December 15, 1983

President William C. Friday  
The University of North Carolina  
Chapel Hill, North Carolina 27514

Dear President Friday:

In accordance with the requirements of the ITRE Charter, Section B(6), I am pleased to submit to you the 1982-83 Annual Report of The UNC Institute for Transportation Research and Education (ITRE).

This is the fifth Annual Report for our Institute. As reflected herein, it illustrates a steady growth in Institute services and activities over the past five years. Research and development services are being provided to a number of state agencies. In addition, a rather large number of extension and training programs are now being provided to local government agencies throughout the state.

Copies of this report are provided annually to the ITRE Council, Advisory Committee, Technical Coordinating Committee, and other interested constituents. This year, for the first time, this report is being sent to local governments throughout the state as well, in order that they may become further acquainted with Institute services and programs.

Sincerely,

W. F. Babcock  
W. F. Babcock  
Acting Director

WFB/tcb
THE UNC INSTITUTE FOR
TRANSPORTATION RESEARCH AND EDUCATION

ANNUAL REPORT 1982-1983
PREFACE

This is the fifth Annual Report of The University of North Carolina Institute for Transportation Research and Education (ITRE). An annual report is required by the ITRE Charter, Section B(6) which calls for an annual accounting of the Institute's accomplishments, finances, and plans for the future. As in previous years, this report generally covers program activities for the previous fiscal year, although project descriptions and information on programs are current through December, 1983.

This Annual Report presents the ITRE Council, the UNC General Administration, the ITRE Advisory Committee, University faculty and staff, and state and local government agencies with an opportunity to review ITRE's programs. The body of this Annual Report describes the Institute's research, education, public service, and information dissemination activities during fiscal year 1982-1983. The Appendices provide additional supporting documentation. In a slight departure from previous years, a separate report has been prepared highlighting transportation research and public service activities throughout the sixteen campuses of The University of North Carolina.

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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 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 and, in 1965, the name of the campus at Raleigh 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, without changing their names, the remaining ten state-supported senior institutions into The University as follows: Appalachian State University, East Carolina University, Elizabeth City State University, Fayetteville State 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, with authority to choose their own chairman and other officers. 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 overall organization of The University of North Carolina is shown in the following chart.

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 and Research and Education (ITRE) is located as an interinstitutional activity under the Vice President for Research and Public Service. It has grown in its six-year history to 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 six-year history.
The President, Vice Presidents, and their staff comprise the General Administration of The University of North Carolina.

Organizational location of The UNC Institute for Transportation Research and Education (ITRE). Physical location is in the Research Triangle Park.

Campuses with faculty, staff, and graduate students who currently participate in ITRE projects and programs. This list of campuses that involve is subject to change depending on program needs and interest of individual faculty.
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I. BACKGROUND ON ITRE

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 their efforts to maintain and upgrade our transportation systems and to provide innovation 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 C. 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 a projected 1983-1984 annual budget of over one million dollars. Cumulative project revenues to date are over $2.5 million.

The policy-making body of the Institute is called the Council for Transportation Research and Education. Appointed by the President, the Council is made up of vice presidents of The University, administrators from several campuses, the State Highway Administrator, and private industry representatives. 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 continuing statewide efforts 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. The Institute remains committed to the task of leading faculty and staff resources of the universities and research affiliates to assist local, state, regional, and federal agencies in meeting effectively their responsibilities for transportation programs and services.
ITRE's involvement in transportation programs includes not only the engineering functions of planning, design, construction, operation, and maintenance of highways and other transportation facilities, but also the management of vehicle fleets, the operation and design of those vehicles, and the impacts of transportation systems on the communities they serve. Impacts that ITRE has analyzed include energy use, environmental impact, safety, efficiency, and cost effectiveness. 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.

Since it was created, the Director of the Institute has been W. F. Babcock, former State Highway Administrator and Professor of Civil Engineering at North Carolina State University. The Deputy Director is Edd Hauser, who for 10 years prior to joining the ITRE staff was involved in transportation-related programs at the Research Triangle Institute.

The ITRE staff, which currently is made up of 14 professionals and supporting staff, is based in a 20,000 square foot building located in Research Triangle Park. The core staff of ITRE has continued during the past year at 3.2 state-funded positions, plus ten professionals and support staff funded by grants and contracts. The 1983 session of the General Assembly provided funds for another half position.

