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Transportation Research and Public Service Organizations

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Traffic Safety Center

Traffic Safety Center*

Transportation Institute*

Traffic Safety Center

Urban Institute*

* Members of Executive Committee of ITRE's Technical Coordinating Committee

** The Transportation and Infrastructure Research Center at Duke University is also an ITRE Research Affiliate
Preface

The following annual report presents an accounting of the past year's accomplishments, a summary of program and project activity, and the current status and future plans of The UNC Institute for Transportation Research and Education (ITRE). The institute's level of activity and amount of financial support has increased significantly over the previous fiscal year as can be seen in the various sections of this report.

ITRE presently has a full-time staff of eighteen, plus supporting staff through the UNC General Administration at Chapel Hill. While the body of this annual report reflects the activities of the ITRE staff, a number of other activities in transportation research and education throughout the sixteen campus University is reflected in the Appendices. In all of these programs and projects, a wide range of transportation issues and problems are being addressed by faculty, staff, and students throughout the University of North Carolina. As in previous years this annual report affords the ITRE Council, the UNC General Administration, the ITRE Advisory Committee, University faculty and staff, as well as state, local and federal agencies, an opportunity to review ITRE's programs and projects.

The University of North Carolina was chartered in 1789 and opened its doors to students at the Chapel Hill campus in 1795. Throughout most of its early history, it has been governed by a Board of Trustees chosen by the legislature and presided over by the Governor. During the period 1917-1972, the Board consisted of one hundred elected members and a varying number of ex-officio members.

By an act of the General Assembly of 1931, it was merged with The North Carolina College for Women at Greensboro and The North Carolina State College of Agriculture and Engineering at Raleigh to form a multicampus institution designated The University of North Carolina.

In 1963, the General Assembly changed the name of the campus at Chapel Hill to The University of North Carolina at Chapel Hill and that at Greensboro to The University of North Carolina at Greensboro. In 1965, the name of the campus at Raleigh was changed to North Carolina State University at Raleigh.

Charlotte College was added as The University of North Carolina at Charlotte in 1965, and, in 1969, Asheville-Biltmore College and Wilmington College became The University of North Carolina at Asheville and The University of North Carolina at Wilmington, respectively.

On October 30, 1971, the General Assembly in special session merged the remaining ten state-supported senior institutions into The University as follows: Appalachian State University, East Carolina University, North Carolina Agricultural and Technical State University, North Carolina Central University, North Carolina School of the Arts, Pembroke State University, Western Carolina University and Winston-Salem State University. This merger, which resulted in a statewide multicampus university of sixteen constituent institutions, became effective on July 1, 1972. Over 120,000 students currently attend these schools.

The constitutionally authorized Board of Trustees was designated the Board of Governors, and the number was reduced to thirty-two members elected by the General Assembly. The Board is responsible for the general determination, control, supervision, management, and governance of all affairs of the constituent institutions. Each constituent institution has its own board of trustees, and each is headed by a Chancellor as its chief administrative officer. The Chancellors of the constituent institutions are responsible to the President as the chief administrative officer of The University of North Carolina.

The President's staff is designated as UNC-General Administration. Five Vice Presidents report directly to the President. It is in this office that the UNC Institute for Transportation Research and Education (ITRE) is located as an interinstitutional activity under the Vice President for Research and Public Service. It has grown in its seven-year history to become one of the major university transportation institutes in the country. This Annual Report presents not only the activities of the most recent fiscal year, but also a brief summary of the Institute's seven-year history.
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On August 1, 1984, Edwin W. (Edd) Hauser was appointed Director of the UNC Institute for Transportation Research and Education. He was also appointed to continue as Adjunct Associate Professor of Civil Engineering at North Carolina State University.

In addition to his new administrative duties, he continues to manage the Institute's programs in school bus transportation management, transportation planning, and energy conservation programs.

Before coming to the University in 1979, Dr. Hauser was Senior Transportation Systems Planner at the Research Triangle Institute. During a 10-year period, he was involved in engineering, transportation planning, environmental assessment, and highway safety studies.

In addition to his undergraduate degree in Civil Engineering from North Carolina State University, he also holds the M.S. and Ph.D degrees from that Institute. He earned a Master of Regional Planning degree from the University of North Carolina at Chapel Hill and studied for a year at the Northwestern University Graduate School in Evanston, Illinois. He is a member of several professional organizations and currently serves as Vice President of the National Council of University Transportation Centers.

Edd and his wife, Julia, and their children, Winn, Kim and Justin, live in Raleigh where they are involved in various civic and church activities.
Professor W. F. Babcock retired from the Civil Engineering faculty at North Carolina State University in 1984. Over a career spanning more than four decades, he has served as Professor, State Highway Administrator, Consulting Engineer, and most recently as the first Director of ITRE. His contribution to the early development of the Institute is measured in the success of the program as reflected throughout the pages of this report.

A native of Boston, Massachusetts, he completed his undergraduate and graduate work in Civil/Transportation Engineering at M.I.T. His teaching career began at NCSU in 1940 and he became full professor and head of transportation engineering in 1952. Throughout his career at NCSU, he served as an advisor and consultant in Transportation Engineering to more than 60 municipalities in North Carolina.

In 1957 Governor Hodges reorganized the North Carolina Highway Department and asked Professor Babcock to serve as the first State Highway Administrator. Some of his major accomplishments included the development of the Photogrammetry, Traffic Engineering and Planning departments. He developed the first long range highway development plan in 1960 which is still being followed. During his twelve years in this position he had the opportunity to professionalize the department, and brought in over 500 graduate engineers.

Returning to NCSU in 1969, he continued to serve as a consultant to state and local governments. When the UNC Institute for Transportation Research and Education was formed in 1978, Babcock was asked to serve as Director, reporting directly to President William Friday.

During his 44-year career, Professor Babcock has been National President of Chi Epsilon, a member of Tau Beta Pi, Sigma Xi, and Theta Tau, and a Fellow of ASCE and ITE, serving on dozens of committees and chairing many. He is also a member of the NCSU Academy of Outstanding Teachers and is an "Alumni Distinguished Professor". He has been awarded many honors including the "Outstanding Civil Engineer in North Carolina" and the "Outstanding Transportation Engineer" awards by the American Society of Civil Engineers in 1979.

Throughout the state of North Carolina his colleagues, associates, and friends know him primarily as "Mr. B.". The University is fortunate to have his continued association with the Institute.
I. The UNC Institute for Transportation Research and Education

Over 25 percent of our nation's output is tied to our transportation systems. Transportation is such an important part of the economy of our nation, state, and communities, that continuous upgrading of our systems and facilities are needed. Colleges and universities have traditionally provided technical and professional assistance to government agencies and private industry in the area of transportation systems, and in providing innovative approaches in the operation of those systems.

Recognizing the unique role of universities in solving transportation-related problems, the North Carolina General Assembly (Session Laws 1975, Second Session, Chapter 983, Section 57) authorized the Board of Governors of The University of North Carolina to establish an Institute for Transportation Research and Education (ITRE). The Institute was established in the office of UNC President William Friday, and therefore was designed to utilize the resources of all the 16 institutions that make up the UNC system. Since its first year of operation in 1978, ITRE has grown to one of the major university transportation institutes in the country, with 1983-1984 projects and grants totalling over one million dollars. Cumulative project revenues to date are over $3.0 million.

The policy-making body of the Institute (appointed by the President) is called the Council for Transportation Research and Education. In addition, an Advisory Committee works with the Council and ITRE staff in reviewing programs and projects and ensuring that these are responsive to user needs throughout the state. The Advisory Committee represents city and county government, various state agencies, and several private industry groups that are users of transportation research, technical assistance, and training services. Members of the ITRE Council and Advisory Committee are listed in the Appendices.

A Charter setting out the purpose, functions, and operating framework for ITRE was adopted by the UNC Board of Governors at its meeting of February 10, 1978. A set of operating policies was subsequently adopted by the ITRE Council and the UNC General Administration in July, 1981. As stated in these documents, ITRE's function includes providing a leadership role among the constituent institutions of The University of North Carolina, private universities, and not-for-profit research affiliates of the universities in research, education, and training activities in a wide range of transportation related programs.

