THE UNIVERSITY OF NORTH CAROLINA
INSTITUTE FOR
TRANSPORTATION
RESEARCH AND EDUCATION

ANNUAL REPORT
1981-82

P. O. BOX 12551, RESEARCH TRIANGLE PARK, N. C. 27709
December 30, 1982

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 1981-82 Annual Report of The UNC Institute for Transportation Research and Education (ITRE).

This is the fourth annual report for our Institute. It includes a rather detailed description of projects carried out by the Institute's staff, associated faculty, and graduate student assistants. It also highlights certain projects, people, and events within the broad spectrum of The University of North Carolina's sixteen campuses that relate to transportation research and educational programs. Copies of this report are provided annually to the ITRE Council, Advisory Committee, Technical Coordinating Committee, and other interested constituents.

Sincerely,

W. F. Babcock
Acting Director

WFB/mbt
PREFACE

This is the fourth 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 throughout the University system are current through December, 1982.

This Annual Report presents the ITRE Council, the UNC General Administration, the ITRE Advisory Committee, University faculty and staff, and State Agency Administrators with an opportunity to review ITRE's programs for its fourth full year of operation. The body of this Annual Report describes the Institute's research, education, public service, and information dissemination activities during fiscal year 1981-1982. The Appendices provide additional supporting documentation containing detailed information on personnel involved in the field of transportation research and education activities throughout the sixteen campuses of The University of North Carolina.

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 multi-campus 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 100,000 students 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 thirteen member board of trustees, eight of whom are appointed by the Board of Governors, four by the Governor, and the student body president who serves as an ex-officio member (see Organization chart which follows).

Each institution has its own faculty and student body, 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 and executive 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 is located as an interinstitutional activity under the Vice President for Research and Public Service (see Organization chart which follows). ITRE was established by act of the North Carolina General Assembly in 1976 (Session Laws 1975, Second Session, Chapter 983, Section 57). It has grown in its five 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 five-year history.
ORIENTATION OF THE UNIVERSITY OF NORTH CAROLINA

President and Staff

Vice President for Academic Affairs
Vice President for Finance
Vice President for Planning
Vice President for Research and Public Service
Vice President for Student Services and Special Programs

Major Research and Doctoral Granting Universities

Chancellor
UNC-Chapel Hill

Chancellor
North Carolina State University

Chancellor
UNC-Greensboro

Comprehensive Universities

Chancellor
Appalachian State University

Chancellor
East Carolina University

Chancellor
North Carolina A&T State University

Chancellor
North Carolina Central University

Chancellor
UNC-Charlotte

Chancellor
Western Carolina University

General Baccalaureate Universities

Chancellor
Elizabeth City State University

Chancellor
Fayetteville State University

Chancellor
Pembroke State University

Chancellor
UNC-Asheville

Chancellor
UNC-Wilmington

Chancellor
Winston-Salem State University

Specialized Institution

Chancellor
North Carolina School of the Arts

*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 thus involved is subject to change depending on program needs and interest of individual faculty.
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I. SUMMARY OF PROGRESS

During its first five years (since February, 1978), ITRE has been directly involved in 57 studies or projects under 18 different contractual arrangements with 11 organizations. A complete listing is provided in Appendix H. For the most part, these project activities, be they research studies, technical training, or public service, have fallen in the areas of highway transportation engineering, energy-related studies, and transportation planning and management-related studies. ITRE has also coordinated a broad spectrum of transportation-related activities throughout The University, in a number of additional subject areas related to transportation.

For the most part, projects have been undertaken for state agencies (see "Project Sponsors" list) at their request. Over this period of time, ITRE has come to be recognized by many state agencies as a "research and training arm" for their organization. This relationship, quite naturally, has been strongest with the state Department of Transportation.

In terms of organizational structure, ITRE's Director, W. F. Babcock, has managed the contractual agreement and project activity with the Division of Highways. The Deputy Director, Edd Hauser, has managed all other projects that have come directly to ITRE. Dr. Hauser has also served as project coordinator and has been involved in project activity on several DOT projects.

In addition to sponsored research and training activities as identified above, ITRE has also been involved to the extent that time and resources allow, with assisting organizational units within the various campuses in applying for funds for research and training, developing research concepts, developing proposals, and generally serving as a technology transfer conduit and information dissemination agency for the various campus-based programs. This activity currently needs to be expanded.

The Technical Coordinating Committee (TCC) members, and other individuals involved full-time in transportation related research and educational programs throughout the University, have been the major recipients (and providers) of communications and information with ITRE. Usually, this level of activity has been somewhat limited to matters related to projects that ITRE has worked on, in conjunction with faculty and staff from the various campuses.

As mentioned on several occasions in both written and oral communications with TCC members and others, many of the specific policies that were developed by the TCC and ITRE staff, and subsequently approved by the ITRE Council, have only been partially implemented due to the pressing need of managing projects that ITRE has conducted, and a shortage of state funds. Concerning these projects, ITRE has been extremely cognizant of University resources and capabilities, and utilized campus-based resources wherever possible. Approximately half of the $1.7 million
### Project Sponsors, 1978-82

<table>
<thead>
<tr>
<th>Sponsor</th>
<th>Cumulative Contract Amount</th>
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</thead>
<tbody>
<tr>
<td>Division of Highways, NCDOT*</td>
<td>$759,289</td>
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<tr>
<td>Energy Division, N.C. Department of Commerce*</td>
<td>469,490</td>
</tr>
<tr>
<td>Office of Coastal Management, NCDOT*</td>
<td>208,000</td>
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<tr>
<td>Office of Highway Safety, NCDOT</td>
<td>144,500</td>
</tr>
<tr>
<td>Office of Emergency Medical Services, N.C. Department of Human Resources*</td>
<td>44,541</td>
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<tr>
<td>Transportation Division, State Board of Education (Controller's Office)*</td>
<td>22,915</td>
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<tr>
<td>Public Transportation Division, NCDOT*</td>
<td>20,000</td>
</tr>
<tr>
<td>UNC - General Administration</td>
<td>6,000</td>
</tr>
<tr>
<td>Office of the Governor*</td>
<td>2,000</td>
</tr>
<tr>
<td>North Carolina State Ports Authority*</td>
<td>(open agreement)**</td>
</tr>
<tr>
<td>Oak Ridge National Laboratory*</td>
<td>(open agreement)**</td>
</tr>
</tbody>
</table>

**Total** $1,676,735  

*Active agreements as of 12/31/82*  
**Total authorizations under these two agreements are for a maximum of $125,000 annually; task orders have been funded to date for approximately $10,000.*
in contract revenues over the past five years that have come through
ITRE have been passed through directly to the organizational units or
individual faculty members or staff on one of the UNC campuses.

