THE UNIVERSITY OF NORTH CAROLINA
INSTITUTE FOR
TRANSPORTATION
RESEARCH AND EDUCATION

ANNUAL REPORT
1978-79

P. O. BOX 12551, RESEARCH TRIANGLE PARK, N. C. 27709
December 14, 1979

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 1978-1979 annual report of The UNC Institute for Transportation Research and Education.

This first annual report is in narrative form. It includes a rather detailed analysis of our policies and operations. It is believed that this might be helpful to those who are unfamiliar with this new activity of The University of North Carolina.

Sincerely,

W. F. Babcock  
Director
The contents of this report reflect the viewpoints, opinions, and information collected by The UNC Institute for Transportation Research and Education. The contents are not reflective of official positions of The UNC General Administration, the North Carolina Department of Transportation, nor any other public or private organization connected with the establishment of this Institute.
PREFACE

This annual report of The University of North Carolina's Institute for Transportation Research and Education (ITRE) responds to the requirement of the ITRE Charter, Section B(6) calling for a description of The Institute's accomplishments, finances, and plans. It covers program activities generally for fiscal 1978-79. It presents the ITRE Council, The UNC General Administration, and other University and State Agency Administrators an opportunity to review ITRE's progress to date.

Part I of this report describes a rationale for developing such an institute and some background on the development of ITRE. Part II reports on the Institute's research, education, public service, and information dissemination activities during 1978 and 1979, and attempts to convey a sense of scope, character, and importance of institute work. The Appendices provide supporting documentation containing detailed information on personnel involved in transportation activities in general throughout the sixteen campuses of The University of North Carolina.

The University of North Carolina, the first state university in this country, was authorized by the state constitution of 1776 and chartered by the General Assembly of 1789. For almost a century, the university located at Chapel Hill was the only state-supported institution of higher education in North Carolina. Between 1877 and 1963 the General Assembly created or acquired for the state fifteen additional institutions that are today a part of The University of North Carolina. The new state constitution of 1971 dictated one public system of higher education under a Board of Governors and one Chief Administrative Officer, the President of The University. The President's staff is designated as UNC-General Administration. It is in this office that the Institute for Transportation Research and Education is located as an inter-institutional activity under the Vice President for Research and Public Service. The Institute is located in The University's Research Triangle Park Building at 30 Alexander Drive.
CONTENTS

Preface i
Contents 11

PART I: BACKGROUND
A Definition of the Word "Transportation" 1
The Role of Transportation Institutes 4
Previously Existing Transportation Programs at UNC 6
Establishment of ITRE 10
  Legislation 10
  ITRE Council 11
  ITRE Charter 12
  Incentive Grant from NCDOT 14

PART II: SUMMARY OF PROGRESS, 1978-79
Purposes for ITRE 15
Staff Activities 17
Development of Policies 22
Program Development Projects 23
  Education 24
  Information Services 25
  Research 25
Financial Statement 28
APPENDICES

Appendix A: Council on Transportation Research and Education 30
Appendix B: ITRE Technical Coordinating Committee 31
Appendix C: ITRE Management and Personnel 32
Appendix D: ITRE Policies 33
Appendix E: ITRE Reports and Papers 39
Appendix F: Transportation Research and Public Service Activities at UNC Constituent Institutions 41
Appendix G: Faculty and Staff Involved in Transportation Related Programs 55
Appendix H: Transportation-Related Educational Programs at UNC Constituent Institutions 60
PART I: BACKGROUND

A DEFINITION OF THE WORD "TRANSPORTATION"

Transportation is a complex set of interrelated systems that accommodate the movement of people and goods across time and space by some mode of conveyance over or through some type of guideway. Because transportation systems support basic economic and social activities, this relatively simple definition needs expanding in order to understand it fully.

Transportation is pervasive, influencing business locations and life styles. It allows alternative consumer choices in selecting living sites, offices, factories, schools, shopping centers, and recreational activities. Improvements in transportation permit increasing levels of participation, often by the transportation disadvantaged, in community activities.

Improvements in transportation systems and services can facilitate economic growth through promoting economies of scale, specialization, and the efficient use of factors of production. Improved transportation can lower the costs of production and can increase competition among producers by expanding the area in which a given plant may distribute its products.

The cost and quality of transport services also influence the effectiveness of government activities, such as the national defense, mail delivery, and emergency services. In terms of scale, annual expenditures for transportation in the U.S. have amounted to approximately 20 percent of the annual gross national product, with approximately equal amounts distributed between freight and passenger transportation.
Due to the pervasiveness of transportation systems and services, our definition will be expanded into a broad framework of parameters that need to be considered in understanding activities that might take place in a transportation research and education institute. The framework for defining transportation includes, but is not necessarily limited to, the following parameters:

**Guideway Systems**
- Highways
- Railways
- Airways and Airports
- Waterways, Marine Ports and Terminals
- Pipelines
- Cross-country Conveyers, Aerial Trams, Monorails, and Subways
- Futuristic Systems

**Modes**
- Automobiles
- Commercial Vehicles
- Public Transportation (Transit and Para-Transit)
- Motorcycles, Pedalcycles, and Pedestrians
- Trains
- Aircraft (Commercial and general aviation)
- Ships, Boats, and Barges
- Advanced Service Concepts

**Important Values in Transportation Systems**
- Safety
- Mobility
- Service (Efficiency and Equity)
- Cost Effectiveness
- Energy Conservation and Use
- Environmental Quality and Impact
- Adequacy

**Functions in Providing Transportation Systems**
- Planning
- Design of Systems and Vehicles
- Materials Development and Use
- Construction
- Operations
- Maintenance
- Reconstruction, Repair, and Rehabilitation
- Regulation
- Administration and Finance
- Management and Policy Analysis
- Driver/Operator Improvements
- Protection and Crash Survival
These values and functions suggest that many disciplines are directly related to the development and use of transportation systems. Some of these disciplines serve a major role; others are more supportive in that persons engaged in these disciplines typically do not spend all of their time in transportation-related problems and projects.

**Major Disciplines Involved in Providing Transportation Systems**

- Business Administration
- Civil Engineering
- Driver and Traffic Safety Education
- Economics
- Ergonomics (Driver/Vehicle/Roadway Interaction)
- Geography
- Mechanical/Aerospace Engineering
- Physical Distribution (Transportation Management)
- Political Science
- Sociology
- Traffic Engineering
- Transportation Engineering
- Urban/Rural/Regional Planning

**Supporting Disciplines in Providing Transportation Systems**

- Architecture
- Behavioral Sciences
- Biomechanics
- Electrical Engineering
- Energy/Environmental Sciences
- Medical Sciences
- Physical Anthropology
- Statistics
- Systems Analysis/Operations Research

In addition to these directly related disciplines, persons with other interests are often either affected by, or influence the development and use of transportation systems. Obvious examples of this include alcohol use and alcoholism and its effect on highway safety, urban design and its effect on the design and operation of transport facilities, or the development of energy related projects and their associated requirement for transportation facilities. Such additional disciplines may be described as peripheral or interrelated to the major thrust of transportation activities. The complexity of this definition leads us to suggest what may be the role of transportation institutes in general in a university setting.
THE ROLE OF TRANSPORTATION INSTITUTES

In order to develop an understanding concerning the role of the UNC Institute for Transportation Research and Education (ITRE), it is helpful to briefly consider the role or nature of university-based transportation institutes in other parts of the country.

Many of our so-called "transportation problems" result from an incomplete view of the many dimensions of this subject. As indicated in the definition above, there exists a multitude of social, environmental, and economical ramifications. Attempts at solving transportation problems through addressing isolated areas of interest are probably doomed to failure and certainly inefficient. Less prejudicial and more operationally efficient transportation institutes have resulted from considering first of all the fundamental role of these institutes in relation to the totality of societal activities. The definition of transportation proposed above only hints at the issue of "why?." That is, the movement of people and goods takes place not as an end in itself, but to serve larger operations within the community, state or nation. Obviously, a potentially large number of commutations of life-styles and transportation systems exist. There are limits, of course, set by both the extremes of life-style that society will tolerate and physical tolerance of the natural environment.

Therefore, if we view one facet of the role of transportation as supporting of economic functions, for example, we approach this interface with a slightly different appreciation than we get from examining the impact of a proposed facility on the "economy of the affected area." We see that the difficulties arise from both the fragmentation of disciplines and spatial aspects. Therefore the need is to evolve the issues and answers from the larger societal goals.

In examining the values, functions, and disciplines listed in the previous section, it is readily apparent that no single aspect of transportation can be treated in a vacuum. A new transportation system cannot be designed to maximize mobility without considering what its effect will be on the natural environment and the structure of the community that it serves. These considerations involve a substantial number of disciplines.
The establishment of an interdisciplinary transportation institute at The University of North Carolina is a direct response to the nature of the subject. The Institute provides for the aggregation of research and public service activities of the various departments and institutions of The University into a coherent effort. The nature of The University of North Carolina, organized as it is into constituent institutions, schools, and departments to which individual faculty members are responsible, does not easily foster interdisciplinary approaches, either to research or to instruction. By providing a forum, and by maintaining a central focus, an institute such as ITRE can help to bring about an array of research and public service endeavors that will constitute a broad interdepartmental transportation program. As will be noted, ITRE has a unique role in transportation education programs as well.

As we have illustrated, a few transportation problems are unidimensional; most involve several dimensions. ITRE provides a mechanism that organizes the considerable talent within The University and applies it effectively to local, state and national problems. Additionally, the location of ITRE in the Office of the President of The University makes it ideally suited to conduct mission-oriented research, to carry out public service activities, to develop information services, and to advise the President on educational programs in transportation.
PREVIOUSLY EXISTING TRANSPORTATION PROGRAMS AT UNC

Prior to the creation of ITRE, there existed within The University a wide variety of programs, departments, and individuals active in or interested in transportation research or education. It was felt by many policy makers within The University and in state government that these many interests could be combined into a more comprehensive program if there were a central institute which could assist and facilitate these individual programs.

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 Highway Research Program 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

These three programs for the better part of the past decade have accounted for an overall transportation effort of approximately one and one half million dollars annually, with HSRC accounting for over two-thirds of this amount.

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 a number of other departments, centers, and programs (on the six campuses above plus four additional campuses) have an active involvement in transportation-related research, teaching, or public service. As identified by an ITRE survey, these individuals are located in the following units of the University:

**Appalachian State University, Boone**
- Department of Geography
- School of Business
- Urban and Regional Planning Program

**East Carolina University, Greenville**
- Department of Economics
- Department of Geography
- Department of History
- Department of Sociology and Anthropology
- Regional Development Institute
- Urban and Regional Planning Program

**North Carolina A & T State University, Greensboro**
- School of Engineering (Architectural, Mechanical, Electrical)

**North Carolina Central University, Durham**
- Department of Geography

**North Carolina State University, Raleigh**
- Agricultural Extension Service
- Center for Urban Affairs and Community Service
- Department of Economics
- Department of Electrical Engineering
- Department of Political Science
- Engineering Design Center
- Ergonomics Program, Department of Industrial Engineering
- Industrial Extension Service
- School of Design

**University of North Carolina-Chapel Hill**
- Center for Urban and Regional Studies
- Department of Economics
- Department of Pathology
- Department of Political Science
- Department of Psychology
- Institute of Government
- Institute for Research in Social Science
- Piedmont Crescent Energy Project, Department of Physics
- School of Business Administration
- School of Public Health
- Trauma Center, School of Medicine
University of North Carolina-Charlotte
Department of Geography
Institute for Urban Studies and Community Service

University of North Carolina-Greensboro
Department of Economics
Department of Geography
Department of Political Science
Department of Sociology

University of North Carolina-Wilmington
Department of Biology (Marine Studies)

Western Carolina University, Cullowhee
Center for Improving Mountain Living
Department of Economics
Department of Geography

Individuals on five other campuses have either expressed an active interest, or have a latent interest, in transportation-related programs either as part of the outreach of their region of the state, or in relation to a major area of concentration on their campuses:

Elizabeth City State University (Regional Development)
Fayetteville State University (Chemistry-Alternate Fuels)
Pembroke State University (Transportation for the Disadvantaged)
University of North Carolina-Asheville (Pre-Engr. Technology)
Winston-Salem State University (Urban and Regional Development)

All of the interests and entities identified above function along lines that have evolved within the overall UNC framework. In varying degrees, contact and coordination did exist in some cases. Funding mechanisms for the major programs were well established, although obviously the vigor of each program element is dictated by funding levels.