ITRE's involvement in transportation programs ranges from the engineering functions of planning, design, construction, operation, and maintenance of highways and other transportation facilities, to the management of vehicle fleets, their efficient operation, and the impacts of transportation systems on the communities they serve. Energy use, environmental impact, safety, efficiency, and cost effectiveness are just some of the impacts that ITRE has analyzed. Services are available for any government agency in the state, including local governments. ITRE has collaborated with a number of state agencies and other groups in developing and making available to local governments a range of programs and services.
II. Transportation Research Organizational Structure

While the core staff of the UNC Institute for Transportation Research and Education is located in the office of the President of The University of North Carolina, many transportation research, training, and public service programs of the Institute are carried out in part on several campuses of The University. ITRE's headquarters in the Research Triangle Park houses eighteen professional and support staff members. An additional research office is located on the campus at UNC-Charlotte. This office, physically housed in the Urban Institute, is involved in school bus scheduling and routing programs, among other projects.

The Center for Transportation Engineering Studies at North Carolina State University has also continued to function as a second on-campus project office and research affiliate of ITRE. The Center is a focal point for faculty and staff resources on the North Carolina State University campus. Approximately fifteen faculty members, staff, and graduate and undergraduate students are supported by this Center.

Two other research centers that are an integral part of the overall transportation research and training program for the University are the Highway Safety Research Center at UNC-Chapel Hill and the Transportation Institute at North Carolina A&T State University in Greensboro. These organizations serve as on-campus research affiliates of The Institute.

Other programs closely affiliated with the Institute on UNC campuses include three traffic safety education programs at Appalachian State University, East Carolina University, and North Carolina A&T State University. In addition, the faculty at the Department of City and Regional Planning at UNC-Chapel Hill is also involved in Institute programs and projects.

During a given year, an additional forty to sixty faculty and staff, as well as graduate and undergraduate students from these Centers and programs, as well as faculty from other campuses, work on ITRE programs and projects. During the past year, fifty-two personnel have been engaged in this capacity. To date, faculty, staff and students from nine separate campuses have participated in sponsored programs at the Institute.

A number of faculty colleagues are appointed by the ITRE Council to work with ITRE on its Technical Coordinating Committee. A listing of the current Technical Coordinating Committee, as well as other affiliated faculty and staff, is shown in the appendices. ITRE also maintains close working relationships with other research agencies and private firms in the area and from time to time uses such resources for specific project tasks.

During the past year, the Transportation and Infrastructure Research Center was established on the campus at Duke University in Durham, approximately seven miles from the Institute's facilities at Research Triangle Park. The Center has now become a part of the overall ITRE operation as of October, 1984. Faculty from Duke University, North Carolina State University, and UNC-Chapel Hill are currently developing new approaches at joint teaching programs for graduate and undergraduate students. These efforts are expected to result in an increased level of multidisciplinary and multicampus project activity during the coming years.
III. Summary of Progress

During the past year, ITRE has continued to be directly involved in programs and projects that are of significance to state and local governments throughout North Carolina. Government agencies, as well as private sector industries that are involved in transportation and other public services, are in the midst of assessing such things as management skills and how to improve levels of service for their transportation systems.

For example, the Division of Highways of the North Carolina Department of Transportation (NCDOT) has continued a program begun three years ago to improve the level of service of their highway maintenance activities. ITRE has continued to assist the North Carolina Division of Highways in the development of its maintenance management program and in the training of maintenance personnel throughout the state.

As another example, the State Board of Education's Controller's Office has begun a strong management improvement program. Through this program, school bus garages in the 100 counties of the state are beginning to upgrade their capabilities to operate the state's school bus fleet in a more efficient manner. ITRE is assisting the State's Pupil Transportation Division as well as local education agencies across the state in bringing about these changes. Funding is provided for this program by the Energy Division in the State Department of Commerce.

One of the current major needs identified by public transportation agencies across the state (as well as nationwide) is the training of management personnel. Under the direction of the Public Transportation Division of the NCDOT, ITRE is coordinating a series of training programs. Through this program recent graduates or graduate students from several campuses of The University of North Carolina receive on-site training and provide technical assistance to local transportation planning and operations departments.

Similar to the NCDOT, municipalities in the state have concentrated on protecting the investments in city-maintained streets. ITRE has worked with approximately 50 municipal public works departments in helping them establish a municipal pavement management system, conduct initial pavement condition surveys, and other tasks including training.

ITRE has offered a program in municipal sanitation division operational improvements since 1981. This program is partially funded through the North Carolina Energy Extension Service. The program has been provided to over 25 sanitation departments in municipalities of varying size throughout North Carolina, plus a few county solid waste operations. The program objective is the improvement of sanitation operations, both productivity and fuel savings. Municipalities often experience a need for sanitation division operational improvements due to the presence of fragmented and overlapping routes, and/or significant differences in route volumes and collection times.

As yet another example, counties throughout the state are attempting to find ways to operate their emergency medical services in a more cost-effective manner now that federal funding has been cut back. ITRE is working with the Office of Emergency Medical Services in the Department of Human Resources to provide management and technical improvements in the capabilities of counties and other local governments to plan for more efficient use of resources.

In all of these areas, as well as in many others in which ITRE staff and other university faculty are involved, the trend is to continue using computer facilities to increase management information systems and technical analysis capabilities. ITRE has recently upgraded its computer and microcomputer facilities and provides training for personnel in state agencies and local governments in the use of various software packages relevant to the transportation industry.

A significant amount of ITRE program and project activity has centered on assisting local governments in meeting their transportation-related needs. Some of the more important transportation studies and training activities that have continued to be available for local government agencies in the past year include:

- Pavement condition studies, maintenance management studies, and maintenance technical training for street and highway improvements.
- Improving school bus scheduling and routing; transit scheduling; emergency medical services planning methods; transport of hazardous materials; routing of municipal sanitation vehicles.
- Energy conservation in transportation systems and vehicle maintenance; information and training programs for motor vehicle fleet operations and for individual motorists.

Exhibit A presents a summary of contracts and grants in force during fiscal year 1983-1984, along with the sponsoring agencies. Details on these projects are in Section IV. As in the past, a number of important research and development projects conducted by ITRE are carried out by full-time faculty and staff on one or more of the campuses of the sixteen unit University of North Carolina.

Exhibit B shows a cumulative summary of financial support for the Institute for its seven-year history. The appendices include a cumulative summary of financial support for the Institute for five fiscal years and a cumulative summary of projects and programs by title.
Exhibit A
Project Sponsors, 1983-84

Local Education Agencies (2.8%)
NCDOT, Research & Development (23.4%)
NCDOT, Maintenance Technical Training (15.1%)
State Energy Division (30.0%)
Public Transportation, NCDOT (11.1%)
N.C. Office of EMS (7.4%)
UNC & Constituent Institutions (3.0%)
Municipal Governments (7.3%)

Exhibit B
Total Institute Support by Fiscal Year

(\$ in Millions)
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3
'78-'79 '79-'80 '80-'81 '81-'82 '82-'83 '83-'84
IV. Summary of Research and Training Activities, 1983-1984

Introduction

This section contains a brief summary of each research, training and public service activity undertaken by ITRE during the past year. These projects have been handled in one of several ways: 1) by full time or temporary ITRE personnel when it appears that such an approach is in the best interests of The University and the sponsors; 2) by a combination of ITRE and on-campus faculty, staff and graduate students, and 3) by completely assigning projects to one or more of the university campuses. In the latter case, principal investigators from the campus center or department carry out the research with ITRE generally acting in a management and coordinating role. A brief description of each of these programs and projects follows.

A. Research and Technical Training with the Division of Highways, NCDOT

Program Director: W. F. Babcock, ITRE
1983-1984 Administrative and Research Budget: $9,700

Since July 1, 1979, ITRE has continuously been involved in the management and execution of the research and training program with the Division of Highways of the NCDOT. Projects undertaken by ITRE or assigned to campus based faculty and staff are determined by the Research and Development Sub-committee of the Division of Highways. In certain cases, federal aid funds are used for carrying out these projects subject to the approval of the Federal Highway Administration. During the past year, the following specific projects have been undertaken.

1. Maintenance Technical Training

Principal Investigators: W. F. Babcock & Bob Foyle, ITRE
1983-1984 Budget: $155,000

ITRE and the Maintenance Policy Committee of the Division of Highways developed a thorough maintenance technical training program which was attended by over 200 Division of Highways engineers. Each highway engineer obtained the equivalent of forty hours of training. ITRE prepared a 600-page manual covering the Division of Highways pavement maintenance and highway operation procedures and related budgetary matters. This training has been extended in 1984-1985 to cover actual maintenance operating procedures. Also, complete visual aide programs will be developed by ITRE and NCDOT for in-house training in these areas.

