.

The taxicab regulation project had two parts: a national survey of cities and a series of 11 case studies. The survey was conducted by telephone and included questions about how each city sets fares, controls the number of cabs, and administers and enforces its regulations. The case studies involved on-site interviews with city officials and taxi operators.

The taxi operating characteristics study involved more than 900 taxicab operators who responded to detailed questions regarding their operations. The study includes such variables as cost per mile, revenues per hour, vehicle fleet age, and use of lease drivers.

The airport ground transportation study is currently being conducted. It has two parts: a national survey of airport managers and a series of ten case studies. About 90 percent of the 211 sample airports have responded to a mail survey covering airports' control of taxicabs, limousines, rental cars, and hotel vans. Further research in airport access is anticipated.

Transportation and Infrastructure Research Center, Duke University

A number of faculty members of various departments at Duke University have, on an individual basis, been active in many diverse aspects of transportation and infrastructure research over a period of time. At the Transportation and Infrastructure Research Center, which was created in 1983, research is carried out in both the facilities and planning aspects of transportation systems. Professor Mani“Moy” Biswas serves as Director of the Center. The Associate Director is Professor Eric Pas.

On-going projects include investigation of strength and durability of polymer-based structural mortar for bridge construction and rehabilitation; investigations in travel demand analysis; application of electric vehicles in meeting selected travel needs, and design innovations in bridge decks. The Transportation and Infrastructure Research Center serves as a vehicle for coordinated effort in this area of national and international importance. The Center also provides a point for contact for external agencies and organizations interested in transportation and infrastructure research at national, regional, and state levels. In 1984, the Center became a member of the Council of University Transportation Centers and also became formally affiliated with the UNC Institute for Transportation Research and Education.

Otis Personal Rapid Transit, Duke University Medical Center, Durham

The Center is within the School of Engineering and is governed by a steering council chaired by the Dean of Engineering. Representatives of the engineering departments and the Director of ITRE are the members of the council.

The Center draws its primary strength from the eminent faculty of The University. In addition to the resources of the four engineering departments, professional expertise from other departments, institutes, and professional schools are available to the Center. In particular and symbolic of Duke's national scope is the Institute of Policy Sciences and Public Affairs, which conducts studies and analyses of major policy issues facing our national and world economy.
Highway Safety Research Center

The University of North Carolina Highway Safety Research Center's (HSRC) research program deals with many aspects of highway safety. HSRC's current major efforts include occupant restraint programs (both increasing the use of and evaluating the effectiveness of adult and child restraint systems), drunk driving deterrence projects, and accident analysis projects (including the driver, vehicle and roadway aspects of crashes).

HSRC has been under the direction of Dr. B.J. Campbell since the Center was created in 1967. Forest Council is Deputy Director.

Occupant Restraint Programs

Motor vehicle crashes are the leading cause of deaths among children, but the proper use of child safety seats effectively offsets this threat. HSRC has been involved in child passenger safety research since 1977. The current child restraint project involves evaluating the effects of the child passenger safety law; training and educating health care professionals, the law enforcement community and volunteer groups; and the administration of more than 125 safety seat loaner programs across the state. HSRC also conducts public information and education campaigns on child passenger safety and operates a statewide toll free telephone number.

HSRC conducts projects to increase seat belt use in North Carolina. Seat belt use is especially critical for high school students, given their extremely high crash risk. A project designed to increase seat belt usage among high school students is an offshoot of a previous HSRC project that used an education and incentive campaign to increase seat belt use at Chapel Hill High School and later in the entire community. Currently, three North Carolina high schools are participating. The goal is to create a successful prototype that other high schools will be interested in following in the future.

Drunk Driving Countermeasures

The drunk driving problem continues to grow while effective countermeasures have remained difficult to identify or implement. HSRC has several projects dealing with drunk driving deterrence on both the national and state levels. HSRC is working with the North Carolina Department of Human Resources on an evaluation of Alcohol-Drug Education Traffic Schools. HSRC is also monitoring the effects of North Carolina's new driving while intoxicated (DWI) laws.

Several federal projects with the National Highway Traffic Safety Administration (NHTSA) are studying the impact of law enforcement as a drunk driving deterrent. HSRC is examining the effects in three states of combining innovative enforcement strategies with a strong public information campaign. Two other NHTSA projects evaluate the effectiveness of jail sanctions and administrative license removal as deterrents to drunk driving.