In addition to the 3.2 state positions that make up the ITRE staff, only
seven or eight additional people (five professionals, one or two research
assistants, and one secretary) are typically carried under "soft money"
arrangements. Typically, twenty or thirty persons are active at any given
time on ITRE projects on the various campuses.

As indicated in the list of Project Sponsors, most of the continuing
support for the Institute's sponsored projects has come from the Division
of Highways. For the past two fiscal years, the annual budget for ITRE
project activities has been approximately one-half million dollars (see
Financial Statement, Part III).

During the next six to eight months, all of the larger, multi-year contracts
with state agencies that have been sponsors of the ITRE project activity
will terminate. The potential for such multi-year arrangements to continue
past the end of fiscal 1982-83 appear to be somewhat diminished at this
point in time.

As further evidence of the general downturn of funding for transportation
research and development, the dollar value of UNC "contracts and grants
in force" dropped to $3.2 million during the past fiscal year. It had
averaged about $5.5 million for the two previous fiscal years.

At the same time, a number of new, short-term, relatively small research
and development projects have been initiated during the past few months.
In general, it appears at this time that much of the sponsored research
that ITRE has undertaken will be at a significantly reduced level. The
ITRE staff is currently reassessing its role and direction for the next
several years through a series of dialogues with professionals both
within and outside The University.

In the past, ITRE has not been in a position where there was a need to
actively solicit new contract business. As stated before, state agencies
have come to us with their research and training needs. Only two "competi-
tive" proposals have been submitted by ITRE in the last five years to a
federal agency. One of these was to develop a training program, the
second was to develop a technology transfer program. On the other hand,
ITRE continues to work with various faculty and departments throughout the
University in competing for contract and grant funding, however.

During the past fiscal year, the President appointed a twelve-member Advisory
Committee to assist the Council in evaluating ITRE's progress and assuring
that the Institute is being responsive to user needs throughout the state.
The membership, listed in Appendix B, represents a broad range of state and local government as well as private industry groups that have an investment in some aspect of the transportation business. The ITRE staff, in addition, continued to benefit from the policy guidance of the Council on Transportation Research and Education (see Appendix A).

Bringing us up-to-date on the current situation, as a summary, the ITRE staff is seeking the comment and discussion among colleagues from state and local governments, private industry, the ITRE Council, Advisory Committee, Technical Coordinating Committee, and other UNC faculty, staff, and administrators, in planning a future slate of activities in which ITRE should be involved. The objective is to identify and maintain a meaningful role for The University in transportation-related issues in North Carolina.
II. SUMMARY OF RESEARCH AND TRAINING ACTIVITIES, 1981-82

A. INTRODUCTION

This section sets forth in summary form the research and training activities undertaken by ITRE. These projects are handled in certain cases by permanent and temporary ITRE personnel when it appears that such an approach is in the best interest of UNC. In other cases, where several universities may be involved in one research activity, ITRE often acts as the Project Director and handles the budgeting and overall management. Principal Investigators from the universities involved are appointed and they carry out and are generally responsible for the research with ITRE acting in a coordinating role. There are also projects that, although contracted for by ITRE, are assigned completely to one of the universities.

A brief description of each of these projects follows.

B. RESEARCH AND TECHNICAL TRAINING WITH THE DIVISION OF HIGHWAYS, NCDOT

Project Director:  W. F. Babcock  
1981-82 Administrative Budget $9,883

Since July 1, 1979, ITRE has been continuously working on a major research and development contract with the Division of Highways of the North Carolina Department of Transportation. This project is currently extended through June 30, 1983. The projects undertaken by ITRE or assigned to campus-based faculty and staff are determined by the Research and Development Committee of the Division of Highways and subject to the approval of the State Highway Administrator. During the past year, the following specific projects have been undertaken:

1. Maintenance Management Study

   Principal Investigator:  James Martin,  
   1981-82 Expenditures:  
   ITRE  
   $74,546

Since July of 1981, ITRE has worked with the Maintenance and Equipment Branch of the N.C. Division of Highways to implement a statewide pavement management system. The project began with the development and testing of a Pavement Condition Survey during 1981. Several training manuals were developed and training sessions conducted with engineers from all 14 highway divisions throughout the state. During the spring of 1982, teams of trained evaluators conducted an analysis of all streets and
highways on the state system that are paved with flexible pavements. Data received from these field evaluations were then used to provide a computer printout to Division of Highway personnel on a basic inventory of pavement needs and a priority listing of pavement sections for the Urban, Primary and Secondary highway systems in the state. ITRE is continuing to work with the Maintenance and Equipment Branch to analyze, refine, and conduct further surveys and analyses of the state's highway systems. Current work also involves the development of a pavement management system for Portland Cement concrete pavements.

2. Technical Training in Highway Maintenance

Principal Investigator: R. S. Foyle, ITRE  
1981-82 Expenditures: $18,244

Again working with the Maintenance and Equipment Branch as well as field personnel and the Personnel Training Section of the N.C. Department of Transportation, a comprehensive maintenance training program has been developed by ITRE. Scheduled to begin in September, 1982, a continuing training program for field personnel will consist of three levels of an advanced management course, two levels of an advanced supervisory course, two levels of supervisory training for Crew Leaders, three technical training courses in maintenance, and two courses of technical training for Maintenance Supervisors. These training sessions are being held both at the ITRE building and in the various highway divisions throughout the state. Instructors for these courses come from the Personnel Training staff, Division personnel, and ITRE personnel.

3. Center for Transportation Engineering Studies

Principal Investigator: Paul Zia, Head Civil Engineering, NCSU  
1981-82 Expenditures: $14,555

Within an overall agreement between ITRE and the N.C. Department of Transportation to manage the research and training program for the Department, a Center for Transportation Engineering Studies is being developed at N.C. State University. This Center is a successor to the long established Highway Research Program. The purpose of the Center is to provide a focal point for coordinated efforts in applied research and technical service related to transportation engineering. One aspect of the Center's activity is to provide on-call technical assistance to highway division personnel in solving specific, short term technical problems in the field.

4. An Analysis of Bridge Inspection Data

Principal Investigator: Paul Zia, NCSU  
1981-82 Expenditures: $8,670

The N.C. Division of Highways, working with several private contractors, completed a condition survey of all state maintained
bridges in 1981. Working with division personnel, University investigators have been providing assistance in the analysis of these bridge inspection data. Working with a subset of inspection reports, several important statewide questions are being addressed: 1) the current level of service, 2) the desired level of service, 3) the cost of upgrading each bridge to different levels of service, and 4) identifying reconstruction, replacement, maintenance and repair techniques that would achieve a desirable cost/benefit ratio.