It was the judgement of The UNC General Administration that the magnitude of UNC's involvement in transportation research and education could be increased by the creation of an interdisciplinary, inter-institutional activity. ITRE was intended to address the need for marshalling UNC resources and to develop a more effective transportation program.
In addition to these transportation programs that were being carried out throughout the University, other directly related activities in the transportation and highway safety field were being conducted by organizations in the Research Triangle area. Notable among these during the early 1970's were the transportation research program being carried out by the Research Triangle Institute and the highway safety program being conducted by the National Driving Center at Duke University. The National Driving Center was incorporated by the State of North Carolina in 1973 as a private, non-profit corporation. In 1973 the General Assembly (Session Laws 1973, Chapter 617) appropriated funds for the purpose of acquiring land, and for constructing thereon facilities to house the National Driving Center, Incorporated. The building and property is located on T. W. Alexander Drive in Research Triangle Park.

In 1976, the North Carolina General Assembly determined that it was desirable to merge the National Driving Center, Incorporated with the UNC Highway Safety Research Center, which had existed at UNC-Chapel Hill since 1967. This action provided further stimulus to the creation of ITRE. The relationship between this and the establishment of ITRE is related in the following section.
ESTABLISHMENT OF ITRE

Legislation

In 1976, 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 a Council on Transportation Research and Education to accomplish several concurrent tasks:

1. To create a management structure to coordinate and merge the highway safety programs of the UNC Highway Safety Research Center and the National Driving Center, Incorporated;

2. To represent all interests within The University in transportation research and education including, but not limited to, highway safety; and

3. To establish and serve as the policy making body of an Institute for Transportation Research and Education, which would facilitate the development of a broad range of transportation research and education programs involving organizations and institutions within The University which have related programs.

Subsequently, the General Assembly passed another law (Session Laws 1977, Chapter 1029, Senate Bill 751) which transferred the land acquired, the building erected, and the furnishings and equipment acquired at state expense for the National Driving Center, Incorporated, to the Board of Governors of the University of North Carolina.

The short run effect of these legislative actions resulted in many of the highway safety activities previously conducted by the National Driving Center, Incorporated, being assumed by the UNC Highway Safety Research Center (HSRC). In addition, the Board of Directors of the National Driving Center was reconstituted so that its membership was identical to that of the Council on Transportation Research and Education.
ITRE Council

The Council on Transportation Research and Education, appointed by the President, consists of representatives from UNC-General Administration, three campuses of The University, the Research Triangle Institute, and a public member. The current members of this council are identified in Appendix A. The first Chairman of the Council was Dr. Ralph E. Fadum, Dean of Engineering at N.C. State University. The Council's Secretary was Dr. E. Walton Jones, Vice President for Research and Public Service of The University. The current Chairman is Mr. John Sanders, Director of The Institute of Government.

During 1976 and 1977, the Council effectively merged the two highway safety activities and began consideration of the longer range tasks of creating the broad-based institute called for in the legislation. It also set about securing services of professional expertise in developing a charter for the Institute. Although a number of individuals and organizations participated in the review of various charters, the final document was largely a product of Professor W. F. Babcock, Professor of Civil and Transportation Engineering at N.C. State University.

Professor Babcock and the Council recognized that a wide variety of programs, departments, and individual faculty members within the constituent institutions of The University would form the basis for transportation research and education on a continuing basis. The charter was developed with the view of operating an institute under UNC-General Administration which would facilitate a more effective transportation research and education program and to develop a more effective interface within and among the various programs.
ITRE Charter

The charter for ITRE itself was a major undertaking. Professor Babcock provided continuing assistance to the Council in developing concepts and specific wording for this charter, which was approved by the ITRE Council on October 13, 1977. The charter was subsequently approved by the Board of Governors of The University at their meeting on February 10, 1978. The wording of the charter is reproduced here in total.

A. Purpose:

The Institute shall provide continuing statewide leadership in stimulating joint 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 the field of transportation, broadly defined. The Institute shall be concerned with focusing 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.

B. Functions:

Specific functions of the Institute shall include the following:

1. Facilitate communications between, and the exchange of information within, The University and participating organizations on matters relating to transportation research and education.

2. Assist in acquiring financial support for transportation research and education.

3. Advise The University on long-range planning and the development of policy positions concerning transportation research and education.

4. Recognize the integrity and autonomy of existing programs in transportation research and education, including, but not limited to, the Highway Safety Research Center, the N.C. A & T Transportation Institute, the Institute of Government, the Highway Research Program at N.C. State University, the East Carolina University Center for Traffic Safety Education, and other such transportation programs as may exist in operating departments of The University.

5. Aid in coordinating existing programs and make recommendations to the President of The University of North Carolina concerning the needs for strengthening transportation research and education programs and/or developing new programs in the interest of The State of North Carolina.
6. Prepare an annual report describing the year's accomplishments, finances, and plans, and make such special reports as may be necessary concerning transportation research and educational activities.

C. Operation:

1. The Institute for Transportation Research and Education (ITRE) shall be an interinstitutional entity, the administrative head of which shall report to the President of The University of North Carolina.

2. The ITRE Council: The President shall appoint a Council of The Institute for Transportation Research and Education which shall be responsible for recommending policy for the operation of the Institute and for ensuring that its purposes are fulfilled. The membership shall include representatives from the universities and related research organizations. Members of the Council shall be appointed for three-year staggered terms. The Chairman shall be annually designated by the President from the membership of the Council. The Council shall hold regularly-scheduled meetings. On request of the President, it may nominate to him persons for consideration by the President for appointment by him as Director of the Institute.

3. Advisory Committee: An Advisory Committee consisting primarily of representatives of agencies and organizations which are users of transportation research and education shall be appointed by the President upon the recommendation of the Chairman of the ITRE Council. The Advisory Committee shall assist the ITRE Council in ensuring that its program is responsive to needs and that it is meeting the objectives.

4. Director: There shall be a Director and such supporting personnel as may be required to carry out the administrative functions of ITRE. The Director shall keep the Council informed on the activities of the Institute. The Director shall have such authority and responsibility as are delegated to him by the President.

5. Technical Coordinating Committee (TCC): The Director of ITRE shall seek the advice of a Technical Coordinating Committee in the formulation and coordination of the ITRE program. The TCC shall consist of experts in various aspects of transportation, drawn from the academic community and including representatives from on-going programs. The members shall be elected by the ITRE Council upon nomination of the Director.
Incentive Grant from NCDOT

In late 1977, ITRE received an Incentive Grant in the amount of $144,500 from the North Carolina Department of Transportation (NCDOT), through its Office of Highway Safety, to facilitate the institutional and organizational development of ITRE. The grant initially covered the period from November 7, 1977 through June 30, 1979. It was subsequently revised to run through September 30, 1979, although expenditures covered by the grant were made primarily during the period June 1, 1978 through June 30, 1979. The NCDOT Incentive Grant allowed The University to begin staffing ITRE. In February, 1978 Professor W. F. Babcock of the Civil Engineering Department at N.C. State University was appointed as Acting Director of the Institute. Beginning in June, 1978, the Research Triangle Institute provided the services of Dr. Edd Hauser as Acting Deputy Director. Mrs. Terri Hepler was appointed full-time Administrative Secretary for ITRE in September, 1978. In July, 1979 Dr. Hauser became full-time Deputy Director.

In addition to providing funds for staff, the NCDOT Incentive Grant specified that ITRE would be charged with the following objectives:

1. Acquire and maintain knowledge of the various transportation research and educational interests and activities within the State.

2. Acquire, assimilate, and stimulate communication on information concerning support for transportation research and education programs.

3. Provide a liaison service so the different transportation research and education units may work together on proposals and projects.

4. Provide assistance where appropriate in the preparation of proposals, reports, and educational materials.

5. Provide assistance where appropriate in attempting to acquire funds to finance programs and projects.

6. Provide a structure to operate committees to represent all interests in transportation research and education.

7. Assist The University in long-range planning and policy development concerning transportation research and education. Through this structure, provide statewide leadership in stimulating joint efforts in transportation research and education.

Part II of this report relates the accomplishments of ITRE during 1978-79 in meeting these objectives.
PART II: SUMMARY OF PROGRESS, 1978-79

PURPOSES FOR ITRE

A number of significant purposes for ITRE to exist and flourish within The University community have already been explored in general in the section in Part I dealing with the role of transportation institutes, and the discussion on previously existing transportation programs at The University of North Carolina. In order to be more specific, the following are identified here as specific purposes that guided ITRE's activities in its first year of operation.

Representation
The legislative act creating ITRE specified that the Institute would represent all interests within The University on transportation research and educational matters including, but not limited to, highway safety. In order to carry out this purpose, one function of the ITRE staff during its first year has been to acquire and maintain knowledge of all the various transportation research, education, and public service interests and activities within The University, other universities, and other non-university organizations, particularly those in the Triangle area and in the State of North Carolina.

Communications
ITRE has provided a liaison service where needed so that different transportation-related groups may work together on proposals and/or projects. An important function of ITRE is to stimulate information exchange via personal communications on transportation research and education matters. One means of exchange has been through the formation of a Technical Coordinating Committee to provide representation for all interests in the transportation field from the constituent institutions.
Grantsmanship

ITRE was created with the purpose of assisting University units as needed in acquiring financial support for transportation research and education. This assistance has been provided in preparing proposals, project reports, and providing sources of data and other information for ongoing research activities. Through this structure, the intent is for ITRE to provide leadership in stimulating joint efforts in transportation research and education, particularly inter-institutional efforts and in general, efforts of a multidisciplinary nature.

Long-Range Planning

The NCDOT grant and the Charter specify that ITRE would advise The University on long-range planning and on the development of policy positions concerning transportation research and education matters.

Existing Transportation Programs

One of ITRE's major purposes is to aid the coordination of existing programs and to make recommendations to the President concerning the needs for strengthening transportation research and education programs and/or develop new programs in the interest of North Carolina. Consistent with this purpose, ITRE's direction and the Council's continuing concern have been to recognize the integrity and autonomy of existing programs with the intent of optimizing the return in terms of research funds, students trained, and services to the State of North Carolina.

Administrative

The ITRE staff was directed to occupy and assume responsibility for The UNC Research Triangle Park Building, formerly known as the National Driving Center Building, located at 30 Alexander Drive, Research Triangle Park. This building consists of approximately 20,000 square feet of office, library, and conference space, about half of which is occupied by ITRE activities.
STAFF ACTIVITIES

Building Administration

ITRE is responsible for the annual budget for this building (approximately $55,000 per year) and serves in an administrative capacity to handle all public inquiries from the other four General Administration units in the building. It develops annual maintenance contracts. It is responsible for arranging and handling all meetings and conferences in the three class and conference rooms. It handles receptionist duties for the building, taking calls and handling information activities for the other groups as needed.

Inventory of UNC Transportation Programs

ITRE has conducted a complete and thorough inventory and analysis of transportation-related education, research, and extension activities throughout the 16 campuses of The University. This inventory has been conducted for 13 transportation-related research organizations on six separate campuses, eight educational programs with major responsibilities for teaching transportation-related curricula to undergraduates and graduates, 73 educational programs with individual course listings that are related to the transportation field, four public service organizations, and 16 libraries with special holdings in transportation-related materials.