2. Maintenance Management Study

Principal Investigators: W. F. Babcock & James Martin, ITRE
1983-1984 Budget: $28,500

In conjunction with the NCDOT's maintenance management system, ITRE continued to coordinate and supervise the pavement condition survey of the 60,000 miles of state-maintained paved highways in the state. While working with the Maintenance Policy Committee, seven task forces, involving ninety Division of Highways engineers, were established. The task forces are analyzing maintenance operations to find ways to improve efficiency.

3. Center for Transportation Engineering Studies

Project Director: Paul Zia, NCSU
1983-1984 Budget: $21,300

The Center for Transportation Engineering Studies (CTES) has been established in the Civil Engineering Department of North Carolina State University. The Center is provided administrative and support funds for short term technical problems as required by the Highway Division. In addition, research projects are assigned to CTES by ITRE. All of these projects are under the overall supervision of Dr. Zia.

4. An Analysis of Bridge Inspection Data

Principal Investigator: David Johnston, NCSU
1983-1984 Budget: $32,470

This project was designed to increase use of bridge inspection data and develop a bridge maintenance management system based upon a level of service approach. NCDOT bridge deficiencies, recommended levels of service, and improvement costs were examined. An interim report on this work has received nationwide recognition with many state highway departments.
Transportation research at North Carolina State University takes place at the Center for Transportation Engineering Studies established in the Civil Engineering Department. This department is headed by Dr. Paul Zia (top left). Dr. Roy Borden (bottom left photo) and a research assistant evaluate the in-situ compacted soil properties and correlate the results with the known CBR value by using the dilatometer. Dr. David Johnston (top right) works with a structural testing computer to help evaluate the interrelationship between various bridge elements and types of construction and materials. Dr. Paul Khosla (bottom right) works with the new resilient testing apparatus to evaluate the physical properties of bituminous pavement materials in analyzing and developing a predictive model for pavement performance and overlay design.
5. Bridge Capacity by the Load Factor Method
Principal Investigator: Paul Zia, NCSU
1983-1984 Budget: $24,580
This research compared the load factor method with the working stress method when applied to rating and posting of bridges. The preliminary results of this research indicate that a higher load capacity on certain of the substandard bridges in North Carolina may be permitted. This work continues during the 1984-1985 fiscal year.

6. Investigation of Premature Distress in Flexible Pavements
Principal Investigator: Paul Khosla, NCSU
1983-1984 Budget: $35,080
Ten critical pavement failures were examined to determine the causes of premature pavement distress and possible structural failures. Test borings and multiple laboratory tests were conducted to determine the causes of these failures. Recommendations were made concerning the maintenance of existing pavements that have various types of premature pavement distress. The project is being extended for another year to propose a more efficient pavement design and construction method.

7. Dilatometer Evaluation of Sub-grades for Pavements
Principal Investigators: Roy Borden & Paul Khosla, NCSU
1983-1984 Budget: $50,000
The Dilatometer, a recently developed device for investigation of soil properties, offers an economical method of obtaining normally difficult and costly samples. A detailed knowledge of sub-grade soil support conditions substantially enhances pavement rehabilitation measures and the design of bridge foundations. This study developed procedures for Dilatometer use and for making correlations between the Dilatometer data and the California Bearing Ratio. The project is being continued in 1984-1985.

8. Landscape Maintenance Schemes
Principal Investigators: W. B. Gilbert & J. M. DiPaola, NCSU
1983-1984 Budget: $38,650
This is a continuing project conducted by researchers in the Soil Science Department. The study suggested improved maintenance practices, fertilization procedures, mowing techniques, and chemical treatments for various types of plant species used on roadway shoulders and embankments. New plant species were evaluated and the best types and times of growing areas for various ground covers were determined. This research project has received nationwide attention and will be completed in 1984-1985.

B. Transportation Component of the North Carolina Energy Extension Service.
Program Director: E. W. Hauser, ITRE
Project Coordinator, Larry Minor, ITRE
1983-1984 Administrative Budget: $15,000
During the past fiscal year, the Institute has continued to manage the transportation activities of the North Carolina Energy Extension Service (EES) with a grant from the State Energy Division of the Department of Commerce. The projects undertaken by ITRE were either conducted in-house or assigned to other organizations as determined by two advisory committees to the State Energy Division. Programs and services conducted during the past fiscal year are described below.

1. Car Care Clinics
Project Director: Lewis Huff, Independent Garage Owners of North Carolina, Inc.
1983-1984 Budget: $70,000
Car Care Clinics were conducted in association with the Independent Garage Owners of North Carolina, Inc. under an agreement with ITRE. The public was invited to participate in the Clinics via prepublication in newspapers, on local television and radio, and on-site. The Clinics consisted of diagnostic testing of automobiles, pick-up trucks, and vans to determine current operating efficiency. The Clinics were held at:

- Greensboro
- Winston-Salem
- Morehead City
- High Point
- Wilmington
- Raleigh
- Durham
- Burlington
- Elizabeth City
- Roanoke Rapids
- Rocky Mount
- North Wilkesboro
- Asheville
- Charlotte

2. Van Care Clinics
Project Director: Robert L. Martin, N.C. Public Transportation Association, Inc.
1983-1984 Budget: $30,000
Van Care Clinics were conducted by the North Carolina Public Transportation...
Association, Inc. under an agreement with ITRE. All public and private non-profit and
private van transportation service providers in North Carolina were invited and en-
couraged to participate in the Clinics, which consisted of two parts: 1) diagnostic testing of
vans to determine current operating ef-
ficiency (similar to Car Care Clinics) and, 2) a
two-hour, indoor workshop on energy ef-
ficient vehicle maintenance and driving tech-
niques titled "Vehicle Maintenance and Operation for Vans". The cities where the Van
Care Clinics were held are:

Winston-Salem Roanoke Rapids
Wilmington Rocky Mount
Durham Asheville
Burlington Charlotte
Elizabeth City

3. Truck Maintenance Program

Project Director: Paul D. Cribbins, NCSU
1983-1984 Budget: $18,000

The objective of the truck maintenance
component of the North Carolina Energy Ex-
 tension Service was to acquaint independent
truckers' in North Carolina with methods of
increasing fuel efficiency and safe operational prac-
tices. During the past fiscal year, a slide
show entitled "Routes to Fuel Economy" was
developed. A Clinic held at a truckstop near
Charlotte, N.C. was sponsored in conjunction
with the Interstate Commerce Commission.
The slide/tape presentation was also shown
at the Dixie Classic Fair in Winston-Salem. A
future phase of the program will include
presentations of the slide program at the
North Carolina Division of Motor Vehicles
licensing stations.

4. Refuse Collection, Energy Conservation and
Management

Project Director: Larry Minor, ITRE
1983-1984 Budget: $25,000

To help local governments across the state to
improve productivity and fuel savings for
solid waste collection, ITRE provides
technical assistance and conducts
workshops on individual heuristic routing
plans and management techniques. Other
types of studies performed under this agree-
ment have included analysis of proposed
solid waste transfer systems for a number of
North Carolina communities. Services to date
have been provided through the EES Grant
from the North Carolina Energy Division to
twenty-five different communities throughout
the state:

Asheville Huntersville
Cary Jacksonville
Clinton Kernersville
Concord Lenoir
Durham Monroe
Eden Morehead City
Elizabeth City Mount Airy
Fayetteville Nashville
Gastonia Salisbury
Havelock Wake Forest
Henderson Wilson
Hickory Winston-Salem
High Point Mecklenburg Co.
Beaufort Co. Onslow Co.

C. Training Program of the Public Transportation
Division, NCDOT

Program Director: E. W. Hauser, ITRE

ITRE manages an apprenticeship program and
an internship program for the Public Transporta-
tion Division of the NCDOT. The intent of both of
these programs is to place students from UNC
institutions in jobs with transit and human ser-
vice transportation agencies throughout the
state. In this way, agencies have assistance, and
the student or recent graduate enhances his
education with on-the-job training. The program
prepares people for careers in the management
of public transportation systems and services.