5. An Analysis of Traffic Volume Projections

Principal Investigator: Tom Hepler, ITRE

1981-82 Expenditures: $3,833

Departments of Transportation in most states of this country use the method of projecting traffic growth on individual highway segments based on historical trends. A number of computerized models have been developed over the years to incorporate casual factors such as population, potential development, economy, registered vehicles, etc. This project is aimed at providing the Planning and Research Branch of the N.C. Division of Highways with a realistic and usable assessment of the various approaches, with the idea of developing the best approach for North Carolina.

6. Behavior of Anchor Bolt Installations

Principal Investigator: S. H. Ahmad, NCSU

1981-82 Expenditures: $20,818

This project, which is nearing completion, was designed to study the behavior and strength of several types of anchor bolt assemblies under different types of bridge loading conditions. This project was conducted for the Bridge Design and Maintenance Unit of the Division of Highways. Various types of loading conditions were tested. The effects of bolt diameter, embedment length, concrete cover, and spacing between anchor bolts, were analyzed as to the effect they have on the strength of the anchor bolt assembly.

7. Landscape Maintenance Schemes

Principal Investigators: W. B. Gilbert, J. M. DiPaola

1981-82 Expenditures: $39,404

Since mid-1979, this project conducted by researchers in the Crop Science Department at N.C. State University has been coordinated closely with the Landscape Unit of the N.C. Division of Highways to determine better maintenance practices, fertilization, mowing, chemical treatments, etc. for various types of plant species that are used on roadway shoulders and embankments. Other objectives
of this continuing study are to determine the best growing areas for various types of ground covers, determine the permanent and "nurse crop" species for each part of the state and to determine the best type of ground cover to plant during each season of the year. An interim report of the first two years of the project was completed earlier this year.

8. Transverse Cracking in Concrete Bridge Decks

Principal Investigator: D. W. Johnston 1981-82 Expenditures:
W. L. Bingham, NCSU $26,303

The objective of this study is to identify and analyze the causes of specific incidences of transverse cracking in concrete bridge decks. The objective has been achieved by analysis of data gathering during onsite field observations as well as through the analysis of data collected by Project Engineers in their field diaries. The data collected included a sample of bridges constructed during the last five years across the state. This survey included a few continuous girder bridges, but also multiple span pours and other prestressed girder bridges. The analysis has investigated such factors as pour sequence, thermal condition, and vibration on the incidence of transverse cracks.

9. Highway Contract Oversight Commission

Principal Investigator: Stephens Nunnally 1981-82 Expenditures:
NCSU $11,100

The Center for Transportation Engineering Studies provided professional staff assistance to the Governor's Highway Contract Oversight Commission. The six person ad hoc Commission was appointed by Governor James B. Hunt in order to review procedures of the NCDOT in regard to bidding on and awarding of highway construction contracts and to recommend changes in law, regulations, policies or procedure. The Commission's report was forwarded to the Governor in mid 1982.

C. COASTAL ENERGY TRANSPORTATION STUDY

Project Director: E. W. Hauser, ITRE

Since January of 1980, ITRE has participated with the Office of Coastal Management in the North Carolina Department of Natural Resources and Community Development to provide a series of research analyses on the impacts of energy-related developments on North Carolina's coastal zone. The projects undertaken by ITRE and/or assigned to other universities are approved by an advisory board of the Office of Coastal Management and reviewed periodically by a project advisory committee. During the past year, the third phase of the Coastal Energy Transportation Study
was completed. Specific projects carried out during this fiscal year are described below.

1. **Alternative Technologies for Transporting and Handling Export Coal**

   **Principal Investigator:** Paul Cribbins, 1981-82 Expenditures: $4,400
   NCSU

   As part of the Institute's series of studies for the North Carolina Department of Natural Resources and Community Development entitled the "Coastal Energy Transportation Study", ITRE examined various technologies that could be used in coal transportation in North Carolina. Specific types of systems investigated included unit trains, barges, trucks, mechanical conveyors, as well as pneumatic and slurry pipelines. All of these systems were explored for their potential in handling export coal in the Morehead City and Lower Cape Fear areas. In addition, several new technologies were examined for their long range capability including: mine to ship systems, mid-stream transfer, barge carrying vessels, shallow draft vessels and off-shore deep water concepts.

2. **Wide Beam, Shallow Draft Vessel Study**

   **Principal Investigator:** Paul Cribbins, 1981-82 Expenditures: $9,481
   NCSU

   A pre-feasibility study explored the engineering and economic factors involved in developing a bulk commodity business for wide beam shallow draft vessels in the Lower Cape Fear River area. Wide beam, shallow draft vessels (WBSD) offer an option to channel dredging in many U.S. ports in that the new design of the vessel permits a 40-60% increase in capacity over and above conventional vessel limits. This offers an attractive alternative for the 40-45 foot draft restrictions encountered in most U.S. Atlantic Coast ports. This report evaluated the possibility of utilizing such vessels on the Lower Cape Fear River, where an existing 38 foot ship channel extends 30 miles upriver to the port of Wilmington.

3. **Impacts of Increased Rail Traffic on Communities in Coastal North Carolina**

   **Principal Investigator:** John Stone, 1981-82 Expenditures: $19,630
   NCSU

   With a three million tons per year coal port already in operation at the Morehead City Terminal of the N.C. State Ports Authority, and with the potential for other coal terminals to be developed either in the Morehead City region or along the Lower Cape Fear River, an analysis was conducted of the impact of train movements throughout the eastern part of North Carolina. Approximately ten small and large urban areas, as well as a number of isolated rural rail-highway grade crossings were examined for the potential impact of
Various levels of commodity movement by rail. Factors examined included rail/highway safety, traffic impacts, interruption of community services, and more general environmental impacts. This report was also prepared for the N.C. Department of Natural Resources and Community Development, in collaboration with the NCDOT.

4. Projected Demands on Coastal Area Transportation Systems Resulting from Recreational and Industrial Development

Principal Investigator: Paul Tschetter, 1981-82 Expenditures:
East Carolina Univ. $39,162

As various types of industrial development take place, the need for transportation and terminal facilities to handle the movement of commodities must be determined. This study examined the existing transportation systems in North Carolina's coastal area, identified population growth trends and accompanying economic trends, provided a forecast of population and economic growth in a 28 county coastal study area, and provided an impact assessment of the forecasted growth on the transportation systems of the coastal area. The emphasis of this study was on the more general transportation impacts of recreational/retirement and industrial development on the entire coastal study area, as opposed to the transportation-related impacts of specific industry initiatives such as coal export terminals and OCS onshore support bases.