Another project looks at the alcohol-injury relationship in crashes to see if the mere presence of alcohol makes the body more vulnerable to injury. The results should have implications for alcohol education as well as treatment of trauma victims.

Accident Data Analysis

In its accident data analysis project, HSRC has set up a system to assist local police in North Carolina to use local accident and roadway data available on the statewide system. The goal is to allow cities to analyze their own local accidents and eliminate the need for cities to set up costly duplicate accident record systems of their own.

The impact of the automobile fleet shifting to smaller cars is being evaluated in an HSRC project with the Federal Highway Administration (FHWA). This project will identify how small cars are overrepresented in accidents and will define potential countermeasures. The results will be used by the FHWA in planning and funding their roadway research program for the next five years.

Another ongoing FHWA project involves the development of exposure measures for highway safety analysis. The overall goal of this project is to define more accurate and meaningful measures of the risk of being in a crash. The current focus is on signalized intersections. The results will be used to calculate more accurate accident rates in roadway-related accident research.

HSRC is participating in two projects that evaluate roadside features. Under one project with Goodell-Givas, Inc., HSRC is developing a pictorial roadside hazard scale based on data collected from samples of roadsides in six states. A system for predicting the frequency and severity of roadside accidents will also be developed. These models will be used to determine the accident benefits which would be derived from various roadside improvements.

In a separate effort with Southwest Research Institute, HSRC is studying the safety performance of highway apertures. HSRC's involvement includes studying the interior space of vehicles as it relates to deformation by striking objects, and studying the hazard of the vehicle that rebounds from an aperture such as a guardrail or median.

Large trucks are overrepresented in fatal crashes even when mileage is taken into account. HSRC has a project to examine the relationship between a driver's performance record while operating a private vehicle as opposed to his record while driving commercially. The results will be used by state agencies as well as motor carriers in evaluating driver performance and in making decisions about hiring and continued employment.
Other ITRE Affiliates

North Carolina's universities have a long-standing record of excellence in transportation research, planning, management studies, and training. These transportation programs cover all modes of transportation and are focused on problems of local, statewide, regional, and national significance.

This research is as varied as the campuses. In addition to the major program areas identified on the previous pages, studies also are conducted at other campuses on the environmental impact of transportation systems, transportation logistics, public and private transportation systems, and in many other areas. Public service programs are offered at several campuses. Following is a brief description of some of the transportation programs.

Appalachian State University

The traffic safety education program staff at this western North Carolina campus has conducted research and training in emergency vehicle operations and vehicle fleet operational efficiency. Major development work on this campus was performed for ITRE to establish a program in vehicle fleet maintenance training.

East Carolina University

Consistent with the mission of this regional university, research has been conducted by the Department of Sociology and Economics on the social and economic impacts of transportation on communities, with emphasis on those in coastal environments. This department has been involved with ITRE for a multi-year research study on coastal energy commodities movements. ECU's Traffic Safety Center also conducts a public service program.

North Carolina Agricultural and Technical State University

Since 1971, Transportation Institute and other researchers on this campus have conducted studies on transportation logistics, motor freight management, public transportation, rural transportation, and paratransit services. North Carolina Agricultural and Technical University offers graduate and undergraduate degrees in the field of transportation. A traffic safety education program is also located on this Greensboro campus.

North Carolina Central University

On this Durham campus, research is being conducted by the Department of Geography on the spatial analysis of transportation services for minority communities.

North Carolina State University

In the Industrial Engineering Department, ITRE continued funding research in school bus scheduling models. This work is having a continued positive impact on overall transportation improvements in local education agencies throughout the state.

University of North Carolina at Wilmington

Specialized studies are being conducted at the University of North Carolina at Wilmington on the effects of transportation systems on coastal environments. Research and analyses pertaining to the North Carolina port facilities at Wilmington and Morehead City have also been conducted by faculty on this campus.
Council on Transportation Research and Education

**Purpose:** Recommends to the President of The University policies for the operation of the Institute.

**John Sanders** (Chairman)
Director
Institute of Government

**Roy Carroll**
Vice President for Planning
The University of North Carolina

**William DeMarla**
Medical Director
Blue Cross-Blue Shield of North Carolina

**George Herbert**
President
Research Triangle Institute

**E. Walton Jones**
Vice-President for Research and Public Service Programs
The University of North Carolina
(Through June 30, 1985)

**L. Felix Joyner**
Vice-President for Finance
The University of North Carolina

**Larry Monteith**
Dean
School of Engineering
N.C. State University

**Billy Rose**
Deputy Secretary
N.C. Department of Transportation

Pictured left to right are: John Sanders, Edd Hauser, William DeMarla, E. Walton Jones, Larry Monteith, Billy Rose, Roy Carroll and L. Felix Joyner.
ITRE Advisory Committee

**Purpose:** Assists the ITRE Council in ensuring that ITRE's program is responsive to user needs and is meeting its program goals.