Studies of Other Transportation Institutes

In mid-1978, a series of visits and case studies were made to a number of the more important transportation institutes throughout the country. These ranged from the relatively large, established transportation institutes such as Northwestern University and University of California at Berkeley to the more modest, developing transportation institutes such as the University of Maryland. The character of support at these university-based transportation institutes ranged from $50,000 to $300,000 from university sources, and from $115,000 to $500,000 from direct state grants. A number of excellent suggestions and comments were received from the various organizations visited which greatly assisted the development of ITRE. Through professional organizations, contacts have been maintained with professionals in a number of these transportation institutes and opportunities for joint education and research activities are being explored.
Contacts with Funding Sources

On many occasions, meetings have been held and inquiries made concerning the potential for the funding of grants and contracts in the transportation field to The University. Contacts are continuing with the USDOT and its respective administrations, the North Carolina DOT and various units therein, and the Oak Ridge National Laboratory in developing transportation and energy related programs, among others. In addition, professional journals, RFP's, and other information on professional activities are received regularly. Where these activities are of interest to particular faculty and staff throughout The University, the information is forwarded to them and assistance provided in following up with proposals.

Organization of Technical Coordinating Committee

As outlined in the ITRE Charter, the Director of ITRE should seek the advice of this committee in the formulation and coordination of the ITRE program. This committee has been formulated from the major participating organizations on nine different campuses of The University. The committee was called together on three different occasions in the fall semester of 1978 and once during the spring semester. These forums provide an opportunity for interchange of ideas and the exchange of information among heretofore uncoordinated transportation programs, and has provided opportunities for joint preparation of research and educational proposals. This committee also reviews all drafts of various policy and procedure memoranda to be recommended to the ITRE Council for University adoption.

A major benefit of this committee has been to provide an open forum on the types of educational, research, and public service activities that could be developed if resources were combined from more than one campus of The University. The members of this group have expressed their feelings that such coordination is needed on a continuing basis, in order to strengthen existing programs and to plan for new programs. The members represent ITRE on their campuses.

A list of members of the TCC is shown as Appendix B.
Transportation Education Programs

From an analysis of all cataloged material and visitations on 14 campuses, a major report has been completed relating to the status of transportation education within The University. This includes not only those disciplines which are considered completely transportation oriented, but also others that need transportation expertise such as political science, economics, sociology, etc. A complete listing of all of the courses that relate to transportation has been compiled by university and by discipline. A series of biographies has been developed on personnel involved in or related to the transportation teaching activity (See Appendix G).

Recommendations have been developed concerning the need for improvement in transportation education and the directions that might be suggested for The University. Subcommittees will be formed to bring together those teaching similar types of transportation-related courses within The University such that conferences may be developed for general discussion of these teaching areas and to improve teaching expertise.

There is a need for coordinating transportation activities between the universities at Raleigh, Chapel Hill, Greensboro, and Charlotte, in particular, with the view towards exchange of teaching personnel for specialized courses and the coordination and bringing together of these academic people for the development of more complete training programs in transportation for state government.

Transportation Research Program Development

An analysis and report of the status of transportation research programs throughout The University has been completed. From this analysis, it is concluded that transportation research activities are currently in a state of transition. Not only was ITRE created to facilitate transportation research on the various campuses, but various internal changes and trends on the campuses themselves are indicating a process of change. This environment is to some extent a reflection of current shifts in funding patterns at state and federal levels.
For example, indications are that even though a strong commitment
to provide transportation safety research funds still exists, a
great deal of emphasis is being placed on the effect of changes in
the energy situation as it affects transportation systems and services.
No organization within The University has a major focus on trans-
poration and energy-related issues, although several are considering
these issues as a part of their research programs.

In responding to this apparent gap in a major research issue of
current national and statewide interest, a research proposal for
funding of various types of transportation and energy-related
research projects was prepared by ITRE and submitted to the Oak
Ridge National Laboratory, Energy Division. This proposal was
funded as a "Master Research Agreement" at approximately $100,000
per year. The proposal included money for research projects per
se, and not for support of the administrative functions that would
be necessarily assumed by ITRE.

Approximately one-third of the grant received from the North
North Carolina Department of Transportation was set aside for "program
development" projects, which ITRE has used to fund independent
research and educational activities on several campuses of The
University. A general purpose request for proposals was pre-
pared last year and solicitations mailed out to all campuses of
The University. Approximately thirty proposals were received
in response to that solicitation, of which nine were funded
on five different campuses of The University.

As a result of these program development activities, several proposals
were prepared by The University of North Carolina at Charlotte,
N.C. A & T State University, The University of North Carolina at
Chapel Hill, and North Carolina Central University for possible
federal funding. Of particular note, ITRE's staff worked directly
with staff from North Carolina Central University to develop a new
research program in the area of transportation improvements needed
for minorities. At the present time, there is a continuing need
for coordinating further proposals on transportation-related
activities, particularly in the areas of transportation and energy.
Public Service Activities

Management of the NCDOT has expressed an interest in developing training programs for their Division of Highways personnel. ITRE at the present time is working on the development of an annual transportation conference for the North Carolina Department of Transportation employees, and short courses for division and district maintenance, construction, and traffic personnel. Similarly, ITRE may become involved in putting on lectures and seminars on the operation of NCDOT for its two-year training programs for new engineering employees. Many other results are likely to ensue from the current study on research and training needs for the NCDOT, funded at $62,300.

Transportation Information System Development

ITRE and the North Carolina Department of Transportation are in the process of developing a transportation library and information system (TRANSLIS) for users in this state. Services of this system will ultimately be available to transportation researchers from throughout the southeast and other parts of the country. The following tasks have been completed: (1) assessing all transportation-related holdings in central and special library collections on 15 campuses of The University; (2) obtaining a needs list from potential users of transportation references; (3) determining the status of cataloging these collections on the nationwide On-Line Union Catalog (OCLC) system; and (4) cataloging the holdings of the Transportation Institute Library on the N.C. A & T State University campus. These tasks have helped to provide an up-to-date inventory of all transportation material available on the various campuses, and are being used as a data base to develop a proposal for assistance in establishing this system.

It has been ascertained that ultimately such a system, with all the necessary facilities such as OCLC terminals and computerized search facilities, should be staffed with a trained transportation librarian in order to provide specialized reference services. This librarian would work directly with the central and special libraries on each campus, particularly those with significant collections of transportation-related material. ITRE is currently conducting a series of workshops with librarians and users to develop this service further.
DEVELOPMENT OF POLICIES

Working directly with the Technical Coordinating Committee and the ITRE Council, a number of administrative policies and procedures have been thoroughly reviewed and discussed and finally, adopted by the Council at their meeting on December 11, 1978. Policies and procedures were adopted in the area of the functions, membership, and meetings for the Technical Coordinating Committee, research administration and research operations and coordination, the development of transportation libraries and information services, transportation education, and public service activities.

In Education, ITRE will:

Conduct studies of transportation education activities and needs.
Make available and disseminate educational materials.
Make recommendations concerning new courses or new curricula.

In Public Service, ITRE will:

Coordinate extension activities in transportation for The University.
Develop a list of needed training programs.
Publish information on available short courses and training programs.

In Library/Information Services, ITRE will:

Assist in cataloging transportation libraries.
Publish a newsletter on research and other transportation activities.
Develop access to a computerized information retrieval system.

In Research, ITRE will:

Prepare proposals on its own or jointly with others.
Employ additional personnel only when expertise does not already exist.
Represent The University's transportation interests upon request.
Improve lines of communication and coordination among research activities.

A complete set of these policies is listed as Appendix D.
PROGRAM DEVELOPMENT PROJECTS

The Incentive Grant from NCDOT designated approximately $46,000 to be allocated to program development projects for faculty and graduate students, an activity that many transportation institutes throughout the country feel is very fundamental to the development of improved education and research capabilities at university institutes.

In May and June, 1978, ITRE publicized throughout The University that it had these funds available for research and education grants to professors and graduate students. Some of these funds were used for policy development and staff support for the Institute. A number have been used for specific research, education and library development grants at the constituent institutions of The University. Approximately 30 proposals were received for the use of these funds. They continue to be presented to ITRE from time to time.

Because these grants were experimental for ITRE's first year of operation, no attempt was made to direct the research activity beyond the initial statement of work. A summary of nine individual projects is shown in this section. These project descriptions are grouped in three general areas: two projects related to the development of educational materials, one related to providing information services, and six to research projects.

In addition to these proposals that were funded, nineteen other proposals were received for potential funding with a combined value of approximately $235,000. These projects, many of which still are worthy of support, are activities that could be undertaken by ITRE if program development funds are available in the future. With regard to these proposal submissions, ITRE has assisted two of the Principal Investigators in obtaining funding for their projects from outside sources, and another project proposal has been submitted and is currently under consideration for funding.

Significantly, more activity of this nature is warranted. The value of the Incentive Grant money made available for program development work is evident from the fact that these funds spent for background research have contributed to a total of six projects being funded from outside sources with three other proposals still outstanding.
EDUCATION

Development of a Course on Transportation and Energy

Principal Author: Lalita Sen, Transportation Institute, N.C.
A & T State University

Two programs of study are offered at the A & T campus: a major in motor carrier management and physical distribution, and a minor in rural and urban transportation planning. This course was developed for both of these curricula and is oriented to an inter-disciplinary audience. Its aim is to create an active interest in the energy issues affecting the transportation sector of the United States economy. Topics addressed include relationships between land use and energy consumption, energy efficiency of various modes, safe transport of energy commodities, and state and federal roles in planning and policy making. These materials are available upon request. (All major ITRE publications are listed in Appendix E.)

Feasibility Study for the Development of a Curriculum on MOPED Safety

Principal Investigators: Alfred S. King and John E. Schlick, Traffic Safety Center, East Carolina University

This study was undertaken to determine the feasibility of providing MOPED operator education programs both in-school and out-of-school. In addition, a curriculum guide for use in such a program was developed including course outlines, objectives, and "on-the-road" exercises. The conclusions were that these programs need to be developed separate of present high school driver education programs, and that a pilot test of the curriculum as developed should be undertaken. Testing should be conducted by the Traffic Safety Center for the NC Office of Highway Safety as a result of this project.
INFORMATION SERVICES

Cataloging the Transportation Institute Library

Project Director: Richard S. Watt, Transportation Institute, N.C. A & T State University

As an initial effort in the overall development of TRANSLIS, described above, roughly half of the titles of this transportation literature collection were cataloged on the OCLC/SOLINET system. Also included in this effort was the development of a subject heading list that may be used for cataloging other transportation holdings in university and state agency libraries. As funding allows, other transportation holdings will be cataloged on OCLC.

RESEARCH

Safety Analysis of Hazardous Material Transport

Principal Investigator: Carlos G. Bell, Department of Urban and Environmental Engineering, UNC-Charlotte

A summary and evaluation of information on the shipment of hazardous materials was completed during the past year, with particular emphasis on current and near-future problems in North Carolina. The analysis included a broad look at the history, trends, and prospects of the safety effects of transporting toxic chemicals, combustibles, explosives, energy commodities, and radioactive materials. Modes of transportation included in the report are rail, pipeline, highway and water. Materials from this project are also available to augment courses in transportation and transport safety. The final report will be available from ITRE. A major section of the report deals with the dumping of PCB's along some 270 miles of rural roadway in North Carolina.
Market Potential for Innovative Transportation Services

Principal Investigator: Julian Benjamin, Transportation Institute, N.C. A & T State University

A project was completed that accomplished the following objectives: (1) review of recent developments in attitudinal measurement techniques in evaluating market potentials, (2) investigate the results of marketing research, (3) review attitudinal measurement applications in travel demand forecasting, and (4) synthesize those techniques that have some promise of application in small urban and rural areas. Several technical papers are available from this research, and a major research project for UMTA also resulted.