During a given year, an additional 40 to 50 faculty, staff, and graduate students from several of the campuses of the UNC system work on ITRE programs and projects. During the past year 44 personnel have worked on a part-time basis in this capacity. To date, personnel from nine separate campuses have participated in ITRE programs, with a significant amount of this work carried out at North Carolina State University and at The University of North Carolina at Chapel Hill. A number of these faculty colleagues are appointed by the ITRE Council to work with ITRE on its Technical Coordinating Committee. Current members of this committee are also listed in the Appendices. ITRE also maintains close working relationships with other research agencies and consulting firms in the area, and from time to time uses such resources for specific project tasks.
II. SUMMARY OF PROGRESS

ITRE's 1981-82 Annual Report commented on the fact that several multi-
year contracts and grants expired during the 1982-83 fiscal year. The
four-year series of Coastal Energy Transportation Studies was among
them. Although there was a period of somewhat reduced activity during
the early part of the fiscal year, several initiatives made by state
agencies and local governments resulted in a very good year for ITRE's
operation. Contract and grant revenues increased by about 30 percent
above 1981-82. New awards to ITRE since September 1, 1983, have
projected ITRE's operation into the $1 million range for the 1983-84
fiscal year.

Several research and training activities have continued during the past
year under several "Master Agreements." Particularly important among
these Master Agreements is the continuing long-term contract with the
North Carolina Department of Transportation, Division of Highways, to
provide professional services and generally manage the research and
training programs for the NCDOT. This program has continued to provide
the core support for ITRE's projects. An extensive training program for
the NCDOT field forces is currently under way.

Other important contractual agreements that have continued during the
past year include contracts or grants with the North Carolina
Departments of Commerce, Natural Resources and Community Development,
Human Resources, the State Board of Education, and the Governor's
Office.

Among these contractual arrangements, of particular note is the
continuation of the Energy Extension Service (EES) in Transportation,
sponsored by the State Energy Division in the Department of Commerce.
During fiscal year 1982-83, the Energy Division continued to support the
Institute's EES program in heuristic routing of municipal sanitation
vehicles. When the State received "oil overcharge" (or Warner
Amendment) funds to continue EES programs, the Energy Division provided
additional funds to the Institute for computer-oriented school bus
routing and scheduling for LEAs in North Carolina and for workshops and
extension services in vehicle maintenance.

Another important new program that ITRE has been asked to administer is
the training program sponsored by the Public Transportation Division in
the NCDOT. ITRE began working with these programs in May, 1983, and now
provides oversight for both (1) a multicampus Apprenticeship Program,
which places graduates from UNC institutions in transit agencies for a
fifth year of training; and (2) an Internship Program, which utilizes
graduate students from the UNC-Chapel Hill Planning School in transit-
related part-time jobs.

During the past year, ITRE has provided an increasing number of
transportation-related professional services to local governments in
North Carolina. After presentations of ITRE programs to various
conferences and workshops, several municipalities requested that ITRE
work with their Public Works departments in providing professional
services. Some of the more important transportation studies and training activities that have been provided for local governmental agencies in the past year include:

- Pavement condition studies, maintenance management studies, and maintenance technical training for street and highway improvements.

- Improving school bus routing and operations, transit scheduling, emergency medical services improvements, the transport of hazardous materials, and the routing of municipal sanitation vehicles.

- Energy conservation in transportation systems and guidelines for emergency energy planning and motor vehicle fleet improvements.

These activities are continuing and generally leading to an increased level of involvement with local government agencies throughout the state. Work for local government agencies in the area of technology transfer and training, as well as professional services, is being closely coordinated with a number of professional groups and associations, including the North Carolina League of Municipalities, the Association of County Commissioners, the American Public Works Association, Institute of Transportation Engineers, Association of Local Energy Officials, Association of Public Transportation Officials, and others. ITRE has recently projected a major emphasis in assisting local government agencies and school systems for at least the next two fiscal years.

Exhibit A presents a summary of actual project expenditures by sponsoring agency for fiscal year 1982-83. Expenditures include both contractual funds and matching funds provided by The University. ITRE's total operating budget is in Section V.