D. TRANSPORTATION COMPONENT OF THE NORTH CAROLINA ENERGY EXTENSION SERVICE

Project Director: E. W. Hauser, ITRE

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. Due to federal funding cutbacks in these program areas, only two components were offered to local government agencies during the past fiscal year, as described below.

1. Refuse Collection Energy Conservation and Management

Extension Coordinator: Michael Stanley, 1981-82 Expenditures:
ITRE $16,300

To aid local governments across the state in improving productivity and fuel savings, ITRE provides technical assistance and conducts workshops on the development of individual heuristic routing plans for solid waste collection. The heuristic approach involves the application of a set of general rules, tempered by common sense and judgement, to develop the most feasible solution. In heuristic route design, manual calculations and graphics are used instead of a computer and result in relatively quick and inexpensive route designs. Services to date have been provided through a grant from the N.C. Energy Division to approximately 16 different communities.
2. **Driver/Vehicle Energy Conservation (DRIVEC)**

   Extension Coordinator: Larry Minor, 1981-82 Expenditures: ITRE $5,551

Initially developed by ITRE in 1980, the DRIVEC program has continued to provide assistance to motor vehicle fleet operators and managers in various methods of managing their fleets in order to conserve gasoline. ITRE has conducted three day workshops for instructors as well as four hour workshops for a number of organizations. Drivers have been trained from state and local governmental agencies, school systems, and private vehicle fleet operators. This program is also conducted through a grant from the N.C. Energy Division.

E. **TECHNICAL ASSISTANCE TO THE TRANSPORTATION DIVISION, NORTH CAROLINA STATE BOARD OF EDUCATION**

   Project Director: E.W. Hauser, ITRE

   ITRE is assisting with several aspects of an overall management review and technical assistance project on school bus transportation in collaboration with the Office of State Budget and Management.

1. **School Bus Scheduling and Routing**

   Principal Investigator: Henry L. W. Nuttle, 1981-82 Expenditures: $5,453

   In an agreement with the State Board of Education, ITRE evaluated the effectiveness of a computer assisted routing model developed at UNC-Charlotte and compared it with other routing and scheduling models. As another part of the current project with the Board of Education, ITRE is monitoring the current implementation phase of the countywide computerized scheduling and routing program in Wake County. Recommendations on further implementation of computerized approaches in other North Carolina school systems are being developed for the State Board of Education.

2. **Pilot Tests of DRIVEC Program**

   Principal Investigator: Larry Minor, 1981-82 Expenditures: ITRE $6,264

   ITRE is currently conducting an analysis of the effectiveness of the DRIVEC program (described above) in three school systems throughout the state: Union County, Guilford County, and High Point City Schools. School administrators, bus supervisors, as well as drivers are provided various levels of training in DRIVEC principles and practices and before and after data analyses are being conducted in order to determine how effective the proven DRIVEC program can be in reducing operating costs in public school bus fleets. Anticipated savings in the pilot tests are estimated to be in the order of 5-10%. Similar tests in urban transit system fleets in the state have produced 7-17% savings.
F. NEW PROJECTS

In addition to the above activities that were completed during fiscal 1981-82, three new projects were initiated during the latter part of the fiscal year. These three projects (which had no project expenditures during the past fiscal year) are described below. Ed Hauser directs these projects.

1. Improving Transit Schedule Adherence

For the Public Transportation Division in the North Carolina Department of Transportation, ITRE is conducting a study to examine the importance of urban transit buses adhering to their published schedule and what effect has on ridership. Case study cities have been selected including Raleigh, Winston-Salem, and Wilmington. The outcome of this project will be to identify corrective measures that can be taken to improve schedule adherence including measures such as special treatment of transit vehicles apart from other motor vehicles, management and control strategies concerning modification of bus operations and operational strategies dealing with route, schedule and use of available resources. The most beneficial measures to implement in North Carolina's 17 urban transit systems will result from this project.

2. Planning Method for Emergency Medical Response Systems

A pilot study of the ability of the emergency medical systems to deliver services in two or three selected counties in North Carolina is being conducted for the Office of Emergency Medical Services. This study will evaluate the capability of the existing system to serve the future emergency response needs in these pilot test counties, will identify alternatives for changing the emergency response system, and make recommendations for implementation on a statewide basis. The outcome will be a planning method that will be available for use by the state agency responsible for administering grant funds and providing technical assistance to local EMS agencies.

3. Training Program in Hazardous Materials Transport

A recent assessment of the overall needs in the transportation of hazardous materials indicated that there is a critical need to develop ways to provide maximum training opportunities to all persons involved in the transport of hazardous materials. The report recognized that numerous training programs were available for emergency response, firefighting, and law enforcement personnel, but that more opportunities were needed for employees hauling and handling hazardous materials. Of an estimated 6000 motor carriers in North Carolina engaged in interstate transport for hire, only 10% are regulated carriers. Several thousand other carriers are privately owned and/or involved in intrastate transport of motor freight. It is not precisely known what proportion of carriers haul petroleum products, toxic or hazardous substances. This project for the N.C. Board of Science and Technology is in response to a request by the Department of Natural Resources and Community Development to design a long range training and information dissemination program that would be addressed specifically to the trucking industry.
G. INACTIVE PROJECTS WITH AGREEMENT IN PLACE

1. Support of Research and Technical Assistance Needs for the North Carolina Ports Authority

Project Director: E. W. Hauser, ITRE

In 1981, ITRE and the State Ports Authority negotiated an agreement whereby the resources of the university system would be provided to the State Ports Authority in the area of planning, engineering analysis, training, management studies, etc. The concept would be to provide faculty and graduate student assistance to the State Ports Authority, initiated by the Authority through the execution of "Project Authorizations". To date one project authorization has been carried out for the SPA.

2. Participation by University Personnel in Energy and Transportation Research Projects at Oak Ridge National Laboratory

Project Director: E. W. Hauser, ITRE

Funded as an open-ended Basic Order Agreement (BOA) by Oak Ridge National Laboratory, ITRE administers the support of ORNL research projects by faculty and staff on the various campuses of the University of North Carolina system. No projects have been undertaken during the previous fiscal year (1981-82), although a new project was initiated in late 1982.

H. OTHER STAFF ACTIVITIES

1. NC 2000 Project

ITRE's Director and Deputy Director prepared a resource paper for the Commission on the Future of North Carolina on the subject of transportation. The Commission, chaired by UNC President William Friday, was created by Governor Jim Hunt in 1980 in order to provide public participation in setting state goals and policy.