1. Transportation Management Internship
Program

Project Director: Gorman Gilbert, UNC-
Chapel Hill
1983-1984 Budget: $37,395

The Transportation Management Internship
Program provides work and learning oppor-
tunities in the areas of transportation system
operations and management for student in-
terns at the Department of City and Regional
Planning of the University of North Carolina at
Chapel Hill. Up to four second-year students
in the transportation concentration of the
masters degree program are selected each
year.

2. Public Transportation Apprenticeship
Program

Project Coordinator: Michael Stanley, ITRE
1983-1984 Budget: $76,257

The Public Transportation Apprenticeship
Program provides work and learning oppor-
tunities for students from participating uni-
versities who have recently completed under-
gergraduate degrees with a concentration in
(Top) Larry Minor of ITRE demonstrates the function of the fuel consumption monitoring device used in ITRE’s Vehicle Maintenance program sponsored by the N.C. Energy Division. (Center Left) Steve Beachum of the Transportation Division of the State Board of Education explains the street network digitizing process which is an integral part of ITRE’s technical assistance program in school bus routing sponsored by the N.C. Energy Division. (Center Right) Derek Graham (left) and Bob Foyle (right) explain school bus scheduling data. (Bottom) Vijay Sudersanam (left) and Steve Acai (right) of the N.C. Office of Emergency Medical Services (NCOEMS) and Mike Stanley of ITRE review output from an EMS squad allocation program as part of an EMS system evaluation project sponsored by NCOEMS.
D. Improvements in Planning Methods for Emergency Medical Response Systems

Program Director: E. W. Hauser, ITRE

Training and technical assistance has been provided to the State Office of Emergency Medical Services (OEMS) in the Department of Human Resources to help them provide planning services to counties and those municipalities with responsibilities for emergency medical services. The following activities have been a part of this program.

1. Training Program and Technical Assistance

   Principal Investigators: John R. Stone, NCSU; Michael Stanley, ITRE

   1982-1984 Budget: $44,541

   Based on previous research in 1982-83 on EMS delivery systems, ITRE developed a program to train OEMS personnel in the application of two computer programs: 1) an allocation program for distributing EMS vehicles and other services within a designated service area, and 2) a program for analyzing EMS annual budgets. Services have been provided to the following county EMS operations over the past two years: Mitchell County, Forsyth County, Robeson County, and Craven County. Other studies, in conjunction with the OEMS, are currently underway.

2. Improvements in OEMS Planning Models

   Principal Investigator: Michael Stanley, ITRE

   1983-1984 Budget: $31,280

   In order to improve the capabilities of the State Office of Emergency Medical Services and to continue to provide technical assistance to counties throughout the state, a review and upgrading of the two computer programs mentioned above are currently underway. These programs will be set up on the State computer system for direct access by the Office of Emergency Medical Service personnel.

E. Technical Assistance in Pupil Transportation Management Improvements

ITRE has continued to receive grant funds from the State Energy Division in the Department of Commerce to provide technical assistance in school bus operations. The objective is to reduce operating costs and fuel usage by school buses. ITRE is also working very closely with the Pupil Transportation Division in the Controller's Office, and LEA's across the state to increase efficient management of vehicle fleets.

1. School Bus Scheduling and Routing Programs

   Program Director: E. W. Hauser, ITRE
   Project Coordinator: Larry Minor, ITRE

   1983-1984 Budget: $150,000

   Based on research conducted over the past several years in the area of computer assistance in pupil transportation, ITRE is providing technical assistance in school bus routing and scheduling to local education agencies (LEAs) throughout the state.

   ★ Routing

   Project Leaders: Wayne Walcott, UNC-Charlotte
                    Mike Stanley, ITRE

   Technical assistance to LEA's include the preparation of a "computer map" of the district (obtained through the state's Land Resources Information Service). A comprehensive data base of street names and addresses for this map is prepared so that each student in the district may be located by computer. A computer program is used to develop school bus routes. Interpretation of alternative results is then provided. The final decision regarding routing alternatives and their implementation is left to the LEA. School bus routing projects have been initiated with Forsyth, Guilford, and Mecklenburg County Schools and Greensboro City Schools. Digitizing the street network was begun in the High Point City School District.

   ★ School Bus Scheduling

   Project Leader: Derek Graham, ITRE

   Assistance to LEA's consists of data collection and coding, creation of a data base, and production of alternative schedules in an attempt to increase efficiency by reducing the size of the bus
fleet. Training the LEA’s in data collection and interpretation of the data are also provided to LEA officials. School bus scheduling projects have been completed with Avery, Alexander, Guilford, Hoke, Lincoln and Wayne County Schools and Durham City Schools.

2. Training Component

During the past year, one staff member from the Pupil Transportation Division has worked at ITRE on a full time basis in order to receive training in school bus garage operations as well as the use of computer programs for school bus scheduling and routing. An extended set of training activities in this program area are currently under development.

F. Pavement Maintenance Management Systems for North Carolina Municipalities

Project Director: W. F. Babcock, ITRE
Principal Investigator: James Martin, ITRE
1983-1984 Budget: $75,000

Beginning in 1982-1983, many municipalities requested ITRE to modify and develop for municipal analysis the pavement condition survey used by the Department of Transportation. Mr. Billy Rose, Deputy Secretary, made all of the NCDOT computer programs and manuals available to the municipalities. Over 48 municipal pavement condition studies have been completed by ITRE personnel. These include a complete inventory of municipal streets. Itemized pavement distress conditions, a pavement condition rating, and the cost to repair and maintain each street section are provided. A complete report contains the general conditions of the streets and recommended approaches for short and long range maintenance management.

The second phase of work with many municipalities has included the training of municipal public works and street division personnel, as well as the expansion of the basic pavement maintenance management system into other elements of the street environment. Guidelines are being used by many municipalities for short and long range planning, prioritization of pavement resurfacing, and other maintenance activities.

ITRE is also involved in helping municipalities develop their own computerized systems for the updating of pavement condition surveys. ITRE conducts an annual two-day workshop covering all facets of municipal pavement design, construction, maintenance, and budgeting concepts aimed at municipalities who want to implement a pavement management system. The following municipalities have received assistance to date. Many others have sent representatives to ITRE’s training sessions.

| Chapel Hill | Thomasville |
| Henderson | Morehead City |
| Asheville | Salisbury |
| Laurinburg | Hickory |
| Lenoir | High Point |
| Nashville | Gibsonville |
| Reidsville | Jamestown |
| Wake Forest | Ayden |
| Raleigh | Rockingham |
| Rocky Mount | Oxford |
| Lexington | Charlotte |
| Conover | Kernersville |
| Garner | New Bern |
| Maiden | Asheboro |
| Wallace | Graham |
| Albemarle | Fayetteville |
| Gastonia | Raeford |
| Burlington | Jacksonville |
| Goldsboro | Drexel |
| Wilson | Mount Olive |
| Southern Pines | N.C. State University |
| Yaupon Beach | Greenville |
| Mayodan | Huntersville |

G. Technical Assistance to Local Education Agencies in School Bus Scheduling and Routing

Project Director: E. W. Hauser, ITRE
1983-1984 Budget: $27,110

A parallel activity to the EES program sponsored by the State Energy Division is conducted in collaboration with the State Board of Education. ITRE has worked directly with LEAs in helping them to establish a computer-assisted program for scheduling and routing of school buses. Multiple versions of independent scheduling and routing programs are available. Through the state computer center, the State Board of Education is developing a network of microcomputers in the LEAs for overall management control and data management tasks.

H. Assistance to Campuses of the UNC System

Program Director: E. W. Hauser, ITRE
1983-1984 Budget: $30,256

During the past year, ITRE has continued to work with campuses on safer and improved operation of campus transportation systems. Assistance has been provided in the areas of improved circulation and access for handicapped students, faculty, staff and visitors; improved bicycle cir-
culation; pavement condition rating; parking, and overall transportation improvements. The Transportation Division at North Carolina State University, and the Physical Plant Division, have been major users of ITRE services.