Exhibit B presents a six-year summary of programs and projects by title. As in the past, a number of important research and development projects conducted for ITRE are carried out by full-time faculty and staff on one or more UNC campuses.
## EXHIBIT A

### Project Sponsors, 1982-83

<table>
<thead>
<tr>
<th>Agency</th>
<th>Actual Expenditures*** (7/1/82 - 6/30/83)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Division of Highways, NCDOT*</td>
<td>$215,962</td>
</tr>
<tr>
<td>a. Research and Development</td>
<td></td>
</tr>
<tr>
<td>b. Maintenance Technical Training</td>
<td>$95,950</td>
</tr>
<tr>
<td>2. Energy Division, N.C. Department of Commerce*</td>
<td>41,482</td>
</tr>
<tr>
<td>3. Office of Coastal Management, NCDNRCD*</td>
<td>22,150</td>
</tr>
<tr>
<td>4. Public Transportation Division, NCDOT*</td>
<td>24,503</td>
</tr>
<tr>
<td>5. Office of Highway Safety, NCDOT</td>
<td>-0-</td>
</tr>
<tr>
<td>6. Office of Emergency Medical Services, N.C. Department of Human Resources*</td>
<td>28,964</td>
</tr>
<tr>
<td>7. Transportation Division, State Board of Education (Controller's Office)*</td>
<td>27,860</td>
</tr>
<tr>
<td>8. UNC and Constituent Institutions*</td>
<td>2,261</td>
</tr>
<tr>
<td>9. Office of the Governor</td>
<td>5,251</td>
</tr>
<tr>
<td>10. North Carolina State Ports Authority*</td>
<td>-0- **</td>
</tr>
<tr>
<td>11. Oak Ridge National Laboratory*</td>
<td>4,078**</td>
</tr>
<tr>
<td>12. Municipal Governments*</td>
<td>16,359</td>
</tr>
<tr>
<td>13. Local Education Agencies*</td>
<td>3,675</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$488,495</strong></td>
</tr>
</tbody>
</table>

*Active agreements as of 12/31/83

**Total authorizations under these two agreements are for a maximum of $125,000 annually; task orders have been funded to date for approximately $11,000.

***Includes contract/grant funds plus matching funds provided by The University.
EXHIBIT B
Cumulative Listing of ITRE Projects

<table>
<thead>
<tr>
<th>ITRE Program Area or Individual Research and Development Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incentive Grant from North Carolina DOT:</strong></td>
</tr>
<tr>
<td>* Development of UNC/ITRE Organization</td>
</tr>
<tr>
<td>* Scheduling Techniques for Highway Construction, **</td>
</tr>
<tr>
<td>* Maintenance and Safety Projects</td>
</tr>
<tr>
<td>* Safety Analysis of Hazardous Materials Transport</td>
</tr>
<tr>
<td>* Market Potential for Innovative Transportation Services</td>
</tr>
<tr>
<td>* Paratransit Needs for Elderly and Handicapped</td>
</tr>
<tr>
<td>* Personal Transportation Behavior and Energy Conservation</td>
</tr>
<tr>
<td>* Transportation Brokerage and System Management</td>
</tr>
<tr>
<td>* Information Services Project</td>
</tr>
<tr>
<td>* Development of a Course on Transportation and Energy</td>
</tr>
<tr>
<td>* Development of a MOPEG Safety Curriculum</td>
</tr>
<tr>
<td><strong>ITRE Administration and Research Support</strong></td>
</tr>
<tr>
<td>* Study of Research and Training Needs of the NCDOT</td>
</tr>
<tr>
<td>* Support of Transportation and Energy Projects at Oak Ridge National Laboratory</td>
</tr>
<tr>
<td>* Transportation for the Handicapped on UNC Campuses</td>
</tr>
<tr>
<td>* Comparative Impacts of Alternative Transportation Modes for Shipping Energy Feed Stocks and Products</td>
</tr>
<tr>
<td><strong>NCDOT Research and Training (1980-81):</strong></td>
</tr>
<tr>
<td>* Development of a Center for Transportation Engineering Studies at NCSU (CTES)</td>
</tr>
<tr>
<td>* Technical Training and Information Services</td>
</tr>
<tr>
<td>* Development of Research Program in Maintenance and Equipment</td>
</tr>
<tr>
<td>* Roadway Conditions and Levels of Service</td>
</tr>
<tr>
<td>* Coastal Energy Transportation Study (1980-81):</td>
</tr>
<tr>
<td>* OCS Offshore Support Bases and Coal Export Terminals</td>
</tr>
<tr>
<td>* Assessment of Potential Impacts of Energy-Related Transportation Developments on the Coastal Zone</td>
</tr>
<tr>
<td>* Analysis of State and Federal Policies Affecting Energy and Transportation Development</td>
</tr>
<tr>
<td>* Transportation-Energy Extension Services (1980-81):</td>
</tr>
<tr>
<td>* Driver/Vehicle Conservation and Economy Training (DRIVEC)</td>
</tr>
<tr>
<td>* School Bus Energy Conservation</td>
</tr>
<tr>
<td>* Traffic and Transit Operations</td>
</tr>
<tr>
<td>* Routing of Sanitation Vehicles</td>
</tr>
</tbody>
</table>