2. Land Use Research Needs

ITRE's Deputy Director, in a parallel effort to the NC 2000 project, prepared a resource paper on the subject of transportation for a research needs report to the North Carolina Land Use Congress.

3. University Representation

ITRE continued to represent the 16-campus UNC system on the national Council of University Transportation Centers. ITRE also represented The University on other meetings concerned with transportation issues throughout the state of North Carolina. These included, among others, the tenth anniversary meeting of the Southern Growth Policies Board, held in the Research Triangle Park.
III. FINANCIAL STATEMENT

The following statement represents the general allocation of actual expenditures for the Institute for Transportation Research and Education for the 1981-82 fiscal year (July 1, 1981 through June 30, 1982). Sources of funds were from grant and contract revenues to support the projects described in Section II, plus UNC General Administration funds for the fiscal year.

1. Research and Technical Training Projects  $371,792

2. ITRE Administration, Planning, and Coordination*  53,605

3. Maintenance and Operation of UNC-RTP Building  52,218

4. Total Support of ITRE Operation, 1981-82  $477,615

*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

Mr. L. Felix Joyner
Vice President for Finance
The University of North Carolina
General Administration
P. O. Box 2688
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. Larry Monteith, Dean
School of Engineering
North Carolina State University
Raleigh, NC 27650

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

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

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

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

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

Tom McDowell, Executive Director
Raleigh-Durham Airport Authority
Rt. 1, Box 500
Morrisville, NC  27560

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 Godschaik, 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) 952-1304

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. Arthur Saltzman, 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

FACULTY AND STAFF INVOLVED IN TRANSPORTATION-RELATED PROGRAMS

The following is a partial listing of faculty and staff involved in transportation-related programs from ten of the 16 campuses of The University.

**Appalachian State University**

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Burnett</td>
<td>Center for Safety and Driver Education</td>
</tr>
<tr>
<td>Ole Gade</td>
<td>Geography</td>
</tr>
<tr>
<td>Frank Helseth</td>
<td>Earth Studies</td>
</tr>
<tr>
<td>Robert L. Keber</td>
<td>Geography</td>
</tr>
<tr>
<td>Karl C. Mamola</td>
<td>Physics</td>
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<tr>
<td>Charles E. McDaniel</td>
<td>Center for Safety and Driver Education</td>
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<tr>
<td>Jonathan B. Pierce</td>
<td>Political Science</td>
</tr>
<tr>
<td>Evan K. Rowe, Jr. (TCC)*</td>
<td>Center for Safety and Driver Education</td>
</tr>
<tr>
<td>Melvin Roy</td>
<td>School of Business</td>
</tr>
<tr>
<td>Ronald M. Zigli</td>
<td>Business Administration</td>
</tr>
</tbody>
</table>

**East Carolina University**

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>George Chestang</td>
<td>Geography</td>
</tr>
<tr>
<td>Mark Fisch</td>
<td>Sociology and Anthropology</td>
</tr>
<tr>
<td>Wes Hankins</td>
<td>Geography</td>
</tr>
<tr>
<td>Alfred S. King</td>
<td>Traffic Safety Center</td>
</tr>
<tr>
<td>Edward P. Leahy</td>
<td>Geography</td>
</tr>
<tr>
<td>John R. Maiolo (TCC)*</td>
<td>Sociology and Anthropology</td>
</tr>
<tr>
<td>Oscar K. Moore</td>
<td>Economics</td>
</tr>
<tr>
<td>Charles L. Price</td>
<td>History</td>
</tr>
<tr>
<td>Joe Shrader</td>
<td>Traffic Safety Center</td>
</tr>
<tr>
<td>Mac Simpson</td>
<td>Regional Development Institute</td>
</tr>
<tr>
<td>William N. Still, Jr.</td>
<td>History</td>
</tr>
<tr>
<td>Paul D. Tschetter</td>
<td>Sociology and Anthropology</td>
</tr>
<tr>
<td>Paul E. Waldrop, Jr.</td>
<td>School of Technology</td>
</tr>
<tr>
<td>Odell L. Welborne</td>
<td>Traffic Safety Center</td>
</tr>
</tbody>
</table>

* Denotes Representatives to Technical Coordinating Committee
North Carolina A&T State University

Name
Issac Barnett
Julian M. Benjamin
Sidney H. Evans
Joyce H. Johnson
Lee A. Plummer
Arthur Saltzman (TCC)
Lalita Sen
Erskine S. Walter
Richard A. Watt

Department
Safety and Driver Education
Economics; Transportation Institute
Agricultural Economics
Transportation Institute
Economics
Transportation Institute
Sociology; Transportation Institute
Economics
Transportation Institute

North Carolina Central University

Name
Michael W. McKinney
Woodrow W. Nichols, Jr. (TCC)

Department
Political Science
Geography

North Carolina State University

Name
Elsayed M. Afify
W. F. Babcock
W. L. Bingham
G. H. Blessis
Laurie Charest
Paul D. Cribbins
James J. Davies
Ray F. DeBruhl
F. R. DeJarnette
Alan C. Eberhardt
Herbert M. Eckerlin
Salah E. Elmaghraby
G. D. Garson
Billy M. Gay
Wayland C. Griffith (TCC)
Robert Hader
Frank Hart
Clinton L. Heimbach

Department
Mechanical and Aerospace Engineering
Civil Engineering
Civil Engineering
Civil Engineering
Center for Urban Affairs
Civil Engineering
Center for Urban Affairs
Civil Engineering
Mechanical and Aerospace Engineering
Mechanical and Aerospace Engineering
Mechanical and Aerospace Engineering
Operations Research
Political Science
Engineering Research Services Division
Engineering Design Center
Statistics
Engineering Research
Civil Engineering
Name
J. W. Horn
Marc A. Johnson
David W. Johnston
Richard A. King
Paul Khosla
H. Rooney Malcom, Jr.
W. Grigg Mullen
Everett Nichols
Richard G. Pearson
Thomas R. Hepler
Ernest D. Seneca
F. O. Smetana
J. C. Smith
John Stone
Authur L. Sullivan
P. W. Thayer
C. C. Tung
Harvey E. Wahls
John Whitfield
T. G. Wolcott
Ihn J. Won
Paul Zia (TCC)
Carl F. Zorowski

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

University of North Carolina at Chapel Hill
Name
Edward M. Bergman
Raymond J. Burby, III
Gorman Gilbert
Phil Green
Dave Godschalk (TCC)
Ed Kaiser
Ben F. Loeb, Jr. (TCC)
Robert L. Martin
David H. Moreau