1. Improving Transit Schedule Adherence
   Principal Investigator: John R. Stone, NCSU
   1982-1984 Budget: $20,000
   ITRE completed an analysis early in the fiscal year of transit schedule adherence for the Public Transportation Division of the NCDOT. This analysis covered the level of schedule adherence among North Carolina transit properties, and the identification of probable causal factors for poor schedule adherence. Project elements included an overview of system performance and operator perceptions for all properties in the state, and an in-depth analysis of one or two "worst-case" routes in each of the following three cities selected as case-study areas, Raleigh, Wilmington, and Winston-Salem.
Appendices
Appendix A

Council on Transportation Research and Education

Mr. John Sanders, (Council Chairman)
Director, Institute of Government
The University of North Carolina—Chapel Hill

Dr. Roy Carroll
Vice President for Planning
The University of North Carolina—General Administration

Dr. William DeMaria
Medical Director
Blue Cross-Blue Shield of North Carolina

Dr. George Herbert
President
Research Triangle Institute

Dr. E. Walton Jones, (Council Secretary)
Vice President for Research and Public Service Programs
The University of North Carolina—General Administration

Mr. L. Felix Joyner
Vice President for Finance
The University of North Carolina—General Administration

Dean Larry Monteith
School of Engineering
North Carolina State University

Mr. Billy Rose
Deputy Secretary
North Carolina Department of Transportation

Appendix B

ITRE Advisory Committee

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

Mr. Carl E. Annas
Corporate Group Vice President
Burlington Industries Transportation, Inc.

Mr. C. Ronald Aycock
Executive Director
N.C. Association of County Commissioners

Mr. John Brantley
Executive Director
Raleigh-Durham Airport Authority

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

Mr. Carson D. Culbreth, Director
N.C. Energy Division
Department of Commerce

Admiral William M.A. Greene
Executive Director
State Ports Authority

Mr. J. Lynn Leidersdorff
Transportation Director
Watauga County Transportation Authority

Mr. Thomas G. Lynch
Assistant Vice President and Regional Sales Manager
Seaboard Coastline Railroad System

Mr. Bobby Mattocks
President
Jenkins Gas and Oil Company

Mr. Elbert L. Peters, Jr.
Executive Vice President
N. C. Motors Carriers Association

Mr. Tom Runkle, Deputy Controller
State Board of Education

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

Mr. S. Leigh Wilson
Executive Director
N.C. League of Municipalities
Appendix C

ITRE Technical Coordinating Committee

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

Dr. John Bailey, Head
Mechanical Engineering Department
North Carolina State University

Dr. Mrinmay Biswas, Director
Transportation and Infrastructure Research Center
Duke University

Dr. B. J. Campbell, Director
Highway Safety Research Center
The University of North Carolina—Chapel Hill

Dr. Jim Clay, Director
Urban Institute
UNC-Charlotte

Dr. Basil Coley, Acting Director
Transportation Institute
North Carolina A&T State University

Dr. Edd Hauser (TCC Chairman)
Director
UNC-ITRE

Dr. Al King, Director
Traffic Safety Center
East Carolina University

Dr. Ellis King, Chairman
Department of Civil Engineering
UNC-Charlotte

Mr. Ben Loeb, Jr.
Assistant Director
Institute of Government

Dr. John R. Malolo, Chairman
Dept. of Sociology, Anthropology and Economics
East Carolina University

Dr. John J. Manock, Director
Research Administration
UNC-Wilmington

Dr. Woodrow W. Nichols, Chairman
Department of Geography
North Carolina Central University

Dr. Evan Rowe, Coordinator of Academic Programs,
Safety and Driver Education
Appalachian State University

Dr. Michael Stegman, Chairman
Department of City and Regional Planning
The University of North Carolina—Chapel Hill

Dr. Paul Zia, Head
Civil Engineering Department
North Carolina State University
Appendix D

ITRE Management and Personnel

The Institute has continued to operate during its sixth full year with a basic core administrative staff (equivalent of 3.5 positions). Project assignments have been managed by either the Director or Associate Director of the Institute, with principal investigators on a number of projects being drawn from associated faculty and staff from various University organizations or affiliates.

Depending on project and program development needs, ITRE employed the services of various faculty and staff as educational and research consultants to the Institute, supported independent research activity on several campuses of The University, and supported or supervised graduate and undergraduate students as part of a particular project team. Personnel associated with ITRE during the past year are listed below.

**Institute Administrative Staff**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Institution</th>
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</thead>
<tbody>
<tr>
<td>E. W. Hauser</td>
<td>Director</td>
<td>ITRE</td>
</tr>
<tr>
<td>W. F. Babcock</td>
<td>Associate Director</td>
<td>ITRE</td>
</tr>
<tr>
<td>Rosalie Neville</td>
<td>Administrative Secretary</td>
<td>ITRE</td>
</tr>
<tr>
<td>Debra Butterworth</td>
<td>Secretary III</td>
<td>ITRE</td>
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**Associated Faculty, Staff, Graduate Students, and Student Support**

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<tr>
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<tr>
<td>Denise Agner</td>
<td>Research Associate</td>
<td>ITRE</td>
</tr>
<tr>
<td>C. Aziz</td>
<td>Graduate Assistant</td>
<td>NCSU</td>
</tr>
<tr>
<td>Robert Attaway</td>
<td>Assistant Director</td>
<td>ITRE</td>
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<tr>
<td>Angela Baker</td>
<td>Research Assistant</td>
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<tr>
<td>William Barlow</td>
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</tr>
<tr>
<td>David W. Beard</td>
<td>Research Technician</td>
<td>NCSU</td>
</tr>
<tr>
<td>W. L. Bingham</td>
<td>Associate Professor</td>
<td>NCSU</td>
</tr>
<tr>
<td>George H. Blessis</td>
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</tr>
<tr>
<td>Roy H. Borden</td>
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<tr>
<td>J. Chen</td>
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<tr>
<td>Gregory Clarke</td>
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<td>R. D. Cooke</td>
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<td>Paul D. Cribbins</td>
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<td>Joseph M. DiPaola</td>
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<td>Sandra Gatling</td>
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<td>George Gerstle</td>
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<td>W. B. Gilbert</td>
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<td>Derek Graham</td>
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<tr>
<td>C. Scott Iverson</td>
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<td>Gronna Jones</td>
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<td>W. Lowder</td>
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<td>James Martin</td>
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<td>W. D. Massey</td>
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<td>B. H. Mulkey</td>
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<td>Stephens W. Nunnally</td>
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<td>Mary Beth Thurman</td>
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<td>ITRE at UNC-Charlotte</td>
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<tr>
<td>Paul Zia</td>
<td>Head-Civil Engineering</td>
<td>NCSU</td>
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**Consultant/Subcontractors**

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<tr>
<td>Monty Houlder</td>
<td>Associate Director</td>
<td>Indep. Garage Owners of NC</td>
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<tr>
<td>Lewis Huff</td>
<td>Executive Director</td>
<td>Indep. Garage Owners of NC</td>
</tr>
<tr>
<td>Robert L. Martin</td>
<td>Executive Director</td>
<td>NC Public Trans. Assoc.</td>
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**UNC—General Administration Support Staff**

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<tr>
<td>Jewel Altemueller</td>
<td>Accounting Clerk III</td>
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<tr>
<td>Cheryl Davis</td>
<td>Accounting Technician I</td>
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<tr>
<td>Gayle Davis</td>
<td>Personnel Officer</td>
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<tr>
<td>Eugene C. Drogos</td>
<td>Purchasing Officer</td>
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<tr>
<td>Dorothy Eardley</td>
<td>Clerk Typist IV</td>
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<tr>
<td>Holly Eggleston</td>
<td>Clerk Typist III</td>
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<tr>
<td>Milton H. Gupton</td>
<td>Services Officer</td>
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<tr>
<td>Bob Hardison</td>
<td>Purchasing Consultant</td>
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<tr>
<td>Becky Hare</td>
<td>Clerk Typist III</td>
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<tr>
<td>Marilyn Heatherley</td>
<td>Accounting Officer</td>
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<tr>
<td>Betty Holloway</td>
<td>Accounting Technician III</td>
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<tr>
<td>Robert Hill</td>
<td>Director of Information Systems</td>
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<tr>
<td>Elizabeth Lambert</td>
<td>Accounting Clerk</td>
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<tr>
<td>Melinda Shoaf</td>
<td>Clerk Typist IV</td>
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**North Carolina Educational Computing Service**

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<tr>
<td>Art Doser</td>
<td>Data Communications Specialist</td>
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<tr>
<td>John Hogan</td>
<td>Academic Affairs Coordinator</td>
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<tr>
<td>R. Stephen Painter</td>
<td>Assistant Director</td>
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<tr>
<td>Louis T. Parker, Jr.</td>
<td>Director</td>
<td></td>
</tr>
<tr>
<td>Jerry Trott</td>
<td>Computing Consultant</td>
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</table>
Appendix E