| Emergency Energy Planning:                                      |
| * North Carolina Emergency Energy Conservation Plan             |
| * Management for Emergency Planning                             |

| Coastal Energy Transportation Study (1980-82):                   |
| * Alternative Technologies for Transporting and Handling Export Coal |
| * Projected Demands on Coastal Area Transportation Systems Resulting from Recreational and Industrial Development |
| * Impacts of Increased Rail Traffic on Communities in Eastern North Carolina |
| * Wide-Beam, Shallow-Draft Vessel Study                          |

| NCDOT Research and Training (1980-82):                          |
| * Administration                                               |
| * CTES                                                        |
| * Technical Training                                           |
| * Maintenance Management Systems                               |
| * Highway Contract Oversight Commission                        |
| * Analysis of Bridge Inspection Data                           |
| * Traffic Volume Projections                                   |
| * Behavior of Anchor Bolt Installations                        |
| * Landscape Maintenance Schemes                                |
| * Transverse Cracking in Concrete Bridge Decks                 |

<table>
<thead>
<tr>
<th>Support of Research and Technical Assistance Needs for North Carolina State Ports Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Gasoline Rationing Preimplementation Activities:</td>
</tr>
<tr>
<td>* Plan for Administration of State Ration Reserve</td>
</tr>
<tr>
<td>* Guidelines for Local Emergency Energy Planning</td>
</tr>
<tr>
<td>* DRIVEC Training</td>
</tr>
<tr>
<td>* Routing of Sanitation Vehicles</td>
</tr>
<tr>
<td>* Technical Assistance in School Bus Scheduling and Routing</td>
</tr>
<tr>
<td>* Improving Transit Schedule Adherence</td>
</tr>
<tr>
<td>* Planning Model for EMS Providers</td>
</tr>
</tbody>
</table>

| NCDOT Research and Training (1982-83):                           |
| * Administration                                               |
| * CTES                                                        |
| * Technical Training                                           |
| * Maintenance Management System                                |
| * Analysis of Bridge Inspection Data                           |
| * Traffic Volume Projections                                   |
| * Landscape Maintenance Schemes                                |
| * Transverse Crack in Concrete Bridge Decks                    |

| Trucking Firms Handling of Hazardous Materials                      |
| * Municipal Pavement Management Studies                           |
| * Transportation Assistance to North Carolina LEAs              |
| * Coastal Energy Transportation Study (1982-83):                  |
| * Transport of Peat and Peat-Methanol                           |
| * Campus Transportation Studies and Plans                        |
| * Energy Extension Services (1982-84):                          |
| * Heuristic Routing of Sanitation Vehicles                      |
| * School Bus Scheduling and Routing Support                      |
| * Car Care Clinics                                               |
| * Van Care Clinics                                              |
| * Truck Care Clinics                                            |

| NCDOT Research and Training (1983-84):                           |
| * Administration                                               |
| * CTES                                                        |
| * Technical Training                                           |
| * Analysis of Bridge Inspection Data                           |
| * Engineers Cost Estimates                                     |
| * Landscape Maintenance Schemes                                |
| * Premature Pavement Distress                                  |
| * Dilometer Evaluation of Subgrades                            |
| * Bridge Capacity by Load Factor                               |
| * Multi-campus Internship Program                              |

| Public Transportation Training Programs:                         |
| * Internship Program                                            |
| * Multi-campus Apprenticeship Program                          |
III. SERVICES TO LOCAL GOVERNMENTS

The first four annual reports of the Institute highlighted certain projects and programs conducted by ITRE staff, and faculty and graduate assistants from campuses of the UNC system, primarily conducted for state government agencies. As mentioned previously in this Annual Report, these programs for state agencies have continued, but there has been a growing emphasis on providing services to local governments in the State of North Carolina.

Services to local governments have resulted from several factors. The first factor has been a growing level of awareness among municipal and county governments in the state that there are immediate and specific needs to improve the operating efficiency and cost effectiveness of transportation systems at the local level. The second factor has been the growing realization and commitment by various state agencies with which ITRE is affiliated to provide some type of technology transfer and technical assistance to local governments in the state. The third factor has been the progress of ITRE as an organization capable of providing an expanded set of services.