Paratransit Simulation Design

Principal Investigators: Scott Iverson, Dept. of Urban and Environmental Engineering, UNC-Charlotte, and Jonathan L. Benson, Institute for Urban Studies and Community Service

Systems analysis and dynamic programming techniques were used in the design of a simulation model that would analyze data on the transportation needs of the elderly and handicapped. Secondary data sources were identified and collected to use in some initial experiments with the model, and a survey instrument was developed to provide primary data for further testing of the model. A research report on the project is available, and further development of the approach to simulating paratransit services has been conducted with funding from other sources. The Charlotte metropolitan area is the test site for the subsequent investigation.

Personal Transportation Behavior and Energy Conservation

Principal Investigator: Susan E. Clarke, Institute for Research in Social Science, UNC-Chapel Hill

A statewide telephone survey of some 600 households in North Carolina provided data on the viability, effectiveness, and differential impact of state policies for energy conservation in the transportation sector. A major research report was prepared on the analysis of these data covering findings in several aspects: (1) potential for energy savings in the journey to work and in discretionary travel, (2) economic and noneconomic factors affecting changes in transportation modes, and (3) policy options for the State of North Carolina. Many of the findings of this study will be of interest and direct application in other states with a rather diffusely-settled population and a large number of small urban areas.
Transportation Brokerage and System Management

Project Coordinator: Charles Feibel, Dept. of City and Regional Planning, UNC-Chapel Hill

This study was conducted by graduate students in this department under the direction of Professor Gorman Gilbert. Intended as a practical guide in alleviating some of the regional mobility problems in the Research Triangle Region, the final report serves as a resource for area planners and public officials in considering innovative programs in transportation system management (TSM). A proposal was developed for a coordinated set of intercity services with connecting nodes at several regional transfer facilities. The region for coverage of the proposed system is a 3-county region of about 400 square miles. Design specifications for the system, and demonstration project budget estimates, are included in the final report, which is available for distribution.

Scheduling Techniques for Highway Construction, Maintenance and Safety Projects

Principal Investigator: David W. Johnston, Department of Civil Engineering, N.C. State University

A state-of-the-art report was prepared from this investigation on a graphical method for scheduling construction projects. The method, sometimes called the Linear Balance Method or Linear Scheduling Method, is particularly applicable to linear projects such as highways, runways, railways, tunnels and pipelines. A critical review and assessment is made of the method including its possibilities for use in U.S. highway improvements.
FINANCIAL STATEMENT

The following statement represents the general allocation of funds for the Institute for Transportation Research and Education for the 1978-79 year (generally June 1, 1978 through June 30, 1979). Sources of funds were N.C. Department of Transportation Grant No. IG-300-76-001R, and General Administration funds for fiscal year 1979. The DOT grant covered the period November 7, 1977 through September 30, 1979, although most of the allocation was expended during the 13-month period referred to above.

1. Research, Education, Public Service and Information Dissemination Projects $106,814
   Director & Deputy Director $44,742
   Institutional Grants 46,612
   Research Assistants, Typists 15,460

2. ITRE Administration & Support $ 23,411
   Director & Deputy Director $17,400
   Administrative Secretary, Typists $6,011

3. Travel $ 5,775

4. Other Direct Costs $ 8,500

5. Subtotal, Program Development and Support $144,500

6. Building and Grounds, UNC-GA Building, 30 Alexander Drive, Research Triangle Park $ 52,043

APPENDICES

This supporting documentation presents a summary of people that have been associated with ITRE since its inception: Council, staff, associates, and Technical Coordinating Committee. It also gives other details concerning the ITRE program during 1978-79, such as a listing of reports prepared and a complete listing of adopted policies.

Although ITRE has no direct administrative or management function over transportation programs and activities carried out on the campuses of the constituent institutions of The University of North Carolina, ITRE does maintain an overview of these programs and collects, assimilates, and distributes information concerning them. Accordingly, the results of the inventory of faculty and staff employed, courses offered, and research and public service projects conducted throughout The University in the field of transportation during 1978-79 are also presented in this report.

Although we have attempted to be comprehensive and exhaustive in our search for, and assimilation of, information about transportation programs and activities, there will invariably be omissions in a compilation of this type. If such omissions or errors are noted, they should be brought to the attention of ITRE, P.O. Box 12551, Research Triangle Park, N.C. 27709
APPENDIX A
COUNCIL ON TRANSPORTATION RESEARCH AND EDUCATION

John Sanders, Council Chairman
Director, Institute of Government
Chapel Hill, North Carolina 27514

Roy Carroll
Vice President for Planning
The University of North Carolina-General Administration
Chapel Hill, North Carolina 27514

William DeMaria
Medical Director
Blue Cross/Blue Shield of North Carolina
Durham, North Carolina 27702

Lewis C. Dowdy
Chancellor
North Carolina A & T State University
Greensboro, North Carolina 27411

George Herbert
President
Research Triangle Institute
Research Triangle Park, North Carolina 27709

E. Walton Jones
Deputy Secretary
North Carolina Department of Natural Resources & Community Development
Raleigh, North Carolina 27611

L. Felix Joyner
Vice President for Finance
The University of North Carolina-General Administration
Chapel Hill, North Carolina 27514

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

J. Charles Morrow
Provost
University of North Carolina-Chapel Hill
Chapel Hill, North Carolina 27514

Donald J. Stedman
Acting Vice President for Research and Public Service
The University of North Carolina-General Administration
Chapel Hill, North Carolina 27514
APPENDIX P

ITRE TECHNICAL COORDINATING COMMITTEE

W. F. Babcock - Chairman
ITRE
Research Triangle Park, NC 27709

Gordon Bennett
Department of Geography
UNC-Greensboro
Greensboro, NC 27412

B. J. Campbell, Director*
Highway Safety Research Center
UNC-Chapel Hill
Chapel Hill, NC 27514

Paul D. Cribbins*
Civil Engineering Department
North Carolina State University
Raleigh, NC 27650

Sidney Evans, Chairman*
Department of Economics
NC A & T State University
Greensboro, NC 27411

Mark Freeman, Director
Center for Improving Mountain Living
Western Carolina University
Cullowhee, NC 28723

Gorman Gilbert*
Department of City & Regional Planning
UNC-Chapel Hill
Chapel Hill, NC 27514

Wayland C. Griffith, Director
Engineering Design Center
North Carolina State University
Raleigh, NC 27650

Edd Hauser - Secretary
ITRE
Research Triangle Park, NC 27709

Ellis King, Chairman*
Dept. of Urban and Environmental Engineering
UNC-Charlotte
Charlotte, NC 28223

Ben F. Loeb, Jr.
Assistant Director
Institute of Government
Chapel Hill, NC 27514

John R. Maiolo, Chairman*
Sociology & Anthropology Dept.
East Carolina University
Greenville, NC 27834

Charles E. McDaniel, Director
Center for Safety and Driver Ed.
Appalachian State University
Boone, NC 28607

Woodrow W. Nichols, Chairman
Department of Geography
North Carolina Central University
Durham, NC 27707

Melvin Roy, Assistant Dean
College of Business
Appalachian State University
Boone, NC 28608

Arthur Saltzman, Director*
Transportation Institute
NC A & T State University
Greensboro, NC 27411

* Denotes Members of Executive Committee of the TCC
APPENDIX C

ITRE MANAGEMENT AND PERSONNEL

Institute Staff
W. F. Babcock - Director
Edd Hauser - Deputy Director
Terri Hepler - Administrative Secretary
Kim Steed - Secretary and Building Receptionist (since 7-1-79)
Luanne Davis - Secretary and Building Receptionist (1978-79)
Elizabeth Lofton - Research Assistant (part-time temporary)
Zaneta Walker - Research Assistant (part-time temporary)

Associated Faculty and Graduate Students

Depending on project and program development needs, ITRE from time to time during the course of the 1978-79 year employed the services of various faculty and staff as educational consultants to the Institute, supported independent research activity on five campuses of The University, and supported or supervised graduate students as part of a particular project team. Personnel thus associated with ITRE during the past year have included:

Ronald J. Anderson, Graduate Student in Special Education, UNC-CH
Carlos G. Bell, Professor of Urban and Environmental Engineering, UNC-C
Julian Benjamin, Assistant Professor of Economics, NC A & T
Susan Clarke, Asst. Dir. Inst. for Research in Social Science, UNC-CH
Paul D. Cribbins, Professor of Civil Engineering, NCSU
Charles Feibel, Graduate Student in City and Regional Planning, UNC-CH
Don Haynes, Research Assistant, Inst. for Research in Social Science, UNC-CH
Nahed Hazaa, Graduate Student in Civil Engineering, NCSU
Scott Iverson, Asst. Prof. of Urban and Environmental Engineering, UNC-C
David W. Johnson, Assistant Professor of Civil Engineering, NCSU
Alfred S. King, Director, Traffic Safety Center, ECU
L. Ellis King, Chairman, Urban & Environmental Engineering, UNC-C
Robbielene Lawhorn, Graduate Student in Transportation, NC A & T
John E. Schlick, Associate Professor of Driver & Safety Education, ECU
Lalita Sen, Associate Professor of Sociology, NC A & T
Richard S. Watt, Research Associate, The Transportation Institute, NC A & T
Rolf Williams, Graduate Student in Special Education, UNC-CH
APPENDIX D

ITRE POLICIES

The following administrative policies and procedures were adopted by the Transportation Research and Education Council after a series of meetings to develop these policies by the Technical Coordinating Committee. Policies were adopted by The Council at their regular meeting on August 14 and December 11, 1978.

Public Service

1. ITRE is authorized to serve as an "extension specialist" for the University in transportation matters.

2. A major portion of one ITRE staff member's time should be involved in working closely with state and local government on all training and extension activities.

3. ITRE is authorized to develop and coordinate an annual state-wide transportation conference for the NCDOT.

4. ITRE shall initiate a public service program by developing a master list of needed training programs for state and local transportation agencies, and undertake this by developing and/or working with certain committees from state and local agencies.

5. With the aid of the Technical Coordinating Committee, other training areas in terms of both public and private enterprise shall be analyzed with a view towards the desirability of participation from ITRE.

6. ITRE shall take leadership in developing a publication indicating the types of transportation short courses and training programs that are available in North Carolina. It shall develop a master list of training programs that are of interest that are offered through other institutions throughout the country.

Education

The adopted Charter of ITRE indicates that it will facilitate communications between, and the exchange of information within the University on matters relating to transportation education. Also, that ITRE will advise the University on planning and development positions concerning transportation education, and that it will make recommendations to the President in terms of the needs for strengthening transportation education and/or developing new programs in the interest of the State of North Carolina.
1. ITRE is authorized to conduct further in-depth studies and interviews concerning transportation education activities throughout The University.

2. In order to implement the policy statement above, the ITRE Council supports the concept that all educational materials (i.e., course outlines, bibliographies, and related materials) developed by the academic faculties on state time are public property and may be made available through ITRE to others involved in the transportation educational process.

3. The ITRE staff shall make recommendations to the Council and The University's General Administration concerning the need for new courses or curricula. The ITRE staff shall be informed of proposed additions or changes in transportation curricula that might at some future date be acted on by special University degree committees, the Graduate Council, the General Administration, or the Board of Governors.

Transportation Libraries and Information Services

Although the transportation related literature that exists within the State is fairly extensive in scope and coverage, it is scattered among a number of State and University libraries. There is considerable duplication of effort at the present time, and the availability of information for students, faculty, and other people in the transportation industry, is somewhat limited.

1. The first and most obvious policy is that there should not be an extensive collection of transportation literature at the ITRE Building in the Research Triangle Park.

2. ITRE shall encourage and assist in any way possible the cataloging on the OCLC/Solinet system, all transportation libraries within The University.

3. A duplicate card catalog should be maintained of the transportation holdings in The University and NCDOT libraries, as well as major national transportation libraries.