Organizational Units Involved in Transportation

A number of campus-based centers and departments work in collaboration with ITRE on various programs and projects. Campus-based research affiliates of the Institute include the following:

Highway Safety Research Center
University of North Carolina at Chapel Hill

Center for Transportation Engineering Studies
Civil Engineering Department, N. C. State University

Transportation Institute
School of Business & Economics, N.C. A&T State University

Transportation and Infrastructure Research Center
School of Engineering, Duke University

Major teaching programs in the field of transportation throughout The University of North Carolina include:

The Department of Civil Engineering
North Carolina State University

The Mechanical and Aerospace Engineering Department
North Carolina State University

The Industrial Engineering Department
North Carolina State University

The Department of City and Regional Planning
University of North Carolina at Chapel Hill

The Department of Economics
North Carolina A&T State University

The Department of Civil Engineering
University of North Carolina at Charlotte

Driver Education and Traffic Safety Programs
Appalachian State University
East Carolina University
North Carolina A&T State University

In addition to these directly-related transportation programs, faculty and staff from more than fifty departments, centers, and programs have an active involvement in transportation-related research, teaching, or public service.
Transportation research and planning affects the life of every North Carolinian. It makes travel safer and more enjoyable, enables government to increase efficiency in its transportation systems, and helps to meet the challenges of planning for future transportation needs. Whether it was analyzing mass transit in the metropolitan areas or designing better sanitation vehicle routes in a small town, ITRE was there in 1983-84. The Institute’s work with the state and its departments in striving to meet North Carolina’s transportation needs continues.
Appendix F

Faculty and Staff Involved in Transportation-Related Programs

The following is a partial listing of faculty and staff from nine of the sixteen campuses of The University of North Carolina, plus Duke University, involved in transportation-related research and education.

**Appalachian State University**

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
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<tbody>
<tr>
<td>Ole Gade</td>
<td>Geography</td>
</tr>
<tr>
<td>Karl C. Mamola</td>
<td>Geography</td>
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<tr>
<td>Jonathan B. Pierce</td>
<td>Physics</td>
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<tr>
<td>Evan K. Rowe, Jr. (TCC*)</td>
<td>Political Science</td>
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<tr>
<td>Melvin Roy</td>
<td>Center for Safety and Driver Education</td>
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<tr>
<td>Ronald M. Zigli</td>
<td>Business Administration</td>
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**Duke University**

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<tbody>
<tr>
<td>Kurt W. Back</td>
<td>Sociology</td>
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<tr>
<td>Mrinmay Biswas (TCC*)</td>
<td>Civil &amp; Environmental Engineering</td>
</tr>
<tr>
<td>Jack Bartley Chaddock</td>
<td>Mechanical Engineering &amp; Materials Science</td>
</tr>
<tr>
<td>James H. McElhaney</td>
<td>Bio-Medical Engineering</td>
</tr>
<tr>
<td>Devendra P. Garg</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Charles M. Harman</td>
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<tr>
<td>William T. Joines</td>
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<td>Bruce J. Muga</td>
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<td>Eric I. Pas</td>
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<tr>
<td>Henry J. Petroski</td>
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<td>J. Jeffrey Pierce</td>
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<tr>
<td>P. Aarne Vesilind</td>
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<tr>
<td>James F. Wilson</td>
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**East Carolina University**

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<tr>
<td>Ennis Chestang</td>
<td>Geography</td>
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<tr>
<td>Wes Hankins</td>
<td>Geography</td>
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<tr>
<td>Alfred S. King (TCC*)</td>
<td>Traffic Safety Center</td>
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<tr>
<td>Edward P. Leahy</td>
<td>Geography</td>
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<tr>
<td>John R. Malolo (TCC*)</td>
<td>Sociology, Anthropology &amp; Economics</td>
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<tr>
<td>Michael Orbach</td>
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<tr>
<td>Joe Shrader</td>
<td>Traffic Safety Center</td>
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<tr>
<td>Mac Simpson</td>
<td>Regional Development Institute</td>
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<tr>
<td>Paul D. Tschetter</td>
<td>Sociology, Anthropology &amp; Economics</td>
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<tr>
<td>Odell L. Welborne</td>
<td>Traffic Safety Center</td>
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**North Carolina A&T State University**

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<thead>
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<th>Name</th>
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<tbody>
<tr>
<td>Isaac Barnett</td>
<td>Safety and Driver Education</td>
</tr>
<tr>
<td>Julian M. Benjamin</td>
<td>Transportation Institute</td>
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</tbody>
</table>

* Representatives to the Technical Coordinating Committee
<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
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<tbody>
<tr>
<td>Michael W. McKinney</td>
<td>Political Science</td>
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<tr>
<td>Woodrow W. Nichols, Jr. (TCC*)</td>
<td>Geography</td>
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<td>Elsayed M. Afify</td>
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<td>R. F. Keltie</td>
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* Representatives to Technical Coordinating Committee
N. Paul Khosla  
Richard A. King  
Katherine W. Klein  
Philip C. Lambe  
Carlton J. Laith  
H. Rooney Malcom, Jr.  
Vernon C. Matzen  
Everett Nichols  
Henry L. W. Nuttle  
Richard G. Pearson  
J. N. Perkins  
Joseph M. Plecnik  
Ernest D. Seneca  
F. O. Smetana  
J. C. Smith  
Shaler Stidham, Jr.  
J. S. Strenkowski  
John R. Stone  
Arthur L. Sullivan  
P. W. Thayer  
C. C. Tung  
Harvey E. Wahls  
John Whitfield  
T. G. Wolcott  
Ihn J. Won  
Paul Zia (TCC*)

Civil Engineering  
Economics; Agricultural Extension Service  
Psychology  
Civil Engineering  
Geosciences  
Civil Engineering  
Civil Engineering  
Agricultural Extension Service  
Industrial Engineering  
Industrial Engineering  
Mechanical & Aerospace Engineering  
Civil Engineering  
Botany; Soil Science  
Mechanical & Aerospace Engineering  
Civil Engineering  
Industrial Engineering  
Mechanical & Aerospace  
Civil Engineering  
Landscape Architecture  
Psychology  
Civil Engineering  
Civil Engineering  
Civil Engineering  
Mechanical & Aerospace Engineering  
Marine Science & Engineering  
Geosciences  
Civil Engineering

University of North Carolina at Chapel Hill

Name  
Richard N. L. Andrews  
Edward M. Bergman  
Raymond J. Burby, III  
Gorman Gibert  
David R. Godschalk  
Philip P. Green, Jr.  
William W. Hill  
Ed Kaiser  
Ben F. Loeb, Jr. (TCC*)  
David H. Moreau  
Barnett R. Parker  
Herbert J. Proctor  
William Rohe  
Michael Stegman (TCC*)  
Helen Tauchen  
Warren Jake Wicker

Department  
Institute for Environmental Sciences  
City and Regional Planning  
Center for Urban and Regional Studies  
City and Regional Planning  
City and Regional Planning  
Institute of Government  
City and Regional Planning  
City and Regional Planning  
Institute of Government  
Water Resources Research Institute  
Health Administration  
Surgery (Trauma Center)  
City and Regional Planning  
City and Regional Planning  
Economics  
Institute of Government

UNC at Chapel Hill - Highway Safety Research Center

Name  
B. J. Campbell (TCC*)  
Forrest M. Council  
William L. Hall  
William W. Hunter  
John H. Lacey

Title  
Director  
Deputy Director  
Research Associate  
Program Manager, Engineering Studies  
Program Manager, Alcohol Studies

* Representatives to the Technical Coordinating Committee

23
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<td>Lauren M. Marchetti</td>
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<td>Beverly T. Orr</td>
<td>Program Manager, Public Service Activities</td>
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<tr>
<td>Carol Lederhaus Popkin</td>
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<td>Donald W. Reinfurt</td>
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<td>J. Richard Stewart</td>
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<td>Jane C. Stutts</td>
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<td>Patricia F. Waller</td>
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<td>Ann Woodward</td>
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**University of North Carolina at Charlotte**

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<td>Alfred Stuart</td>
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**University of North Carolina at Greensboro**

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<td>Charles R. Hayes</td>
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**University of North Carolina at Wilmington**