As outlined by the ITRE Charter, and as implemented through its first six years of operation, the Institute has viewed transportation in a very broad sense. As noted earlier in this Annual Report, ITRE's transportation programs are very broad and involve engineering, planning, maintenance, management, economics, impact assessment, and operational improvements.

ITRE's unique role among the university system in the state is to provide statewide leadership in addressing local, state, regional, and federal transportation programs and policies. Local government agencies in this state, as well as nation-wide, are increasingly aware of their responsibilities for transportation programs and services. For municipalities, these responsibilities range from repairing and maintaining streets to collecting and disposing of solid wastes, improving traffic flow and operations, and planning for transit improvements, among others. For counties, these responsibilities range from land use planning and its effect on transportation, to providing human service transportation, planning for emergency preparedness, and providing efficient emergency medical services. ITRE currently finds itself in a unique position to provide assistance to local governments in improving these services.

Since 1978, the Institute has been directly involved in eighty projects under twenty-nine contractual arrangements. In addition, a number of purchase orders or Agreements for Services have been arranged for municipalities, counties, and school systems in the state. These projects are summarized in Exhibits A and B.

Many of the projects and programs have utilized grant funds from various state agencies in order to provide services to local governments.
Projects have included highway and transportation engineering, energy-related studies, and transportation planning and management-related projects. Among the various projects that have been conducted by ITRE, the following have particular applications to local governments in the state:

- Roadway condition and levels of service
- Energy-related transportation development needs
- Transport of hazardous materials
- School bus scheduling and routing
- Routing of sanitation vehicles
- Planning for improved emergency medical services
- Efficient operation of vehicle fleets
- Traffic and transit operation and energy conservation
- Elderly and handicapped mobility improvements
- Impacts of increased rail traffic on communities
- Analysis of bridge inspection data
- Traffic volume projections
- Bridge maintenance and levels of service
- Improving transit schedule performance

As a result of these and other project activities, a number of training programs have been developed by ITRE and are currently being provided to local governments as well as to state government agencies and private industry. Training programs currently available or under development include:

- Pavement maintenance and repair
- Heuristic routing of sanitation vehicles
- Driver/Vehicle economy and conservation
- School bus scheduling and routing
- Hazardous materials transportation
- Vehicle maintenance

Technical assistance is also available from the ITRE staff and faculty from throughout the UNC system in the above areas, as well as in planning for emergency medical services, planning for improved transit services, and energy contingency planning. More detail on selected training and technical assistance programs is highlighted in the next section.
IV. SUMMARY OF SELECTED ITRE PROGRAMS, 1982-83

In this section of the Annual Report, ITRE usually provides a brief summary of each of the Research and Training Activities undertaken by the Institute during the previous fiscal year. Rather than providing descriptions of over 25 separate projects in this year's Annual Report, we have chosen to highlight certain extension and training programs that may be of more interest to local government agencies throughout the state.

A. NCDOT MAINTENANCE TECHNICAL TRAINING

The Division of Highways in the NCDOT is involved in a multi-year program to develop a complete Maintenance Management System. ITRE is working closely with the department in the overall development of this system. One component is a pavement condition survey, which involves a visual inspection of over 60,000 miles of pavement and the training of NCDOT personnel for conducting this survey. Results in terms of recommended maintenance practice is one output of the computerized maintenance management system. As another component, ITRE and the NCDOT conduct training for all maintenance personnel, including over 700 supervisors and crew leaders and 190 maintenance engineering personnel. These week-long courses have been taught in 1983 and will be continued in 1984 and 1985.

B. PAVEMENT CONDITION STUDIES

Modeled after the pavement management system developed for the NCDOT, ITRE has worked with some 30 municipalities throughout the state in developing municipal-level pavement management systems. The first year of this program has consisted of working with street maintenance personnel in these municipalities in conducting a pavement condition survey of every section of municipal-maintained streets. Results of these studies include a complete inventory of municipal streets, an itemized pavement distress condition for each street including a condition rating, cost to repair and maintain the street section, and suggested maintenance activity for each section. Guidelines are being used by many municipalities for short and long-range planning and prioritization of pavement resurfacing and other maintenance activities. Surveys have been undertaken for municipalities with as few as ten miles of municipal-maintained streets to as much as five hundred miles.