4. ITRE shall distribute information via a newsletter on current research progress, on results of research, and news of transportation activities in several specific areas, such as energy, environmental impact, public transportation, and safety.

5. A readily available access to the search capabilities of computerized library information retrieval systems needs to be developed at the ITRE Building at Research Triangle Park.

6. Even though a large volume of literature will not be physically stored in a library at the ITRE Building, the ITRE Library shall be recognized as the central repository for information for TRB and other specific transportation libraries, and an official repository for TRB and other specific transportation materials that are not maintained at other libraries.
7. In addition to being an official repository of transportation information and a distribution center, a program shall be implemented on the dissemination of information, news, technical material, and general articles in the transportation field.

Technical Coordinating Committee

From the ITRE Charter, "the Director shall seek the advice of a Technical Coordinating Committee in the formulation and coordination of the ITRE Program."

A. Functions:

1. To inform the Director and Council of transportation activities on the various campuses of The University.

2. To inform the Director and Council of apparent weaknesses in transportation education, libraries, public service activities, and research on the various campuses.

3. To work with the Director in developing recommendations for plans, policies and procedures to strengthen transportation activities for The University.

4. To recommend directions and areas of excellence for transportation activities of The University of North Carolina.

5. To keep ITRE informed of transportation proposals, grants, and contracts.

6. To act for ITRE in processing and distributing transportation educational and research material.

7. Individual members may serve as "project directors" for ITRE on certain types of research contracts.

8. Individual members may serve as coordinators for public service activities including short courses and workshops that may be sponsored by ITRE.

B. Membership

1. The membership shall be drawn from constituent institutions of The University and shall not exceed twenty-four (24).

2. Specifically, initial representatives shall be from:
   a. The Civil Engineering Department or the Highway Research Program at NCSU.
   b. The Mechanical Engineering Department or the Engineering Design Center at NCSU.
   c. The Highway Safety Research Center at Chapel Hill.
   d. The City and Regional Planning Department at Chapel Hill.
   e. The Department of Economics at NC A & T.
3. There may be ex-officio members.

C. Meetings

1. The TCC shall have one regularly scheduled meeting per academic semester.

2. There shall be other meetings as needed by the Director of ITRE.

3. There may be special meetings of selected groups or committees of the TCC for specific purposes.

D. Executive Committee

1. From the membership of the TCC there shall be an Executive Committee formed within the TCC to aid the Director of ITRE. The membership shall be recommended by the Director subject to approval of the Council.

2. It shall have at least two regularly scheduled meetings per semester in addition to the regular TCC meetings.

Research Administration

It is not intended that ITRE will normally be in the business of administering contract research. There will be times when this may be necessary. The following general authorizations are suggested.

1. ITRE is authorized to prepare proposals for all types of transportation grants and contracts on its own initiative or jointly with others.

2. ITRE is authorized to employ personnel part-time or full-time, short-range, or long-range, to carry out research grants and contracts. Such personnel shall be employed only when the needed expertise does not exist within The University or when the research workload cannot reasonably be handled by existing University personnel.

3. ITRE is authorized to have faculty members of The University on its staff on a part-time or released time basis. Such faculty and staff may have split appointments and titles from both ITRE and the respective constituent institution.
4. Specific faculty and staff not a part of the ITRE staff may be asked to represent ITRE and The University at conferences, proposal meetings, etc., as approved by the Director of ITRE.

5. The ITRE staff, when specifically requested, may work with and/or represent other transportation groups within The University at research conferences, etc.

**Research Operation and Coordination**

This will be one of the major functions of ITRE. The Technical Coordinating Committee will have significant input. Although there are several University Departments and individuals that coordinate and contract with granting agencies in transportation research, there exists a need for improved coordination between The University and such agencies in making known research needs and capabilities. ITRE shall work to improve these lines of communication.

1. Upon request, ITRE may assist individual faculty and departments, centers, etc. within The University in the expenditure of ITRE's time and money in the preparation of research proposals for grants and contracts. The details of the administration of the grant or contract shall then be determined mutually between ITRE and the individual group or department.

2. ITRE shall disseminate transportation-related program information and RFP's received from all state agencies.

3. One of the ITRE staff's major responsibilities shall include working with state agencies in determining research needs on a continuing basis. It shall aid the State in finding if certain of its problems have been researched by other states or programs. It shall aid State agencies in determining the type of research that might be required.

4. ITRE may call upon other expertise to work with State government in developing needs and priorities and shall make necessary payments to these individuals in the form of release time payments to their departments or agencies during the academic year, or directly during the summer months.

5. ITRE shall make known these needs through suitable publications.

6. ITRE shall inform state and federal agencies of University expertise by maintaining an up-to-date listing of resources in transportation within The University.

7. ITRE shall have the responsibility to develop and maintain an up-to-date listing of all types of grants, contracts, RFP's and program plans both from the private and public sectors, including, but not limited to, all agencies of the USDOT and NCDOT.

8. ITRE shall publish and distribute to all agencies and groups interested in transportation research such RFP's that may be received from time to time. For those with tight deadlines, ITRE shall telephone this information to interested parties.
9. ITRE shall keep a current listing for distribution of all active transportation grants and contracts within The University and other agencies of the State. Transportation units within The University will be requested to report such information to the Director.

10. ITRE shall keep a listing for distribution of all outstanding proposals for grants and contracts relating to transportation. A copy of the internal clearance form that is sent to General Administration will be obtained by ITRE for such an activity.

11. ITRE shall keep a listing of all individuals within The University having an interest or expertise in certain areas of transportation research and support activities. These shall include biographical sketches and other information which can be made available to any group or agency needing it. ITRE shall publish a yearly condensation of these individual's experience or competence.

12. ITRE shall have a publication series. In addition to its own publications, ITRE may jointly publish documents with other units of The University for distribution to other universities, transportation institutes and public and private agencies.

13. ITRE shall have in its files copies of research results and publications of The University relating to transportation and shall publish on a periodic basis such a listing by title and abstract.

14. ITRE shall periodically make known to The University Administration the existing capabilities for research in the various transportation disciplines.

15. ITRE shall periodically indicate to The University Administration inherent weaknesses in transportation research disciplines and suggest improvements or modifications.

16. ITRE shall periodically prepare for the consideration of The University Administration goals and objectives for transportation research emphasis.

17. ITRE shall make known these goals to The University faculty and staff and should work to bring the greatest expertise possible to bear upon these research goals and objectives in transportation.

18. ITRE should work to stimulate and facilitate research among constituent institutions in certain emphasis areas of current importance to the State and Federal levels.
APPENDIX E

ITRE REPORTS AND PAPERS

Babcock, W. F.

Babcock, W. F.

Babcock, W. F.

Babcock, W. F.

Bell, Carlos G.

Benjamin, Julian

Benson, Jonathan and Scott Iverson

Clarke, S. E. and Don Haynes

City and Regional Planning Department, UNC-Chapel Hill

Hauser, Edwin W. and W. F. Babcock
"Program Development for the UNC Institute for Transportation Research and Education," ITRE, April 1978.
Hauser, Edwin W.

Hauser, Edwin W. and Paul D. Cribbins
"Case Studies of Nine Selected Transportation Institutes," ITRE, August 1978.

Hauser, Edwin W., Paul D. Cribbins, and Jeffrey H. Orleans

Hauser, Edwin W., Lalita Sen and Elizabeth Laney

Johnston, David

Lofton, Elizabeth

Schlick, John E. and Alfred S. King

Sen, Lalita

Sen, Lalita

Sen, Lalita and Edwin W. Hauser

Watt, Richard S.
APPENDIX F

TRANSPORTATION RESEARCH AND PUBLIC SERVICE
ACTIVITIES AT UNC CONSTITUENT INSTITUTIONS

Appalachian State University

"Emergency Medical Technician Module Revision Project"
Charles McDaniel, Center for Safety and Driver Ed.
9/1/78 - 3/30/79
Curriculum Development $ 4,000

"AT & T Long Lines - Advanced Driving Maneuvers"
McDaniel
10/30/78 - 11/21/78
Short Course $ 4,350

"Emergency Vehicle Operators Course (EVOC) for Ambulance Personnel"
McDaniel
11/1/78/ - 9/30/79
Workshop/Short Courses $88,787

"DuPont Company - Advanced Driving Maneuvers Programs"
McDaniel
11/27/78 - 12/31/79
Short Courses $ 6,045

"Emergency Medical Services - Communicators Instructional Program"
McDaniel
12/1/78/ - 11/30/79
Workshop/Short Course $39,388

"Executive and Diplomatic Protection Driver Training Program"
McDaniel
4/3/79 -
Short Courses $15,000

"Development of a School Bus Safety Curriculum"
McDaniel
7/1/79 - 6/30/80
Curriculum Development $15,000

"Transportation and Human Values - A Public Forum"
Stephen Simon, Department of History
10/3/79 - 3/31/80 $ 2,590

"EVOC - Metro Ambulance"
McDaniel
11/26/79 - 2/15/80
Short Course $ 2,122
East Carolina University

"Bicycle Safety Guide for Driver Education Instructors"
Alfred S. King, Traffic Safety Center
10/1/77 - 9/30/78
Curriculum Development $15,000

"Feasibility Study for the Development of a Curriculum for MOPED Operators"
King
7/3/78 - 12/31/78
Curriculum Development $4,000

"Traffic Safety Education Workshop - School Bus Safety"
King
7/1/79 - 6/30/80
Workshop $15,000

North Carolina A & T State University

"An Analysis of Shipper/Receiver Transport Mode Choice"
Alice Kidder, Transportation Institute
7/1/77 - 10/27/78
Research $69,371

"Evaluating Rural Public Transportation Demonstrations"
Joyce Johnson, Transportation Institute
3/1/78 - 2/28/79
Research $75,746

"Local Transportation Finance: Cost-Sharing Arrangements of Towns and Cities"
Kidder
8/15/78 - 8/14/79
Research $70,000

"Catalog the Transportation Institute Library and Assist ITRE in Developing a Transportation Library/Information System"
Richard Watt, Transportation Institute
7/1/78 - 8/14/79
Research Support $6,800

"Research Design for a National Survey of Shipper/Receiver Mode Choices in Selected Rural Areas"
Kidder
10/1/78 - 3/31/79
Research $5,408

"Travel Needs of Low and Middle Income Urban Residents"
Lalita Sen, Transportation Institute
7/1/78 - 6/30/79
Research $88,271
"Class I and II Carriers Perception of Regulatory Changes"
Sidney Evans, Department of Agricultural Economics
9/1/78 - 9/30/79
Research $10,000

"Use of Motor Carrier Service by Small and Limited Resource Operations"
Evans
10/31/78 - 9/25/82
Research $282,927

"Analytical Support for ITRE"
Sen
1/2/79 - 5/17/79
Research $5,451

"The Role of Commuter Transportation in Achieving Balanced Growth in North Carolina"
Evans
3/1/79 - 8/31/80
Research $20,000

"Research on Current Issues in Rural Freight"
Kidder
5/15/79 - 10/27/79
Research $24,859

"Rural Passenger Transportation Facilities in the U.S."
Kidder
5/19/79 - 9/18/79
Research $32,000

"UMTA University Research and Training Program for the Southeast"
Arthur Saltzman, Transportation Institute
7/1/79 - 6/30/82
Research and Education $183,266
(plus $106,734 subcontract with UNC-CH)

"The Utility of Attitudinal Measures for Short-term Public Transportation Planning"
Sen and Julian Benjamin
7/1/79 - 6/30/80
Research $71,000

"School Bus Safety Curriculum Development"
Isaac Barnett, Department of Safety and Driver Ed.
7/1/79 - 6/30/80
Curriculum Development $15,000
North Carolina Central University

"The Equity and Adequacy of Transportation Facilities in Black Communities"
Woodrow Nichols, Department of Geography
6/1/79 - 5/31/80
Research $50,000