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<td>Paul E. Hosier</td>
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<td>John J. Manock (TCC*)</td>
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<td>A. Carl Nelson</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Robert M. Wolff</td>
<td>Recreation</td>
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</table>

* Representatives to the Technical Coordinating Committee
Appendix G

Research and Public Service Activities 1982-1984

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

"Research and Training Program of the North Carolina Department of Transportation" (Research Program and Maintenance Technical Training)
Willard F. Babcock, UNC-ITRE
07/01/82 - 06/30/84
Research $685,300

"Comparative Impacts of Alternate Transportation Modes to Ship Energy Feed Stocks and Products Emphasizing Support Base Requirements for OCS Activity - Phase II"
Edwin W. Hauser, UNC-ITRE
09/01/80 - 08/31/82
Research $160,000

"Energy Extension Service Activities"
Edwin W. Hauser, UNC-ITRE
01/25/82 - 09/30/82
Public Service $20,000

"Technical Assistance Program in School Bus Scheduling and Routing"
Edwin W. Hauser, UNC-ITRE
02/04/82 - 10/31/82
Public Service $22,915

"Heuristic Routing of Sanitation Vehicles"
Edwin W. Hauser, UNC-ITRE
09/30/82 - 11/30/82
Public Service $12,628

"Improving Transit Schedule Adherence"
Edwin W. Hauser, UNC-ITRE
08/18/82 - 12/30/83
Research $20,000

"A Planning Method for Emergency Medical Response Systems"
Edwin W. Hauser, UNC-ITRE
10/15/82 - 06/30/84
Research $44,541

"Heuristic Routing of Sanitation Vehicles - Phase III"
Edwin W. Hauser, UNC-ITRE
11/01/82 - 09/30/84
Public Service $50,000

"Public Transportation Internship Program"
Edwin W. Hauser, UNC-ITRE
05/15/84 - 06/30/85
Training $61,400

"Technical Assistance in School Bus Scheduling and Routing for Local Education Agencies"
Edwin W. Hauser, UNC-ITRE
04/15/83 - 09/30/85
Research $27,110

Note: Projects shown are for past two fiscal years, 1982-1983 and 1983-1984.
“School Bus Scheduling and Routing Assistance for Local Education Agencies (LEAs)”
   Edwin W. Hauser, UNC-ITRE
   10/15/83 - 09/30/84
   Public Service $150,000

“Vehicle Maintenance Public Service Programs”
   Edwin W. Hauser, UNC-ITRE
   10/15/83 - 09/30/84
   Public Service $133,000

“Public Transportation Apprenticeship Program”
   Edwin W. Hauser, UNC-ITRE
   01/26/84 - 01/26/86
   Training $76,725

North Carolina Agricultural & Technical State University

“State and Local Governmental Responses to Increased Financial Responsibilities for Public Transit Systems”
   Lalita Sen & Erskine S. Walther, Transportation Institute; Business and Economics
   07/01/82 - 06/30/83
   Research $78,697

“Public Transportation Apprentice Program”
   Julian Benjamin, Business and Economics
   11/26/82 - 05/25/84
   Public Service $3,983

“The Impact of Motor Carrier Regulatory Reform Upon Shippers and Receivers in Rural and Small Urban Areas: A Two-State Study”
   Lalita Sen & Meada Gibbs, Transportation Institute
   07/01/82 - 11/30/84
   Research $118,526

“An Analysis of Total Factor Productivity in Public Transportation”
   Julian M. Benjamin, Transportation Institute; Business and Economics
   09/14/83 - 09/13/84
   Research $75,000

“The Development and Impacts of Dedicated Funding Sources for Public Transit Systems”
   Erskine S. Walther, Transportation Institute
   07/07/83 - 08/12/84
   Research $80,903

“Summer Faculty Workshop in Transportation in Minority Institute Faculty, A Joint Proposal with Atlanta University”
   Katie G. Dorsett, Transportation Institute, Business and Economics
   03/28/84 - 05/31/85
   Public Service $63,703

Duke University

“Isotropically Reinforced Concrete Bridge Deck Slab”
   Minmay Biswas, Engineering—TIRC
   1984-85
   Research $2,000

“Resistance of Epoxy Mortar to Time Dependent Loading and Extreme Temperature Cycles”
   Minmay Biswas, Engineering-TIRC
   1983-84
   Research $6,000
"Development of Prototype Computer-Based Instructional Materials for Transportation Engineering Education"
Eric I. Pas, Engineering, TIRC
7/1/81 - 6/30/83
Research (Educational) $44,599

"Collaborative Research on Spatial - Temporal Characteristics of Person Travel Behavior"
Eric I. Pas, Engineering - TIRC
10/1/81 - 1/31/84 $38,157

North Carolina State University

"Investigation of the Tire and Pavement Interaction Mechanism"
Allen C. Eberhardt, Engineering
07/01/83 - 11/30/83
Research $160,500

"Release Time Agreement Between NCSU and ITRE"
N. Paul Khoosia, Engineering
08/23/82 - 05/12/84
Research $10,418

"Investigation of Premature Distress in Flexible Pavements"
N. Paul Khoosia, Engineering
08/03/82 - 06/30/83
Research $35,080

"Improving Transit Schedule Adherence"
John R. Stone, Engineering
08/23/82 - 05/14/83
Research $5,206

"A Planning Method for Emergency Medical Response Systems"
John R. Stone, Engineering
08/23/82 - 05/14/83
Research $6,941

"Engineer's Estimate Study"
George H. Blessis, Engineering
01/01/83 - 06/30/83
Research $14,000

"Combustion, Performance, and Exhaust Emission Characteristics of Water and Fuel Microemulsions in Diesel Engines (02 Enriched Atmosphere in I.C.E. - Internal Combustion Engine)"
Elsayed M. Alify, Engineering
06/01/83 - 01/14/85
Research $94,354

"Theoretical Evaluation of Engine Inlet Drooping Cowl Lip Design for Supersonic V/STOL Aircraft"
Michael A. Boles, Engineering
01/01/83 - 08/31/84
Research $57,114

"Transfer of Composites Technology to Design and Construction of Bridges"
Joseph M. Plecnik & Shuaib H. Ahmad, Engineering
09/21/83 - 09/20/84
Research $175,657

"Improving the Transit Traffic Interface"
John R. Stone, Engineering
08/22/83 - 12/21/84
Research $19,539
"Physics of Aircraft Waves"
Hassan A. Hassan & John N. Perkins, Engineering
05/14/84 - 06/30/85
Research $90,500

"Bond of Epoxy Coated Prestressing Strand"
David W. Johnston & Paul Z. Zia, Engineering
07/01/84 - 06/30/85
Research $32,500

"Nondestructive Evaluation of Flexible Pavements"
N. Paul Khosla, Engineering
07/01/84 - 06/30/85
Research $34,404

"Evaluation of Subgrade Support for Pavement Rehabilitation Planning by Dilatometer Test"
Roy H. Borden & N. Paul Khosla, Engineering
05/16/83 - 06/30/85
Research $74,994

"Analysis of Bridge Inspection Data"
David W. Johnston & Paul Z. Zia, Engineering; Center for Transportation Engineering Studies
07/01/82 - 06/30/85
Research $97,745

"Bridge Capacity by Load Factor Method"
Paul Z. Zia, Engineering; Center for Transportation Engineering Studies
07/01/83 - 06/30/85
Research $50,270

"Center for Transportation Engineering Studies"
Paul Z. Zia, Engineering; Center for Transportation Engineering Studies
07/01/83 - 06/30/85
Research $41,300

"Wave Propagation in Layered Media"
Robert A. Douglas, Civil Engineer
05/01/83 - 04/30/85
Research $112,329

"Correlation Between Pavement Distress and Condition Rating"
N. Paul Khosla, Engineering
07/01/84 - 06/30/85
Research $29,576

University of North Carolina at Chapel Hill

"Taxicab Regulation: Removing the Barriers to Private Sector Involvement in Transit"
Gorman Gilbert, City and Regional Planning
06/28/82 - 08/14/83
Research $71,485

"North Carolina Infrastructure Analysis in the Areas of Water Supply, Waste Treatment, and Transportation to the Year 2000"
Edward J. Kaiser, City and Regional Planning
02/15/83 - 06/01/83
Research $6,000

"The Role of the Media and Public Attention in Drinking Driver Countermeasures"
James W. Luckey, Public Health
09/13/83 - 11/30/84
Research $87,878
“Private Sector in Public Transportation”
Gorman Gilbert, City and Regional Planning
10/18/83 - 02/17/85
Research $ 23,949