C. REFUSE COLLECTION ENERGY CONSERVATION

Services to municipal sanitation divisions are continuing by ITRE in the area of route balancing and heuristic routing of sanitation vehicles. To date, services have been provided to more than 25 sanitation departments in municipalities of varying sizes across the state. Municipalities have requested assistance from ITRE in
redesigning refuse collection districts and routes due to 1) the presence of fragmented and/or overlapping routes, 2) recent community growth and annexation, 3) changes in collection practices such as the use of a transfer station, etc., 4) inequitable crew workloads, and 5) the fact that the sanitation division itself may have not had time to analyze its overall system in recent years. The State Energy Division is currently providing support for this program.

D. PLANNING METHODS FOR EMERGENCY MEDICAL RESPONSE SYSTEMS

Based on a research project developed under the guidance of the State Office of Emergency Medical Services (OEMS), a program is currently being developed for EMS personnel in the application of two computer programs: 1) an allocation program for distributing EMS vehicles and other services within a county-wide system and 2) a program for analyzing EMS annual budgets. Although this program is currently being developed for state personnel, it is anticipated that in the future it may be available for county and municipal EMS managers as well. ITRE has worked with a number of counties in pilot-testing this program.

E. SCHOOL BUS SCHEDULING AND ROUTING

Based on research conducted over the past several years for the Controller's Office in the State Board of Education and the Energy Division in the Department of Commerce, ITRE is providing technical assistance in school bus scheduling and routing to local education agencies (LEAs) throughout the state. Modifications of ITRE's basic system of scheduling and routing computer models are made as appropriate for each LEA participating in the program. Other technical assistance consists of data collection and coding, testing of various routing and/or scheduling alternatives, identification of feasible alternatives, and training in the use of the programs. The LEAs select the most feasible routes and schedules for their school buses. This program is also projected as a major extension program for ITRE for the next several years.

F. PUBLIC TRANSPORTATION TRAINING AND EXTENSION

ITRE manages two programs for the Public Transportation Division in the NCDOT, an Apprenticeship Program and an Internship Program. The intent of both of these programs is to place students from UNC institutions in jobs with transit and human service transportation agencies throughout the state, in order that 1) the agencies might have the assistance, and 2) that the student or recent graduate might enhance his education with on-the-job training. The intent is to prepare people for careers in management of public transportation systems and services in North Carolina.
V. FINANCIAL STATEMENT

The following statement represents the general allocation of actual expenditures for The UNC Institute for Transportation Research and Education for the 1982-83 fiscal year (July 1, 1982 through June 30, 1983). Sources of funds were from grant and contract revenues to support the projects described in Section III, plus UNC-General Administration funds for the fiscal year.

1. Research and Technical Training Projects* $488,495

2. ITRE Administration, Planning, and Coordination** 43,750

3. Maintenance and Operation of UNC-RTP Building 55,791

4. Total Support of ITRE Operation, 1982-83 $588,036

*See Exhibits A and B for expenditures by agency and project budgets.

**Includes time and materials for conferences and workshops for UNC faculty and staff; proposal preparation; meetings, contacts with project sponsors; technology transfer functions; liaison with ITRE Council, Advisory Committee, and Technical Coordinating Committee; and representing The University on various transportation-related issues.
APPENDIX A

COUNCIL ON TRANSPORTATION RESEARCH AND EDUCATION

Mr. John Sanders, (Council Chairman)
Director, Institute of Government
Knapp Building
UNC-Chapel Hill
Chapel Hill, NC  27514

Dr. Roy Carroll
Vice President for Planning
The University of North Carolina
General Administration
P. O. Box 2688
Chapel Hill, NC  27514

Dr. William DeMaria
Medical Director
Blue Cross-Blue Shield of
North Carolina
P. O. Box 2291
Durham, NC 27707

Dr. George Herbert, President
Research Triangle Institute
P. O. Box 12194
Research Triangle Park, NC 27709

Mr. L. Felix Joyner
Vice President for Finance
The University of North Carolina
General Administration
P. O. Box 2688
Chapel Hill, NC  27514

Dr. Larry Monteith, Dean
School of Engineering
North Carolina State University
Raleigh, NC  27650

Dr. J. Charles Morrow, III, Provost
UNC-Chapel Hill
104 South Building
Chapel Hill, NC  27514

Mr. Billy Rose
State Highway Administrator
North Carolina Division of
Highways
P. O. Box 25201
Raleigh, NC  27611