Department
City and Regional Planning
Center for Urban and Regional Studies
City and Regional Planning
Institute of Government
City and Regional Planning
City and Regional Planning
Institute of Government
City and Regional Planning
City and Regional Planning
Name
Barnett R. Parker
Herbert J. Proctor
Carl M. Shy
Joseph W. Straley
Helen Tauchen
Jake Wicker

Department
Health Administration
Surgery (Trauma Center)
Institute for Environmental Studies
Physics and Astronomy
Economics
Institute of Government

Highway Safety Research Center (UNC-CH)

Name
B. J. Campbell (TCC)
George Chi
Forrest M. Council
Robert Daniel
William C. Fischer
William Hall
William Hunter
John H. Lacey
Livia K. Li

University of North Carolina at Greensboro

Name
D. Gordon Bennett
Charles R. Hayes
G. Donald Judd (TCC)
David M. Olson

Department
Geography
Geography
Business and Economics
Political Science

University of North Carolina at Wilmington

Name
Joseph Dunn
Thomas E. Eaton
Paul E. Hosier

Department
Business Administration
Biology
Biology

Western Carolina University

Name
Maurice Jones
John J. Manock (TCC)

Department
Economics
Center for Improving Mountain Living
University of North Carolina at Charlotte

Name
Carlos G. Bell, Jr.
James W. Clay
Gerald L. Ingalls
Scott C. Iverson
L. Ellis King (TCC)
Wayne Walcott
Edward M. Willis

Department
Urban and Environmental Engineering
Institute for Urban Studies and Community Service
Geography
Urban and Environmental Engineering
Urban and Environmental Engineering
Geography
Engineering Technology
APPENDIX E

ITRE MANAGEMENT AND PERSONNEL

Institute Staff

The Institute has continued to operate during its fourth 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
Terri Hepler - Administrative Secretary
Libby Dick - Secretary III (2/22/82 to 10/1/82)
Kim Steed - Secretary III (to 9/15/81)
Pam Garrett - Secretary III (11/3/80 to 8/28/81)

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 1981-82 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 support or supervised graduate and undergraduate students as part of a particular project team. Personnel thus associated with ITRE during the past year have included:

Robert Attaway, Research Engineer
Angela Baker, Research Assistant
Shepherd Barge, Civil Engineering Student, NCSU
W.L. Bingham, Associate Professor of Civil Engineering, NCSU
Tom Bourgeois, Graduate Student, City and Regional Planning, UNC-CH
Diane Brown, Economist, Research Triangle Institute
John Burnett, Coordinator of Advanced Driving Program, ASU
Cindy Cunningham, Civil Engineering Student, NCSU
Paul D. Cribbins, Professor of Civil Engineering, NCSU
Paul S. Cribbins, Legal Consultant
Ken Davis, Graduate Student, ASU
J.M. DiPaola, Assistant Professor of Crop Science, NCSU
Anne Dunson, Research Assistant, Research Triangle Institute
David Edwards, Graduate Student, Civil Engineering, NCSU
Thomas S. Farmer, Research Consultant
Mark Fisch, Assistant Professor of Sociology and Anthropology, ECU
Bob Foyle, Research Engineer
W.B. Gilbert, Professor of Crop Science, NCSU
William Galler, Professor of Civil Engineering, NCSU
Tom Hepler, Instructor of Civil Engineering, NCSU
Linda Hix, Research Consultant
D.W. Johnston, Associate Professor of Civil Engineering, NCSU
Steve Johnson, Head of Energy Economics Department, Research Triangle Institute
Ellis King, Chairman of Urban and Environmental Engineering, UNC-C
Paul Khosla, Assistant Professor of Civil Engineering, NCSU
Dan Latta, Graduate Student, Business Administration, UNC-CH
John Maiolo, Professor of Sociology and Anthropology, ECU
Tom Marsilli, Graduate Student, Sociology and Anthropology, ECU
James Martin, Research Engineer
Elizabeth Martinez, Graduate Student, City and Regional Planning, UNC-CH
David McCullough, Graduate Student, Civil Engineering, NCSU
Charles McDaniel, Director of Center for Safety and Driver Education, ASU
Matthew McGivney, Economist, Research Triangle Institute
Larry Minor, Educational Consultant
Laurie O. Modlin, Research Assistant
Henry L.W. Nuttle, Associate Professor of Industrial Engineering, NCSU
Evan Rowe, Assistant Professor, Center for Safety and Driver Education, ASU
Donna Smith, Research Engineer
Mike Stanley, Research Consultant
John R. Stone, Assistant Professor of Civil Engineering, NCSU
Mary Beth Thurman, Research Assistant
Paul Tschetter, Associate Professor of Sociology and Anthropology, ECU
Zaneta Walter, Research Assistant
Paul Zia, Head, Civil Engineering Department, NCSU
APPENDIX F

ORGANIZATIONAL UNITS INVOLVED IN TRANSPORTATION

A number of campus-based programs that are involved to varying degrees in transportation programs are listed herein as a reference.

The major research programs that have existed in the transportation field at The University of North Carolina are:

The Highway Safety Research Center at UNC-Chapel Hill
The Center for Transportation Engineering Studies in the Civil Engineering Department at N. C. State University
The Transportation Institute in the School of Business and Economics at North Carolina A&T State University

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

The Department of Civil Engineering at N. C. State University
The Mechanical and Aerospace Engineering Department at N. C. State University
The Department of City and Regional Planning at UNC-Chapel Hill
The Department of Economics (Transportation Major) at N. C. A&T State University
The Department of Urban and Environmental Engineering at UNC-Charlotte
Three Driver Education and Traffic Safety Programs at Appalachian State University, North Carolina A&T State University, and East Carolina 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.
APPENDIX G

TRANSPORTATION RESEARCH AND PUBLIC SERVICE ACTIVITIES
AT THE UNIVERSITY OF NORTH CAROLINA
1981 - 1982

East Carolina University

"Comparative Impacts of Alternative Transportation Modes for Shipping Energy Feed Stocks and Products with Emphasis on Support Base Requirements for OCS Activity - Phase III"
Tschetter, Sociology
9/1/81 - 10/31/82
Research $ 37,578

North Carolina A & T State University

"UMTA Research and Training Program Grant - Year 3"
Saltzman, Transportation Institute
7/1/81 - 6/30/82
Research $ 100,000

"Establish and Manage a Transportation Systems Institute for Historically Black Colleges in North Carolina, South Carolina, and Florida"
Claiborne, Transportation Institute
10/1/81 - 12/31/82
Research $ 100,000

"An Empirical Test of the Utility of Attitudinal Measures for Short-Term Public Transportation Planning"
Sen/Benjamin, Transportation Institute
7/1/80 - 12/31/81
Research $ 147,600