"Geographic Field Methods and Techniques"
Nichols
6/23/79 - 8/1/80
Research $39,448

North Carolina State University

"Bicycle Safety Education Program"
Claude E. McKinney, School of Design
3/22/77 - 12/31/78
Public Service $40,000

"Noise Control of General Aviation Aircraft"
Franklin D. Hart, Dept. of Mechanical & Aerospace Engineering
7/1/77 - 9/30/79
Research $58,000

"Truck Tire Vibration Studies"
7/1/78 - 6/30/80
Research $70,000

"Curriculum Guide on a Course for Bicyclists"
Laurie Charest, Center for Urban Affairs and Community Service
10/1/77 - 9/30/78
Curriculum Development $21,000

Grigg Mullen, Dept. of Civil Engineering
7/1/78 - 6/30/79
Research $350,000

"Attitude Survey on Highway Safety"
K.W. Klein/P.W. Thayer, Dept. of Psychology
9/27/78 - 12/31/79
Research $7,604

"Vehicle Geometry Transformations"
F.O. Smetana, Dept. of Mechanical & Aerospace Engineering
5/1/79 - 9/30/79
Research $9,938
"Mechanized Bridge Maintenance Scaffold Erection and Support Device"
Carl F. Zorowski, Dept. of Mechanical & Aerospace Engineering
5/14/79 - 8/31/79
Research $ 7,281

"Aerodynamic Characteristics of Wings at Subsonic Speeds"
F. R. DeJarnette, Dept. of Mechanical & Aerospace Engineering
5/16/79 - 5/15/80
Research $ 19,485

"Extend New Method of Extract Thrust Horsepower and Drag from Flight Test Data to Other Performance Parameters"
Smetana
7/23/79 - 7/22/80
Research $ 49,000

"Seasonal and Directional Transport Rate Differentials"
Marc A. Johnson, Agricultural Extension Service
5/14/79 - 9/30/81
Research $ 44,929

"IPA Assignment Agreement with the USDOT"
Michael J. Goodman, Dept. of Industrial Engineering
8/1/79 - 7/30/80
Research and Education $ 26,586

"Evaluation of Lubricating Oil Recycling Demonstration"
Wayland C. Griffith, Engineering Design Center
9/1/79 -
Research $400,000

"Bridge Inspectors Training Program"
Ray F. DeBruhl, Dept. of Civil Engineering
2/10/79 -
Training $ 7,765

"Resource Conservation in Nepal"
Griffith
6/1/79 - 8/15/79
Research $ 10,000

"Evaluation Resource Materials to Rural Transportation Facilities"
Johnson
4/1/79 - 9/30/81
Research $ 89,540

* A set of projects from the 1978-79 Highway Research Program is shown on the following pages. Funding includes continuation funds for some projects that are continuing into 1979-80.
Project Number: 71-5
Title: Evaluation of the Effectiveness of Fabric Reinforcement in Extending the In-Service Life of Bituminous Concrete Analysis
Principal Investigators: W. G. Mullen and R. J. Hader
Budget: $3,230 - 1978-1979

Under this project a long term study has been made of the effectiveness of certain fabric and non-fabric reinforcements in preventing development of reflective cracking in bituminous resurfacing overlays of old pavements needing rehabilitation.

Project Number: 76-1
Title: Some Problems Peculiar to Highway Construction in the North Carolina Coastal Areas
Principal Investigators: S. W. Broome, J. M. Muller, E. D. Seneca and R. W. Skaggs
Budget: $16,887. - 1978-1979

This study undertaken over a period of almost four years has been to evaluate the effects of highway construction in the coastal maritime forest, dune and marsh areas on flora and fauna of the area.

Project Number: 77-5
Title: Dynamic Stress Analysis of Steel Girders During Transit Over the Road
Principal Investigator: W. L. Bingham
Budget: $2,765 - 1978-1979

Large steel bridge girders transported from fabrication plant to construction site have been instrumented and monitored to determine if handling and transportation loads are damaging to these structural members.

Project Number: 78-2
Title: Relating Traffic Volume, Traffic Lane Width and Accidents for Continuous Flow Sections of Multilane Urban Arterials
Principal Investigators: C. L. Heimbach and P. D. Cribbins
Budget: $53,980 - 1978-1979

Field and laboratory studies have been conducted to determine the interrelations of traffic lane width on multilane urban arterial streets and volume of traffic on these streets to incidence of accidents.
Project Number: 78-4
Title: Camber in Prestressed Beams
Principal Investigator: J. F. Mirza (deceased)
Budget: $6,707 - 1978-1979

An investigation has been undertaken to determine causes of and possible controls for variations in camber of pretensioned, precast, prestressed concrete bridge beams. Causes for variations that are observed are not now fully understood.

Project Number: 79-00
Title: Contingency
Principal Investigator: W. G. Mullen, Coordinator
Budget: Varies

These temporarily unallocated funds are used to support interim research projects, proposal development, implementation efforts and project extensions. Balance is usually near zero by end of fiscal year.

Project Number: 79-2
Title: Deflection Criteria for Wind Induced Vibration in Cantilever Highway Sign Structures
Principal Investigators: J. A. Edwards and W. L. Bingham
Budget: $27,800 - 1978-1979

Large cantilever highway sign structures have been instrumented to determine deflection criteria for wind induced vibrations to provide safe design practices. Three structures have been instrumented including one in Virginia which is the largest of its type in service. At least one failure of one of these structures has been reported in Texas.

Project Number: 79-3
Title: Runaway Truck Arresting Schemes
Principal Investigators: J. K. Whitfield and A. C. Eberhardt
Budget: $19,315 - 1978-1979

A combined theoretical and experimental study has been undertaken to define and quantify the design parameters necessary to produce arresting beds and devices for halting runaway trucks in areas of steep highway grades to prevent loss of life and damage to property.

Project Number: 79-4
Title: Bond Characteristics of Epoxy Coated Reinforcing Bars
Principal Investigators: D. W. Johnston and P. Z. Zia
Budget: $3,300 - 1978-1979

Design parameters are being determined in an experimental investigation for bond characteristics of epoxy coated reinforcing bars used in highway structures.
Project Number: 79-5
Title: Mixing Water and Maturity of Hardened Concrete Using Scanning Electron Microscope Techniques
Principal Investigators: W. G. Mullen and B. D. Barnes
Budget: $18,545 - 1978-1979

Using scanning electron microscope techniques to study voids and crystal structure of concrete it is being attempted to determine the water cement ratio and maturity of portland cement concrete and to provide a procedure using comparison photograph standards for routine accomplishment of this task.

Project Number: 79-99
Title: Administration
Principal Investigator: W. G. Mullen, Coordinator
Budget: $42,000 - 1978-1979

Administration provides typing and logistical support for all projects, publication of reports, purchasing, payroll and coordination with the North Carolina Department of Transportation, the Federal Highway Administration and the University.
University of North Carolina at Charlotte

"Charlotte Motor Speedway Driver Testing Project"
Glen A. Dawson, Dept. of Health and Physical Ed.
6/1/78 - 11/11/78
Research $1,330

"Bus Service Demonstration Grant"
Wayne A. Walcott, Dept. of Geography
6/1/78 - 5/30/79
Research $9,503

"Paratransit Simulation Design"
Scott C. Iverson, Institute for Urban Studies and Community Service
7/3/78 - 12/31/78
Research $6,500

"Urban Environmental Studies Program"
Gerald L. Ingalls, Dept. of Geography
2/9/79 - 1/30/80
Curriculum Development $10,630

"Feasibility of Alternate Redevelopment Strategies - N. Graham Street"
Walcott
12/29/78 - 3/30/79
Research $1,120

University of North Carolina at Chapel Hill

"Fare Elasticities and Performance Measures in the Taxi Industry"
Gorman Gilbert, Dept. of City and Regional Planning
8/15/77 - 8/14/78
Research $51,958

"North Carolina Paratransit Conference"
Gilbert
6/1/78 - 8/30/78
Workshop $20,009

"Personal Transportation Behavior and Energy Conservation in North Carolina"
Susan E. Clarke, Institute for Research in Social Science
7/1/78 - 6/30/79
Research $5,031

"Analysis of Intercity Bus Service in North Carolina"
Gilbert
8/15/78 - 8/15/79
Research $18,337
"A Transportation Brokerage System for the Research Triangle Area"
Charles Feible, Dept. of City and Regional Planning
1/1/79 - 5/30/79
Research $ 2,500

"NC Transit Management Internship Program"
Gilbert
3/6/79 - 4/5/80
Research and Education $ 20,510

"Economies of Scale in the U.S. Intercity Bus Industry"
Gilbert
5/15/79 - 5/14/80
Research $ 33,782

"Public Transportation Research and Training Program"
Gilbert
7/1/79 - 6/30/82
Research and Education $106,734

"North Carolina Parking Studies"
Gilbert, Center for Urban and Regional Studies
8/1/79 - 7/30/80
Research $ 15,000
"Driver Education for Motorcycle Operation Pilot Evaluation"  
10/1/77 - 9/30/78 $ 74,000

"Special Skills Resource for Emergency Driving"  
10/1/77 - 9/30/78 $100,000

"Upgrading North Carolina's Traffic Data Acquisition, Management and Utilization System"  
10/1/77 - 9/30/78 $248,111

"Bicycle Accident Analysis"  
10/1/77 - 9/30/78 $ 31,000

"Bicycle Safety Awareness - Evaluation"  
10/1/77 - 9/30/78 $ 20,000

"Improvement of N.C. School Bus Driver Training Process"  
10/1/77 - 9/30/78 $ 38,958

"Increasing Child Restraint Usage Through Physician and Public Education"  
10/1/77 - 9/30/78 $ 60,000

"Coordinated Driver Improvement"  
10/1/77 - 9/30/78 $100,000

"Accident Investigation Team: Pilot Study of School Bus Crashes"  
10/1/77 - 9/30/78 $ 81,000

"Development of Instruments and Procedures for Classified Licensing"  
8/19/77 - 11/30/77 $181,000

"Highway Safety Program Problem Identification"  
2/1/78 - 9/30/78 $ 32,000

"Exploratory Analysis (HSRC Accident Data File)"  
9/19/77 - 7/18/78 $ 10,000

"Analysis of State Road Test Examinations"  
9/15/77 - 3/15/78 $ 48,833

"Techniques for Predicting High Risk Drivers for Alcohol Countermeasures"  
12/1/77 - 6/30/78 $ 14,705

"Impact of Recent Change in Highway Safety Environment"  
10/1/77 - 9/30/78 $ 76,891

"Requirements Analysis for Heavy Vehicle Driver Licensing"  
4/1/78 - 3/31/79 $ 97,701
<table>
<thead>
<tr>
<th>Title</th>
<th>Date</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Highway Accident Research and Evaluation&quot;</td>
<td>9/1/78 - 8/31/79</td>
<td>$ 42,383</td>
</tr>
<tr>
<td>&quot;Upgrading North Carolina's Traffic Data Acquisition Management and Utilization Systems&quot;</td>
<td>10/1/78 - 9/30/79</td>
<td>$266,000</td>
</tr>
<tr>
<td>&quot;Highway Safety Problem Identification and Program Planning&quot;</td>
<td>10/1/78 - 9/30/79</td>
<td>$ 40,000</td>
</tr>
<tr>
<td>&quot;MOPED Accident Analysis&quot;</td>
<td>10/1/78 - 9/30/79</td>
<td>$ 35,000</td>
</tr>
<tr>
<td>Improvement of North Carolina's School Bus Driver Training Process</td>
<td>10/1/78 - 9/30/79</td>
<td>$ 47,688</td>
</tr>
<tr>
<td>&quot;Increasing Child Restraint Usage Through Physician and Public Education&quot;</td>
<td>10/1/78 - 9/30/79</td>
<td>$ 84,350</td>
</tr>
<tr>
<td>&quot;Coordinated Driver Improvement&quot;</td>
<td>10/1/78 - 9/30/79</td>
<td>$135,101</td>
</tr>
<tr>
<td>&quot;Accident Investigation Team: Pilot Study of School Bus Crashes&quot;</td>
<td>10/1/78 - 9/30/79</td>
<td>$ 84,000</td>
</tr>
<tr>
<td>&quot;Seat Belt Usage Workshops for State Officials - Child Restraint Workshops&quot;</td>
<td>9/29/78 - 9/28/79</td>
<td>$ 93,754</td>
</tr>
<tr>
<td>&quot;An Analysis of MOPEDS as a Potential Safety Problem in the United States&quot;</td>
<td>2/1/78 - 1/31/79</td>
<td>$ 20,010</td>
</tr>
<tr>
<td>&quot;Identification of Driver Licensing Research Requirements&quot;</td>
<td>9/6/78 - 9/10/79</td>
<td>$ 56,489</td>
</tr>
</tbody>
</table>