Dr. E. Walton Jones, (Council Secretary)
Vice President for Research and
Public Service Programs
The University of North Carolina
General Administration
P. O. Box 2688
Chapel Hill, NC  27514
APPENDIX B

ITRE ADVISORY COMMITTEE

Billy Rose (Advisory Committee Chairman)
State Highway Administrator
N.C. Division of Highways
P.O. Box 25201
Raleigh, NC 27611

Carl E. Annas
Corporate Group Vice President
Burlington Industries Transportation, Inc.
P.O. Box 691
Burlington, NC 27215

C. Ronald Aycock, Executive Director
North Carolina Association of County Commissioners
P.O. Box 1488
Raleigh, NC 27602

Henry Clegg, Director
Highway Division, Carolinas Branch
Associated General Contractors of America, Inc.
3700 National Dr., Suite 201
Raleigh, NC 27612

Bob Deaton, Director
Transportation Department
City of Charlotte
600 East Trade St.
Charlotte, NC 28202

William M. A. Greene, Executive Director
State Ports Authority
P.O. Box 3248
Wilmington, NC 28406

Thomas G. Lynch, Assistant Vice President and Regional Sales Manager
Seaboard Coastline Railroad System
901 Elizabeth Ave., Suite 201
Charlotte, NC 28204

Bobby Mattocks, President
Jenkins Gas and Oil Company
P.O. Box 156
Pollocksville, NC 28573

Elbert L. Peters, Jr., Executive Vice President
North Carolina Motor Carriers Association
291 Martin St.
Raleigh, NC 27601

Ed Vick, President
Kimley-Horn and Associates, Inc.
P.O. Box 33037
Raleigh, NC 27606

S. Leigh Wilson, Executive Director
North Carolina League of Municipalities
P.O. Box 3069
Raleigh, NC 27602
APPENDIX C

ITRE TECHNICAL COORDINATING COMMITTEE (TCC)

Prof. W. F. Babcock, (TCC Chairman*)
Director
UNC/ITRE
P.O. Box 12551
Research Triangle Park, NC 27709
COURIER #311 (919) 549-0541

Dr. B. J. Campbell, Director*
Highway Safety Research Center
Craige Trailer Park
UNC - Chapel Hill
Chapel Hill, NC 27514
COURIER #312 (919) 962-2202

Dr. Dave Godschalk, Past Chairman*
Department of City and Regional Planning
UNC - Chapel Hill
Chapel Hill, NC 27514
COURIER #312 (919) 962-5204

Dr. Wayland C. Griffith, Director
Engineering Design Center
North Carolina State University
Raleigh, NC 27650
STATE COURIER (919) 737-3224

Dr. Edd Hauser, (TCC Secretary*)
Deputy Director
UNC/ITRE
P.O. Box 12551
Research Triangle Park, NC 27709
COURIER #311 (919) 549-0541

Dr. G. Donald Jud, Director
Center for Applied Research
School of Business and Economics
UNC - Greensboro
Greensboro, NC 27412
COURIER #214 (919) 379-5430

Dr. Ellis King, Chairman*
Dept. of Urban and Environmental Engineering
UNC - Charlotte
Charlotte, NC 28223
COURIER #312 (704) 597-2320

Mr. Ben F. Loeb, Jr.
Assistant Director
Institute of Government
P.O. Box 990
Chapel Hill, NC 27514
COURIER #312 (919) 962-1304

Dr. John R. Maiolo, Chairman
Sociology and Anthropology Dept.
East Carolina University
Greenville, NC 27834
COURIER #142 (919) 757-6883

Dr. John J. Manock, Director
Office of Research Administration
Western Carolina University
Cullowhee, NC 28723
NO COURIER (704) 227-7480

Dr. Woodrow W. Nichols, Chairman*
Department of Geography
North Carolina Central University
Durham, NC 27707
COURIER #202 (919) 683-6233

Dr. Evan Rowe, Coordinator of
Academic Programs
Center for Safety and Driver Education
Appalachian State University
Boone, NC 28607
NO COURIER (704) 262-3143

Dr. Basil Coley, Acting Director
Transportation Institute
North Carolina A&T State University
Greensboro, NC 27411
COURIER #212 (919) 379-7745

Dr. Paul Zia, Head*
Civil Engineering Department
North Carolina State University
Raleigh, NC 27650
STATE COURIER (919) 737-2331