- **Billy Rose** (Advisory Committee Chairman)
  - Deputy Secretary
  - N.C. Department of Transportation

- **Carl E. Annas**
  - Corporate Group Vice President (Retired)
  - Burlington Industries Transportation, Inc.

- **C. Ronald Aycock**
  - Executive Director
  - N.C. Association of County Commissioners

- **John Brantley**
  - Executive Director
  - Raleigh-Durham Airport Authority

- **Henry Clegg**
  - Director
  - Highway Division
  - Carolinas Branch
  - Associated General Contractors of America, Inc.

- **Carson D. Culbreth**
  - Director
  - N.C. Energy Division
  - Department of Commerce

- **William M.A. Greene**
  - Executive Director (Retired)
  - State Ports Authority

- **Bobby Mattocks**
  - President
  - Jenkins Oil Company

- **Elbert L. Peters, Jr.**
  - Executive Vice President
  - N.C. Motor Carriers Association

- **Tom Runkle**
  - Deputy Controller
  - State Board of Education

- **C.E. Vick, Jr.**
  - President
  - Kimley-Horn and Associates, Inc.

- **S. Leigh Wilson**
  - Executive Director
  - N.C. League of Municipalities

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ITRE Technical Coordinating Committee

**Purpose:** Gives advice to ITRE's Director in the formulation and coordination of programs.

- **W. F. Babcock**
  - Associate Director
  - UNC-ITRE

- **John A. Bailey**
  - Head
  - Mechanical Engineering Department
  - N.C. State University

- **Mrinmay Biswas**
  - Director
  - Transportation and Infrastructure Research Center
  - Duke University

- **B.J. Campbell**
  - Director
  - Highway Safety Research Center
  - UNC-Chapel Hill

- **Jim Clay, Jr.**
  - Director
  - Urban Institute
  - UNC-Charlotte

- **Basil Coley**
  - Acting Director
  - Transportation Institute
  - North Carolina A&T State University

- **Edd Heuser (TCC Chairman)**
  - Director
  - UNC-ITRE

- **Al King**
  - Director
  - Traffic Safety Center
  - East Carolina University

- **Ellis King**
  - Chairman
  - Department of Civil Engineering
  - UNC-Charlotte

- **Ben Loeb, Jr.**
  - Assistant Director
  - Institute of Government

- **John R. Maiolo**
  - Chairman
  - Department of Sociology, Anthropology and Economics
  - East Carolina University

- **Woodrow W. Nichols**
  - Chairman
  - Department of Geography
  - North Carolina Central University

- **Evan Rowe**
  - Coordinator of Academic Programs,
    - Safety and Driver Education
  - Appalachian State University

- **Michael Stegman**
  - Chairman
  - Department of City and Regional Planning
  - UNC-Chapel Hill

- **Paul Zia**
  - Head
  - Civil Engineering Department
  - N.C. State University
ITRE is in the fortunate position of having an ideal location for research and development programs. Located in North Carolina's Research Triangle Park, ITRE is able to draw on the resources of the three leading research universities in the state: the University of North Carolina at Chapel Hill, North Carolina State University at Raleigh, and Duke University in Durham. All the campuses are within a 30-minute driving time, and are linked to ITRE's park offices via several computer links and local telephone service.

Also located in the Research Triangle Park is the North Carolina Microelectronics Center, which has a microwave communication network established between locations in North Carolina and the Southeast. Within the next two years, the 100-acre tract on which ITRE is located will also house the central offices and studios for the Center for Public Television in North Carolina. This is anticipated to further enhance ITRE's ability to conduct educational programs throughout the state, and to produce professional-quality training aides for ITRE's workshops and short courses.

In addition, being administratively housed in the Office of the President of The University of North Carolina, ITRE has regular collaboration with, and participation by faculty and staff from other university campuses in the state. To date, faculty, staff and graduate students from nine campuses, plus several consulting firms and the Research Triangle Institute, have participated in ITRE's programs and projects. Twenty-two of ITRE's staff of 32 professional and support persons are located in a 20,000 square foot building in the Research Triangle Park. The remainder are housed in its offices at UNC-Charlotte campus, and in Raleigh in facilities provided by the North Carolina Department of Transportation.