University of North Carolina - Highway Safety Research Center

“Improvement and Utilization of the Traffic Records System”
B. J. Campbell, UNC-HSRC
10/01/82 - 09/30/83
Research $ 71,500

“Increasing Child Restraint Usage Through Local Education and Distribution Programs”
B. J. Campbell, UNC-HSRC
10/01/82 - 09/30/84
Research $399,241

“Evaluation of a Program to Promote Restraint Usage for Elementary School Children”
B. J. Campbell, UNC-HSRC
10/01/82 - 09/30/83
Research $ 48,328

“Project to Increase Adult Restraint Use on a Community Wide Basis”
B. J. Campbell, UNC-HSRC
01/01/83 - 12/31/84
Public Service $105,000

“Community Seat Belt Incentives”
B. J. Campbell, UNC-HSRC
03/01/83 - 02/28/84
Research $ 30,000

“Effectiveness of Child Protection Devices”
B. J. Campbell, UNC-HSRC
01/07/83 - 05/31/84
Research $ 98,394

“Training Program in Hazardous Materials Transportation”
B. J. Campbell, UNC-HSRC
12/01/82 - 06/30/83
Research $ 2,000

“Evaluation of Design Analysis Procedures and Acceptance Criteria for Roadside Hardware”
B. J. Campbell, UNC-HSRC
10/15/82 - 12/31/85
Research $33,687

“Exploratory Analysis of HSRC Accident Analysis Files”
B. J. Campbell, UNC-HSRC
09/30/82 - 09/29/84
Research $40,000

“Development of Perception of Risk Approaches Designed to Increase Safety Belt Usage”
B. J. Campbell, UNC-HSRC
09/30/82 - 09/29/83
Research $103,309

“Further Analysis of the Effectiveness of Federal Motor Vehicle Safety Standard 105”
B. J. Campbell, UNC-HSRC
09/18/82 - 11/15/82
Research $ 5,621
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<td>05/10/82</td>
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<td>Enforcement and Public Information Strategies for the General Deterrence of Driving While Intoxicated</td>
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<td>The Potentiating Effects of Alcohol on Traumatic Injury</td>
<td>Patricia F. Waller &amp; B. J. Campbell</td>
<td>UNC-HSRC</td>
<td>09/29/83</td>
<td>08/31/84</td>
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<td>J. R. Stewart &amp; B. J. Campbell</td>
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<td>02/01/84</td>
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<td>10/01/83</td>
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<td>09/01/83</td>
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"Evaluation of the Effectiveness of the Safe Roads Acts"
B. J. Campbell, UNC-HSRC
02/01/84 - 06/30/84
Research
$ 41,246

"Follow-Up Utility Vehicle Study"
B. J. Campbell, UNC-HSRC
08/01/83 - 03/31/84
Research
$ 37,000

University of North Carolina at Charlotte

"Third Party Van Pool Demonstration"
Wayne A. Walcott, Arts and Sciences
12/15/82 - 04/15/84
Public Service
$ 40,430

"Transportation Survey"
William J. McCoy, Urban Institute
02/06/84 - 04/30/84
Public Service
$ 6,500

"School Bus Scheduling and Routing Program"
Wayne Walcott & Paul Smith, Urban Institute
12/08/83 - 09/30/84
Public Service
$ 38,718

University of North Carolina at Wilmington

"An Investigation of Recovery Enhancement Techniques Following Off-road Vehicle Impacts Near Hatteras Inlet, Cape Hatteras National Seashore"
Paul E. Hosier, Arts and Sciences
05/01/84 - 04/30/85
Research
$ 2,903
Appendix H

Cumulative Listing of ITRE Projects

Research and Technical Training - Division of Highways, NCDOT
- NCDOT Long-Range Research and Training Needs (1979-1980)
- Development of the Center for Transportation Engineering Studies (1980-1985)
- Technical Training and Information Services (1980-1985)
- Maintenance Management Study (1980-1985)
- Roadway Pavement Conditions and Levels of Service (1980-1985)
- Analysis of Bridge Inspection Data (1981-1985)
- Landscape Maintenance Schemes (1981-1985)
- Transverse Cracking in Concrete Bridge Decks (1981-1983)
- Investigation of Premature Distress in Flexible Pavements (1982-1985)
- Dilatometer Evaluation of Sub-grades for Pavements (1983-1985)
- Bridge Capacity by the Load Factor Method (1983-1984)

Motor Vehicle Fleet Operations and Maintenance
- Pilot Tests of DRIVEC Program (1981-1982)
- Car Care Clinics (1983-1985)
- Truck Maintenance Program (1983-1985)

Transportation Energy Conservation and Management
- Personal Transportation Behavior and Energy Conservation (1978-1979)
- Development of a Course on Transportation and Energy (1978-1982)
- Coastal Energy Transportation Study (1979-1982)
- School Bus Scheduling and Routing Programs (1980-1984)
- Pilot Tests of DRIVEC program (1981-1982)
- Truck Maintenance Program (1983-1984)

Emergency Preparedness for Energy/Emergency Medical Services
- Emergency Conservation Planning:
    - Plan for Administration for State Ration Reserve
    - Guidelines for Local Governments Emergency Energy Planning
- Emergency Medical Services (EMS):
  - Planning Model for Emergency Medical Service Providers (1983-1984)
    - Training Program and Technical Assistance to OEMS
    - Computer Program Development/OEMS Planning Models
Coastal Energy/Transportation Studies
- Impacts of Outer Continental Shelf Oil and Gas Exploration and Production Activity (1979-1980)
- Impacts of Coal Exports from North Carolina (Coal Terminals) (1979-1980)
- Comparative Impacts of Alternative Transportation Modes for Shipping Energy Feed Stocks and Products (1979-1981)
- Impacts of Energy-related Transportation Developments on the Coastal Zone (1979-1980)
- Support of Research for and Technical Assistance to the N.C. State Ports Authority (1980-1984)
- Wide Beam, Shallow Draft Vessel Study (1981-1982)
- Impacts of Increased Rail Traffic on Communities in Coastal North Carolina (1981-1982)
- Projected Demands on Coastal Area Transportation Systems Resulting from Recreational and Industrial Development (1981-1982)

Hazardous Materials Transportation

Ridesharing and Public Transportation
- Market Potential for Innovative Transportation Services (1978-1979)
- Paratransit Simulation Design - Needs for Elderly and Handicapped (1978-1979)
- Transportation Brokerage and System Management (1978-1979)
- Improving Transit Schedule Adherence (1981-1984)

Public Transportation Training Programs
- Transportation Management Internship Program (1982-1985)
- Multi-campus Apprenticeship Program (1983-1985)

Program Evaluation
- Evaluation of Other Transportation Institutes (1978-1979)
- Evaluation of Transportation Education Programs of UNC Campuses (1978-1979)
- Evaluation of Transportation Research Programs of UNC Campuses (1978-1979)
- Evaluation of Comparative Impacts of Alternative Transportation Modes for Shipping Energy Feed Stocks and Products (1979-1981)
- Evaluation of Impacts of Outer Continental Shelf Oil and Gas Exploration and Production Activity (1979-1980)
- Evaluation of Transportation Services for the Handicapped on UNC Campuses (1979-1980)

Other Projects
- Transportation Library and Information System (1978-1984)
- Feasibility Study for the Development of Curriculum on MOPED Safety (1978-1979)
- Transportation Services for the Handicapped on UNC Campuses (1979-1980)
- Assistance to Campuses of the UNC System (Campus Transportation Studies and Plans) (1983-1984)
- Technical Assistance to:
  - Pupil Transportation Division, N.C. State Board of Education (1981-1984)
• Division of Highways, N.C. Department of Transportation (1978-1984)
• N.C. State Ports Authority (1980-1984)
• Campuses of the UNC System (1979-1984)
• Public Transportation Division, NCDOT (1982-1984)
  — Development of Computer Software, with Hardware On-Site at TUCC
  — Sanitation Division Operational Improvements for N.C. Municipalities (1982-1985)
The assistant director serves as office manager at UNC-Chapel Hill.

Current staff consists of 4 research associates, 3 research assistants, and 3 student assistants.

Research Triangle Park and UNC-Chapel Hill offices

Organization of the University of North Carolina Institute for Transportation Research and Education