*Indicates member of Executive Committee
APPENDIX D

ITRE MANAGEMENT AND PERSONNEL

Institute Staff

The Institute has continued to operate during its fifth full year with a basic core administrative staff (equivalent of 3.2 positions). Project assignments have been managed by either the Director or Deputy 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. The administrative staff includes:

W. F. Babcock - Director of ITRE and Professor of Civil Engineering, NCSU
Edd Hauser - Deputy Director of ITRE
Libby Dick - Administrative Secretary
Joan Beaman - Secretary III

Associated Faculty, Staff, Graduate Students, and Student Support

Depending on project and program development needs, ITRE from time to time during the course of the 1982-83 year employed the services of various faculty and staff as educational and research consultants to the Institute, supported independent research activity on six campuses of The University, and supported or supervised graduate and undergraduate students as part of a particular project team. Personnel thus associated with ITRE during the past year have included:

N. Ali, Research Assistant, Civil Engineering, NCSU
Robert Attaway, Research Engineer
Angela Baker, Research Assistant
David W. Beard, Research Technician, Crop Science, NCSU
Kenneth Bedford, Student Assistant, Civil Engineering, NCSU
W. L. Bingham, Associate Professor of Civil Engineering, NCSU
George H. Blessis, Associate Professor of Civil Engineering, NCSU
Roy H. Borden, Assistant Professor of Civil Engineering, NCSU
Scott Boyles, Student Assistant, Civil Engineering, NCSU
T. H. Cheng, Research Assistant, Civil Engineering, NCSU
E. N. Chrzanowski, Research Assistant, Civil Engineering, NCSU
Paul D. Cribbins, Professor of Civil Engineering, NCSU
M. E. Davis, Research Technician, Crop Science, NCSU
David Dickenson, Student Assistant, Civil Engineering, NCSU
Joseph M. DiPaola, Assistant Professor of Crop Science, NCSU
Letisha Faust, Student Assistant, Civil Engineering, UNC-Wilmington
Mark Fisch, Assistant Professor of Sociology and Anthropology, ECU
Bob Foyle, Research Engineer
W. B. Gilbert, Professor of Crop Science, NCSU
Derek Graham, Graduate Student, Industrial Engineering, NCSU
Terri Hepler, Research Assistant
Tom Hepler, Instructor of Civil Engineering, NCSU
Elizabeth Howard, Student Assistant, Civil Engineering, UNC-Wilmington
C. Scott Iverson, Associate Professor of Urban Engineering, UNC-Charlotte
David W. Johnston, Associate Professor of Civil Engineering, NCSU
Paul Khosla, Associate Professor of Civil Engineering, NCSU
Paul Lauria, Graduate Student, City and Regional Planning, UNC-Chapel Hill
Leake P. Little, Graduate Student, City and Regional Planning, UNC-Chapel Hill
John Maiolo, Professor of Sociology and Anthropology, ECU
Tom Marsilli, Graduate Student, Sociology and Anthropology, ECU
James Martin, Research Engineer
L. B. McCarty, Research Technician, Crop Science, NCSU
David McCullough, Graduate Student, Civil Engineering, NCSU
Joseph McLeland, Graduate Student, City and Regional Planning, UNC-Chapel Hill
Larry Minor, Educational Consultant
Stephens W. Nunnally, Professor of Civil Engineering, NCSU
Henry L. W. Nuttle, Associate Professor of Industrial Engineering, NCSU
M. S. Omer, Research Assistant, Civil Engineering, NCSU
G. R. Perfetti, Research Assistant, Civil Engineering, NCSU
Robert Rhodes, Student Assistant, Civil Engineering, NCSU
Debbie Saho, Student Assistant, Civil Engineering, UNC-Wilmington
Donna Smith, Research Engineer
Lowery Sorensen, Student Assistant, Civil Engineering, UNC-Wilmington
Mike Stanley, Research Consultant
John R. Stone, Assistant Professor of Civil Engineering, NCSU
E. K. Svendsen, Research Assistant, Civil Engineering, NCSU
Mary Beth Thurman, Research Assistant
Paul Tschetter, Associate Professor of Sociology and Anthropology, ECU
H. E. Wahls, Professor of Civil Engineering, NCSU
Wayne Walcott, Associate Professor of Geography, UNC-Charlotte
William Watson, Graduate Student, Computer Science, UNC-Charlotte
Paul Zia, Head, Civil Engineering Department, NCSU