"Transit Apprentice Program II"
Benjamin, Transportation Institute
11/1/80 - 5/31/82
Service Agreements $ 25,755

"Investigate and Analyze Use of Motor Carrier Services by Small and Limited Resource Operators in North Carolina"
Evans, Agricultural Economics
10/1/80 - 9/30/81
Research $ 80,603
<table>
<thead>
<tr>
<th>Title</th>
<th>Author/Department</th>
<th>Start Date - End Date</th>
<th>Research Fund</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;State and Local Governmental Responses to Increased Financial</td>
<td>Sen/Walther, Transportation</td>
<td>7/1/82 - 6/30/83</td>
<td>$78,697</td>
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<tr>
<td>Responsibilities for Public Transit Systems&quot;</td>
<td>Institute</td>
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<tr>
<td>&quot;The Impact of Motor Carrier Regulatory Reform Upon Shippers and</td>
<td>Sen, Business and Economics</td>
<td>7/1/82 - 6/30/84</td>
<td>$60,000</td>
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<td>Receivers in Rural and Small Urban Areas: A Two-State Survey&quot;</td>
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<td>North Carolina State University</td>
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<tr>
<td>&quot;An Analysis of Bridge Inspection Data&quot;</td>
<td>Zia, Civil Engineering</td>
<td>8/1/81 - 6/30/83</td>
<td>$31,500</td>
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<tr>
<td>&quot;Highway Contract Oversight Commission&quot;</td>
<td>Nunnally, Civil Engineering</td>
<td>7/1/81 - 4/1/82</td>
<td>$11,100</td>
</tr>
<tr>
<td>&quot;Selection, Establishment, and Maintenance of Vegetation Along N.C.</td>
<td>Gilbert/DiPaola, Soil Science</td>
<td>7/1/81 - 6/30/84</td>
<td>$111,673</td>
</tr>
<tr>
<td>Roadsides&quot;</td>
<td></td>
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<tr>
<td>&quot;Behavior of Anchor Bolt Installations:&quot;</td>
<td>Ahmad, Civil Engineering</td>
<td>7/1/81 - 6/30/82</td>
<td>$21,571</td>
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<tr>
<td>&quot;Incidence Assessment of Transverse Cracking in Concrete Bridge</td>
<td>Johnston, Civil Engineering</td>
<td>7/1/81 - 6/30/83</td>
<td>$76,196</td>
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<td>Decks&quot;</td>
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<tr>
<td>&quot;Center for Transportation Engineering Studies (CTES)&quot;</td>
<td>Zia</td>
<td>8/1/81 - 6/30/83</td>
<td>$43,700</td>
</tr>
<tr>
<td>&quot;Impact of Offshore Pipeline Corridors and Landfalls in Coastal</td>
<td>Sorrell/Gopalakrishnan,</td>
<td>9/1/80 - 10/31/82</td>
<td>$120,000</td>
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<tr>
<td>North Carolina:</td>
<td>Marine Science and Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Investigation of the Tire/Pavement Interaction Mechanisms&quot;</td>
<td>Eberhardt, Mechanical</td>
<td>11/1/80 - 2/28/83</td>
<td>$150,000</td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
"The Use of Methanol Vapor as Fuel in Spark Ignition Engine Vehicles:
Afify, Mechanical Engineering
6/30/80 - 6/30/82
Research
$ 10,671

"Seasonal and Directional Transport Rate Differentials:
Johnson, Agricultural Extension Service
5/14/79 - 9/30/82
Research
$ 44,929

"Evaluation of Lubricating Oil Recycling Demonstration"
Ferrell/Griffith/Canada, Engineering Design Center
4/1/80 - 7/31/82
Research
$198,000

"Impact of Off-Road Vehicles on Beach Invertebrates of the Cape Lookout National Seashore:
Walcott, Marine Science and Engineering
10/1/79 - 3/31/82
Research
$ 10,527

"Sweet Potato Cultivar Development for Fuel Ethanol Production:
Lacy/Collins, Horticuluture
5/1/81 - 7/31/82
Research
$ 10,000

"Investigation of the Aerodynamic Characteristics of Leading Edge Vortex Flaps"
DeJarnette, Mechanical Engineering
3/1/82 - 1/31/83
Research
$ 35,689

"Methods to Reduce Cooling Drag of General Aviation Aircraft without Compromising Engine Cooling or Flight Safety"
Smetana, Mechanical and Aerospace Engineering
1/1/81 - 12/31/81
Research
$ 60,100

University of North Carolina at Charlotte

"Technical Assistance in School Bus Scheduling and Routing"
Walcott, Geography
5/15/82 - 8/15/82
Research
$ 2,000

"Campus Bus Service for the City of Charlotte"
Walcott
Extension
NA
"Taxicab Operating Statistics and Economic Analyses"
Gilbert, City and Regional Planning
1/1/81 - 3/31/82
Research
$ 50,030

"A Beach Access Program for the State of North Carolina"
Brower, Center for Urban Studies
9/1/81 - 10/31/82
Research
$ 25,000

"Taxicab Regulations: Removing the Barriers to Private Sector Involvement in Transit"
Gilbert, City and Regional Planning
6/28/82 - 8/14/83
Research
$ 71,485

"Land Use and Transportation Development Conference"
Rohe, City and Regional Planning
8/1/81 - 8/1/82
Research/Extension
$ 12,300

The Institute of Government, UNC-CH

During the fiscal year 1981-82, the Institute of Government presented the following transportation-related short courses:

"Driver License Hearing Officers"
3-day program

"Driver License Examiners"
1-week program

"Driver License Examiners Supervisors"
3-day program

"Weight Station Operators"
3-day program

"Inspectors"
3-day program

"Driver Education Representatives"
3-day program

Highway Safety Research Center, UNC-CH

"Increasing Child Restraint Usage Through Local Education and Distribution Programs"
Funding: N.C. Governor's Highway Safety Program
10/1/81 - 9/30/82
$ 270,000
"PI & E Voluntary Compliance for Restraints"
  Funding: N.C. Governor's Highway Safety Program
  10/1/81 - 9/30/82                           $ 25,500

"Evaluation of a Program to Promote Restraint Usage for
Elementary School Children:
  Funding: N.C. Governor's Highway Safety Program
  10/1/81 - 9/30/82                           $ 44,880

"Driver Alcohol and Medical Problems"
  Funding: N.C. Governor's Highway Safety Program
  10/1/81 - 9/30/82                           $ 47,600

"Improvement and Utilization of the Traffic Records System"
  Funding: N.C. Governor's Highway Safety Program
  10/1/81 - 9/30/82                           $162,230