**Computation Facilities**

From its Park location, ITRE has direct lines to the following computational facilities: the Triangle Universities Computer Center (TUCC), the State Computing Center in Raleigh (IBM 3083 computers); and at its UNC-Charlotte office, the primary mainframe computer (Burroughs A9).

TUCC is a regional computer network formed and operated jointly by the University of North Carolina at Chapel Hill, North Carolina State University at Raleigh, and Duke University. The computer equipment at TUCC consists of one IBM 3081 with twenty-four million bytes of memory, one IBM 370 Model 166 with eight million bytes of memory, multiple 3330- and 3350-type disk drives, 13 tape drives, card readers, a VAX/750 computer and various printers. Also available is a small Hewlett-Packard 2000 Access computer which provides BASIC interactive computing.

ITRE's in-house computerized graphics and word processing capabilities are enhanced by a complement of IBM PC-AT, PC-XT, and Apple microcomputers. These microcomputers provide communication terminals for many research projects plus personal computing and word processing capability for the staff. A Tektronix graphics terminal at the State's Land Resources Information Services (LRIS) is regularly used for ITRE network research and development projects, particularly school bus routing.

The UNC Educational Computing Service (ECS) provides programming and system support to ITRE.

**Laboratories**

Laboratories at the Triangle Universities that are available for ITRE projects offer tremendous opportunity for research.

At North Carolina State University, the facilities include a complete structural testing laboratory, a materials and geotechnical engineering laboratory, a traffic engineering laboratory, an ergonomics laboratory, subsonic and supersonic wind tunnels, extensive sound and vibration laboratories with anechoic chambers, a large reverberation room, a machinery noise laboratory with field test and analysis instrumentation, a signal processing laboratory using a Data General AP130 Eclipse computer, a computer graphics and vibration analysis laboratory using a Nicolet 6602 structural analysis system and a Tektronix 4114 terminal, materials processing laboratory, an experimental stress analysis and photoelasticity laboratory; and aerelasticity laboratory; automotive performance and emission control facility; a solar energy storage laboratory; a heat transfer laboratory, and a robotics laboratory.

Additional computational facilities include VAX 11/7509 and IBM 3081 computers, a 4341 CAD/CAM system, micro and array processors and three microcomputer workshops with 16 to 30 IBM PC-XT's each for instructional purposes.

The Triangle Universities are among the sponsoring institutions of the Oak Ridge Associated Universities at Oak Ridge, Tennessee. Through this cooperative association, graduate research programs have at their disposal the facilities and research staff at Oak Ridge National Laboratory (ORNL). Staff and faculty go to Oak Ridge for advanced study in their particular fields. ITRE, in particular, has a working relationship with the ORNL Energy Division.

**Libraries**

At its Research Triangle Park offices, ITRE has assembled a complete reference library in the field of transportation. This collec-
A large collection of state and federal government publications further strengthens the library's research holdings. Since 1924, the D.H. Hill Library has been a depository for U.S. federal documents. The library has a comprehensive collection of government research reports on microfiche including reports published by the U.S. Department of Transportation, the Department of Energy (DOE) and its predecessor agencies; the Atomic Energy Commission (AEC) and the Energy Research and Development Administration (ERDA); also, the National Aeronautical and Space Administration (NASA); the Educational Resources Information Center (ERIC) and the National Technical Information Service (NTIS).

The libraries of Duke University consist of the William R. Perkins Library and its seven branches on campus, including the engineering branch; the Undergraduate Library; the Pearse Memorial Library at the Duke Marine Laboratory in Beaufort; the Fuqua School of Business Library; the School of Law Library; and the Medical Center Library. These libraries contain more than 3.3 million volumes. Approximately 10,300 periodicals, 11,300 serials, and 166 newspapers are received regularly.
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Clinton L. Hainbach, Ph.D., P.E.
Robert L. Martin, M.S., P.E., AICP
Robert S. Foyle, M.S., P.E.

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Rosalie Neville
Debra Butterworth, B.A.
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The UNC Institute for
Transportation Research and Education
P.O. Box 12551
Research Triangle Park, NC 27709
E.W. HAUSER, DIRECTOR