"Accident Data Tabulations for Evaluation of Federal Motor
Vehicle Safety Standard 108"
  Funding: National Highway Traffic Safety Administration
  6/1/82 - 10/1/82                           $ 13,155

"Exposure Measures for Evaluating Highway Safety"
  Funding: Federal Highway Administration
  5/10/82 - 9/9/83                           $100,000

"Increasing Safety Belt Use Through an Incentive Program"
  Funding: National Highway Traffic Safety Administration
  9/29/81 - 9/28/82                           $ 70,000

"Trend Analysis - State and National Accident Summary Files"
  Funding: National Highway Traffic Safety Administration
  11/13/81 - 11/12/82                        $ 49,649

"Exploratory Analysis of HSRC Data Files"
  Funding: National Highway Traffic Safety Administration
  7/8/82 - 1/8/83                           $ 10,000

"Enforcement and Public Information Strategies for the General
Deterrence of Driving While Intoxicated"
  Funding: National Highway Traffic Safety Administration
  1/7/81 - 1/6/84                           $ 90,000

"Use and Delineation of Traffic Barriers in Work Zones"
  Funding: Texas A & M Research Foundation
  12/1/81 - 12/31/82                        $ 39,498

"Analysis of Vehicle Size in Crashes"
  Funding: Insurance Institute for Highway Safety
  12/15/81 - 3/15/82                        $ 4,786

"Analysis of Frontal Crashes"
  Funding: Insurance Institute for Highway Safety
  1/15/82 - 4/15/82                        $ 924
"Research and Training Program for the North Carolina Department of Transportation - Phase II"
   Babcock
   7/1/79 - 6/30/83
   Research/Training $740,704

"Transportation Component of the North Carolina Energy Extension Service:
   Hauser
   7/1/80 - 12/31/81
   Extension $206,862

"Alternative Transportation Mode Impacts for Shipping Energy Feed Stocks and Products - Phases II and III"
   Hauser
   9/1/80 - 8/31/82
   Research $180,000

"Participation by University of North Carolina Personnel in Energy and Transportation Research Projects at Oak Ridge National Laboratory"
   Babcock/Hauser
   3/9/79 - 9/30/82
   Research $200,000*

"Support of Research and Technical Assistance Needs for the N.C. State Ports Authority"
   Hauser
   1/28/81 - 6/30/82
   Research $25,000*

"Energy Extension Service Activities"
   Hauser
   1/25/82 - 9/30/82
   Public Service $20,000

"Technical Assistance Program in School Bus Scheduling and Routing"
   Hauser
   2/4/82 - 10/31/82
   Public Service $22,915

*Maximum authorized expenditures under open-ended agreements.
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<tr>
<th>Title</th>
<th>Principal Investigator</th>
<th>Start Date - End Date</th>
<th>Institution</th>
<th>Amount</th>
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<td>&quot;Heuristic Routing of Sanitation Vehicles&quot;</td>
<td>Hauser</td>
<td>7/15/82 - 9/30/82</td>
<td>Public Service</td>
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<td>&quot;Improving Transit Schedule Adherence&quot;</td>
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<td>&quot;A Planning Method for Emergency Medical Response Systems&quot;</td>
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<td>9/1/82 - 11/30/83</td>
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<td>&quot;Heuristic Routing of Sanitation Vehicles - Phase II&quot;</td>
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<td>University of North Carolina at Wilmington</td>
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<td>&quot;Study of Off-Road Vehicle Use at Cape Lookout National Seashore&quot;</td>
<td>Hosier</td>
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<td>Western Carolina University</td>
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<td>7/17/81 - 1/30/82</td>
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<td>&quot;Alcohol Fuel Workshop&quot;</td>
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APPENDIX H

UNC INSTITUTE FOR TRANSPORTATION RESEARCH AND EDUCATION

Cumulative Project History and Institute Support

<table>
<thead>
<tr>
<th>Date</th>
<th>Sponsor</th>
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<th>Projects</th>
<th>Principal Investigator (P.I.)</th>
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<td>E. W. Hauser</td>
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<td>2. Scheduling Techniques for Highway Construction, Maintenance and Safety</td>
<td>D. Johnston, NCSU</td>
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<td>C. Bell, UNC-C</td>
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<td>4. Market Potential for Innovative Transportation Services</td>
<td>J. Benjamin, NCA&amp;T</td>
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<td>5. Paratransit Needs for Elderly and Handicapped</td>
<td>S. Iverson, UNC-C</td>
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<td>6. Personal Transportation Behavior and Energy Conservation</td>
<td>S. Clarke, UNC-CH</td>
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<td>7. Transportation Brokerage and System Management</td>
<td>C. Feibel, UNC-CH</td>
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<td>8. Information Services Project</td>
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<td>9. Development of a Course on Transportation and Energy</td>
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<td>10. Development of a MOPED Safety Curriculum</td>
<td>A. King, ECU</td>
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*All amounts shown are authorized budgets and do not represent actual expenditures.*
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<td>UNC-GA</td>
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<td>3/9/79-present</td>
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<td>13. Support of Transportation and Energy Projects at Oak Ridge National Laboratory</td>
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<td>7/1/79-12/30/79</td>
<td>UNC-GA</td>
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<td>14. Transportation for the Handicapped on UNC Campuses</td>
<td>E. W. Hauser  P. D. Cribbins, NCSU</td>
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<td>1/1/80-8/31/80</td>
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<td>15. Comparative Impacts of Alternate Transportation Modes for Shipping Energy Feed Stocks and Products</td>
<td>E. W. Hauser, Proj. Dir.</td>
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<td>E. W. Hauser, Project Director</td>
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<td>20. OCS OnShore Support Bases and Coal Export Terminals</td>
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<td>21. Assessment of Potential Impacts of Energy-Related Transportation Developments on the Coastal Zone</td>
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<td>State Energy Division</td>
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<td>Transportation-Energy Extension Services</td>
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<td>23. Driver/Vehicle Conservation and Economy Training (DRIVEC)</td>
<td>C. McDaniel, ASU</td>
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<td>25. Traffic and Transit Operations</td>
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<td>26. Routing of Sanitation Vehicles</td>
<td>B. Martin, KH&amp;A</td>
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<td>30. Projected Demands on Coastal Area Transportation Systems Resulting from Recreational and Industrial Development</td>
<td>P. D. Cribbins, NCSU</td>
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<td>31. Impacts of Increased Rail Traffic on Communities in Eastern North Carolina</td>
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<td>32. Wide-Beam, Shallow-Draft Vessel Study</td>
<td>J. Stone, NCSU</td>
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<td>2/4/82-10/30/82</td>
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<td>47. Technical Assistance in School Bus Scheduling and Routing</td>
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