*Project Director on all projects listed as B.J. Campbell; all are research projects.*
UNC-Chapel Hill, Institute of Government

During a given year, the Institute of Government will put on a number of workshops, conferences, and short courses in a variety of transportation-related areas. Except for the last entry, courses are taught on demand, typically 4 to 6 times annually. During 1978-79, the following courses have been offered:

"Division of Motor Vehicle School - License and Theft Section" 1-week short courses

"Division of Motor Vehicle School - Driver Education Section" 4-day short courses

"Division of Motor Vehicle School - Driver License Section" 1-week short courses

"Division of Motor Vehicle School - Hearing Officer Section" 3-day short courses

"Municipal and County Administration Course" 3-day short courses

"Municipal Administration for City Managers and Department Heads" 4-day short courses

"Zoning Administration School" 1-week short courses

"North Carolina Planning Conference" 2-day conference

University of North Carolina at Wilmington

"The Impact of Off-Road Vehicles on Beach Dune and Grass Land Ecosystems"
P.E. Hosier/T.E. Eaton, Department of Biology
6/1/78 - 12/31/79
Research $22,674
UNC-General Administration

"A Study of Research and Training Needs of The North Carolina Department of Transportation"
W. F. Babcock, ITRE
7/1/79 - 8/31/80
Research $ 62,300

"Comparative Impacts of Alternate Transportation Modes for Shipping Energy Feed Stocks and Products with Emphasis on the Transport of OCS Gas and Oil"
E. W. Hauser, ITRE
1/1/80 - 12/31/80
Research $ 28,000

"Participation by University of North Carolina Personnel in Energy and Transportation Research Projects at Oak Ridge National Laboratory"
W. F. Babcock, E. W. Hauser
3/9/79 - 9/30/81
Research $199,910*

*Maximum funding level under Master Research Agreement; Individual projects assigned under separate task statements
APPENDIX G

FACULTY AND STAFF INVOLVED IN TRANSPORTATION RELATED PROGRAMS

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

**Appalachian State University**

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charles E. Browning</td>
<td>Center for Safety and Driver Education</td>
</tr>
<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>Robert L. Keber</td>
<td>Geography</td>
</tr>
<tr>
<td>Karl C. Mamola</td>
<td>Physics</td>
</tr>
<tr>
<td>Charles E. McDaniel (TCC)*</td>
<td>Center for Safety and Driver Education</td>
</tr>
<tr>
<td>Jonathan B. Pierce</td>
<td>Political Science</td>
</tr>
<tr>
<td>Melvin Roy (TCC)*</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>Robert L. Augspurger</td>
<td>Economics</td>
</tr>
<tr>
<td>George Chestang</td>
<td>Geography</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>John E. Schlick</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 E. Waldrop, Jr.</td>
<td>School of Technology</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isaac Barnett</td>
<td>Safety and Driver Education</td>
</tr>
<tr>
<td>Julian M. Benjamin</td>
<td>Economics; Transportation Institute</td>
</tr>
<tr>
<td>Sidney H. Evans (TCC)*</td>
<td>Agricultural Economics</td>
</tr>
<tr>
<td>Joyce H. Johnson</td>
<td>Transportation Institute</td>
</tr>
<tr>
<td>Alice E. Kidder</td>
<td>Economics; Transportation Institute</td>
</tr>
<tr>
<td>Lee A. Plummer</td>
<td>Economics</td>
</tr>
<tr>
<td>Arthur Saltzman (TCC)*</td>
<td>Transportation Institute</td>
</tr>
<tr>
<td>Lalita Sen</td>
<td>Sociology; Transportation Institute</td>
</tr>
<tr>
<td>Erskin S. Walther</td>
<td>Transportation Institute</td>
</tr>
<tr>
<td>Richard A. Watt</td>
<td></td>
</tr>
</tbody>
</table>

### North Carolina Central University

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael W. McKinney</td>
<td>Political Science</td>
</tr>
<tr>
<td>Woodrow W. Nichols, Jr. (TCC)*</td>
<td>Geography</td>
</tr>
</tbody>
</table>

### North Carolina State University

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elsayed M. Afify</td>
<td>Mechanical &amp; Aerospace Engineering</td>
</tr>
<tr>
<td>W.F. Babcock</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>B. D. Barnes</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>G. H. Blessis</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>W. L. Bingham</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>Laurie Charest</td>
<td>Center for Urban Affairs</td>
</tr>
<tr>
<td>Paul D. Cribbins (TCC)*</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>James J. Davies</td>
<td>Center for Urban Affairs</td>
</tr>
</tbody>
</table>
Name
Ray F. DeBruhl
F. R. DeJarnetke
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
J. W. Horn
J. Leroy Hulsey
Marc A. Johnson
David W. Johnston
Richard A. King
K. W. Klein
Carlton J. Leith
H. Rooney Malcom, Jr.
Grigg Mullen
Everett Nichols
Richard G. Pearson
Eileen Phalen
G. N. Richardson
F. O. Smetana
J. C. Smith
Shaler Stidman, Jr.
Arthur L. Sullivan
P. W. Thayer
C. C. Tung
Harvey E. Wahls
John Whitfield
Ihn J. Won
Paul Zia
Carl F. Zorowski
Ernest D. Seneca

Department
Civil Engineering
Mechanical & Aerospace Engineering
Mechanical & Aerospace Engineering
Mechanical & Aerospace Engineering
Operations Research
Political Science
Engineering Research Services Division
Engineering Design Center
Statistics
Mechanical & Aerospace Engineering
Civil Engineering
Civil Engineering
Civil Engineering
Agricultural Extension Service
Civil Engineering
Economics; Agricultural Extension Service
Psychology
Geosciences
Civil Engineering
Civil Engineering
Agricultural Extension Service
Industrial Engineering
Industrial Engineering
Civil Engineering
Mechanical & Aerospace Engineering
Civil Engineering
Industrial Engineering
Landscape Architecture
Psychology
Civil Engineering
Civil Engineering
Civil Engineering
Mechanical & Aerospace Engineering
Geosciences
Civil Engineering
Mechanical & Aerospace Engineering
Botany; Soil Science
### University of North Carolina at Charlotte

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carlos G. Bell, Jr.</td>
<td>Urban and Environmental Engineering</td>
</tr>
<tr>
<td>Jonathan L. Benson</td>
<td>Institute for Urban Studies &amp; Community Service</td>
</tr>
<tr>
<td>Scott C. Iverson</td>
<td>Urban and Environmental Engineering</td>
</tr>
<tr>
<td>L. Ellis King (TCC)*</td>
<td>Urban and Environmental Engineering</td>
</tr>
<tr>
<td>David Milder</td>
<td>Institute for Urban Studies &amp; Community Service</td>
</tr>
<tr>
<td>Wayne Walcott</td>
<td>Geography</td>
</tr>
<tr>
<td>Edward M. Willis</td>
<td>Engineering Technology</td>
</tr>
</tbody>
</table>

### University of North Carolina at Chapel Hill

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edward M. Bergman</td>
<td>City and Regional Planning</td>
</tr>
<tr>
<td>Raymond J. Burby, III</td>
<td>Center for Urban &amp; Regional Studies</td>
</tr>
<tr>
<td>Gorman Gilbert (TCC)*</td>
<td>City and Regional Planning</td>
</tr>
<tr>
<td>Phil Green</td>
<td>Institute of Government</td>
</tr>
<tr>
<td>George Hemmens</td>
<td>City and Regional Planning</td>
</tr>
<tr>
<td>William W. Hill</td>
<td>City and Regional Planning</td>
</tr>
<tr>
<td>Ed Kaiser</td>
<td>City and Regional Planning</td>
</tr>
<tr>
<td>Ben F. Loeb, Jr. (TCC)*</td>
<td>Institute of Government</td>
</tr>
<tr>
<td>David H. Moreau</td>
<td>City and Regional Planning</td>
</tr>
<tr>
<td>David W. Orr</td>
<td>City and Regional Planning</td>
</tr>
<tr>
<td>Barnett R. Parker</td>
<td>Institute of Government</td>
</tr>
<tr>
<td>Herbert J. Proctor</td>
<td>City and Regional Planning</td>
</tr>
<tr>
<td>Carl M. Shy</td>
<td>Political Science</td>
</tr>
<tr>
<td>Joseph W. Straley</td>
<td>Health Administration</td>
</tr>
<tr>
<td>Helen Tauchen</td>
<td>Surgery (Trauma Center)</td>
</tr>
<tr>
<td>Jake Wicker</td>
<td>Institute for Environmental Studies</td>
</tr>
<tr>
<td></td>
<td>Physics and Astronomy</td>
</tr>
<tr>
<td></td>
<td>Economics</td>
</tr>
<tr>
<td></td>
<td>Institute of Government</td>
</tr>
</tbody>
</table>

*Denotes Representatives to Technical Coordinating Committee*
Highway Safety Research Center (UNC-CH)

B. J. Campbell (TCC)*
Forrest M. Council
Linda Pitts Desper
Amitabh Dutt
William C. Fischer
Robert G. Hall
William W. Hunter
Ralph D. Johnson, Jr.
John H. Lacy

Elizabeth C. Leggett
Livia K. Li
Lauren M. Ogle
Beverly T. Orr
William P. Pope, Jr.
Donald W. Reinfurt
Margarita B. Roper
J. Richard Stewart
Patricia F. Waller

University of North Carolina at Greensboro

Name
D. Gordon Bennett (TCC)*
Charles R. Hayes
David M. Olson

Department
Geography
Geography
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
Mark Freeman (TCC)*
Maurice Jones

Department
Center for Improving Mountain Living
Economics

*Denotes Representatives to Technical Coordinating Committee
APPENDIX H

TRANSPORTATION-RELATED EDUCATIONAL PROGRAMS AT UNC CONSTITUENT INSTITUTIONS

Included herein is a summary of transportation related educational programs offered at all 16 constituent institutions of The University of North Carolina. Exhibit A shows degrees offered in discipline areas most closely associated with the field of Transportation. The remaining exhibits show course names arranged by subject areas. Where a "%" figure is shown by a course name, it indicates the percentage of that course related to that subject heading. The key for course level is: 'U'—undergraduate course; 'UG' advanced undergraduate and graduate course; and 'G'—graduate course. Exhibits included are:

<table>
<thead>
<tr>
<th>EXHIBIT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>'A'</td>
<td>UNC DEGREES IN RELATED DISCIPLINES</td>
</tr>
<tr>
<td>'B'</td>
<td>AEROSPACE, AUTOMOTIVE, MASS TRANSPORTATION; RAIL, AIR AND WATER TRANSPORTATION</td>
</tr>
<tr>
<td>'C'</td>
<td>COURSES IN TRANSPORTATION ENGINEERING AND PLANNING FOR STREETS AND HIGHWAYS</td>
</tr>
<tr>
<td>'D'</td>
<td>TRANSPORTATION COURSES IN ADMINISTRATION, ECONOMICS AND PLANNING OF STREETS AND HIGHWAYS</td>
</tr>
<tr>
<td>'E'</td>
<td>CITY AND REGIONAL PLANNING AND RELATED GEOGRAPHY COURSES</td>
</tr>
<tr>
<td>'F'</td>
<td>THE TRANSPORTATION BUSINESS - BUSINESS ADMINISTRATION AND RELATED ECONOMICS COURSES</td>
</tr>
<tr>
<td>'G'</td>
<td>TRANSPORTATION-RELATED COURSES IN GOVERNMENT AND ADMINISTRATION (POLITICAL SCIENCE AND ECONOMICS)</td>
</tr>
</tbody>
</table>
### Exhibit A. UNC Degrees in Transportation-Related Disciplines

<table>
<thead>
<tr>
<th>Type of Degree</th>
<th>UNC-CH</th>
<th>NCSU</th>
<th>UNC-G</th>
<th>ASU</th>
<th>ECU</th>
<th>A&amp;T</th>
<th>NCCU</th>
<th>UNC-C</th>
<th>WCU</th>
<th>ECSU</th>
<th>FSU</th>
<th>PSU</th>
<th>UNC-A</th>
<th>UNC-M</th>
<th>WSSU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Engineering</td>
<td></td>
<td></td>
<td>B,M,D</td>
<td></td>
<td></td>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>B,M,D</td>
<td></td>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aerospace Engineering</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td>B</td>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering Technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driver and Safety Education</td>
<td></td>
<td></td>
<td>B,M</td>
<td>B,M</td>
<td>B,M</td>
<td>B,M</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City &amp; Regional Planning</td>
<td>M,D</td>
<td></td>
<td></td>
<td>B</td>
<td></td>
<td>B</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

'B' = Bachelor  
'M' = Masters Level  
'D' = Doctor of Philosophy or Equivalent
### AEROSPACE ENGINEERING AND DESIGN

<table>
<thead>
<tr>
<th>NCSU - Mechanical Engineering U &amp; G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace Vehicle Performance</td>
</tr>
<tr>
<td>Aerodynamics I &amp; II</td>
</tr>
<tr>
<td>Propulsion I &amp; II</td>
</tr>
<tr>
<td>Aerospace Vehicle Structures I &amp; II</td>
</tr>
<tr>
<td>Aerodynamics of V/STOL Vehicles</td>
</tr>
<tr>
<td>Flight Stability and Control</td>
</tr>
<tr>
<td>Aerospace Vehicle Design I &amp; II</td>
</tr>
<tr>
<td>Theory of Noise in Transportation</td>
</tr>
<tr>
<td>Advanced Flight Vehicle Stability &amp; Ctrl</td>
</tr>
<tr>
<td>Inertial Navigation Analysis &amp; Design</td>
</tr>
<tr>
<td>Airfoil Theory</td>
</tr>
<tr>
<td>Transonic Aerodynamics</td>
</tr>
<tr>
<td>Supersonic Aerodynamics</td>
</tr>
<tr>
<td>Hypersonic Aerodynamics</td>
</tr>
<tr>
<td>Aerodynamic Heating</td>
</tr>
<tr>
<td>Turbulence</td>
</tr>
<tr>
<td>Introduction to Rocket Propulsion</td>
</tr>
</tbody>
</table>

### AUTOMOTIVE ENGINEERING (Machines)

<table>
<thead>
<tr>
<th>NCSU - Mechanical Engineering U &amp; G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamics of Machines</td>
</tr>
<tr>
<td>Energy Conservation</td>
</tr>
<tr>
<td>Internal Combustion Engine Fundamentals</td>
</tr>
<tr>
<td>Machine Component Design</td>
</tr>
<tr>
<td>Automotive Engineering</td>
</tr>
<tr>
<td>Fluid Dynamics of Combustion I</td>
</tr>
<tr>
<td>Advanced Automotive Energy Systems</td>
</tr>
<tr>
<td>Advanced Machine Design II</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Charlotte - Mechanical and Eng. Tech U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Conservation I &amp; II</td>
</tr>
<tr>
<td>Machine Design I &amp; II</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NCA &amp; T - Mechanical Engineering U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Conservation</td>
</tr>
<tr>
<td>Internal Combustion Engines</td>
</tr>
</tbody>
</table>

### PUBLIC OR MASS TRANSPORTATION

<table>
<thead>
<tr>
<th>NCSU - Civil Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>UG - Mass Transportation</td>
</tr>
<tr>
<td>NC A &amp; T - Mechanical Engineering U</td>
</tr>
<tr>
<td>Transportation Engineering I &amp; II = 20%</td>
</tr>
<tr>
<td>Charlotte - Civil Engineering</td>
</tr>
<tr>
<td>Transportation Engineering I&amp;II = 20%</td>
</tr>
<tr>
<td>CH. Hill - City and Reg. Planning UG</td>
</tr>
<tr>
<td>Public Transportation</td>
</tr>
</tbody>
</table>

### RAILROAD TRANSPORTATION

<table>
<thead>
<tr>
<th>NCSU - Civil Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation Engineering II = 20%</td>
</tr>
<tr>
<td>CH Hill - City and Regional Planning</td>
</tr>
<tr>
<td>Railroad Planning -G</td>
</tr>
</tbody>
</table>

### AUTOMOTIVE MAINTENANCE AND SERVICE

<table>
<thead>
<tr>
<th>NCA &amp; T Industrial Technology U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive Car and Engine Care</td>
</tr>
<tr>
<td>Automotive Fundamentals</td>
</tr>
<tr>
<td>Automotive Power Transmission</td>
</tr>
<tr>
<td>Automotive Instrumentation &amp; Sys. Anal.</td>
</tr>
<tr>
<td>Automotive Service Management</td>
</tr>
<tr>
<td>Auto Body Repair and Refinishing</td>
</tr>
<tr>
<td>Automobile Body Designs and Repairs.</td>
</tr>
</tbody>
</table>

### WATER TRANSPORTATION (NCSU)

| C.E. - Water Transportation |
| M.E. - Undersea Vehicle Design |
## EXHIBIT C. COURSES IN TRANSPORTATION ENGINEERING FOR STREETS AND HIGHWAYS

### CONSTRUCTION

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCSU - Civil, Const. Option</td>
<td>U &amp; G</td>
</tr>
<tr>
<td>Construction Engineering I &amp; II</td>
<td></td>
</tr>
<tr>
<td>Construction Engineering Projects</td>
<td></td>
</tr>
<tr>
<td>Cost Analysis and Control</td>
<td></td>
</tr>
<tr>
<td>Legal Aspects of Contracting</td>
<td>(5 graduate courses in process of adoption and numbering)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCA&amp;T Industrial Technology</td>
<td>U</td>
</tr>
<tr>
<td>Construction Technology</td>
<td></td>
</tr>
<tr>
<td>Construction Engineering Intro Processes for Construction Proj.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlotte - Engineering Technology</td>
<td>U</td>
</tr>
<tr>
<td>Construction Scheduling Laboratory</td>
<td></td>
</tr>
<tr>
<td>Cost Estimating I &amp; II</td>
<td></td>
</tr>
<tr>
<td>Construction Engineering Field Lab.</td>
<td></td>
</tr>
</tbody>
</table>

### GEOMETRIC DESIGN

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCSU - Civil Engineering U &amp; G</td>
<td></td>
</tr>
<tr>
<td>Transportation Engineering I = 25%</td>
<td></td>
</tr>
<tr>
<td>Transportation Engineering II = 50%</td>
<td></td>
</tr>
<tr>
<td>Transportation Design (UG)</td>
<td></td>
</tr>
<tr>
<td>Advanced Transportation Design (G)</td>
<td></td>
</tr>
<tr>
<td>Special Project Design (UG &amp; G)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlotte - U</td>
<td></td>
</tr>
<tr>
<td>CE Laboratory II = 25%</td>
<td></td>
</tr>
<tr>
<td>CE Trans. Eng. I &amp; II = 10%</td>
<td></td>
</tr>
<tr>
<td>Eng Tech - Highway Design &amp; Const =10%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCA&amp;T - concepts only in Trans Eng</td>
<td></td>
</tr>
</tbody>
</table>

### SOILS, FOUNDATIONS, EMBANKMENTS

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCSU - Civil Engineering</td>
<td>U &amp; G</td>
</tr>
<tr>
<td>Soils Engineering I &amp; II = 50%</td>
<td></td>
</tr>
<tr>
<td>Eng. Properties of Soil I &amp; II Foundation Engineering</td>
<td></td>
</tr>
<tr>
<td>Advanced Soil Mechanics I &amp; II Ground Water Engineering</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlotte</td>
<td></td>
</tr>
<tr>
<td>CE = Geotechnical Eng = 50%</td>
<td></td>
</tr>
<tr>
<td>Eng. Tech Foundations and Earthwork</td>
<td></td>
</tr>
<tr>
<td>Soil Testing Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

### DRAINAGE & STORM WATER

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCSU - Civil Engineering U &amp; G</td>
<td></td>
</tr>
<tr>
<td>Water Resources Engineering I&amp;II = 40%</td>
<td></td>
</tr>
<tr>
<td>Municipal Engineering Projects = 15%</td>
<td></td>
</tr>
<tr>
<td>Advanced Water Management Systems (G)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlotte - U</td>
<td></td>
</tr>
<tr>
<td>C.E. Engineering Hydrology = 25%</td>
<td></td>
</tr>
<tr>
<td>Eng Tech - Intro Urban Eng = 25%</td>
<td></td>
</tr>
</tbody>
</table>

### MAINTENANCE

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCSU - Civil Engineering U &amp; G</td>
<td></td>
</tr>
<tr>
<td>Municipal Engineering Projects = 15%</td>
<td></td>
</tr>
<tr>
<td>Highway &amp; Airport Pavement Design =10%</td>
<td></td>
</tr>
</tbody>
</table>

### PAVEMENTS

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCSU - Civil Engineering U &amp; G</td>
<td></td>
</tr>
<tr>
<td>Materials of Construction = 75%</td>
<td></td>
</tr>
<tr>
<td>Transportation Eng. II = 15%</td>
<td></td>
</tr>
<tr>
<td>Theory of Concrete Mixes</td>
<td></td>
</tr>
<tr>
<td>Asphalt and Bituminous Materials</td>
<td></td>
</tr>
<tr>
<td>Highway and Airport Pavement Design</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlotte - Engineering Technology U</td>
<td></td>
</tr>
<tr>
<td>Pavement Design</td>
<td></td>
</tr>
<tr>
<td>Asphalt Paving Mixtures</td>
<td></td>
</tr>
</tbody>
</table>

### STRUCTURES (ABOUT 35% BRIDGES)

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCSU - Civil Engineering</td>
<td></td>
</tr>
<tr>
<td>U= 5 course UG &amp; G = 17 courses</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlotte U= 9 course in CE</td>
<td></td>
</tr>
<tr>
<td>U= 5 courses in Eng. Tech</td>
<td></td>
</tr>
</tbody>
</table>

### SURVEYING - ROUTE

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCSU - Engineering Surveying = 40%</td>
<td></td>
</tr>
<tr>
<td>U Trans. Eng. I = 20%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institution</th>
<th>Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlotte U</td>
<td></td>
</tr>
<tr>
<td>Lab II = 75%</td>
<td></td>
</tr>
<tr>
<td>W11 MHTN: TON - Route Surveying</td>
<td></td>
</tr>
</tbody>
</table>
### EXHIBIT D. TRANSPORTATION COURSES IN ADMINISTRATION, ECONOMICS AND PLANNING OF STREETS AND HIGHWAYS

<table>
<thead>
<tr>
<th>ADMINISTRATION &amp; ECONOMICS</th>
<th>THE PLANNING OF TRANSPORTATION FACILITIES (THOROUGHFARE PLANNING &amp; DESIGN)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NCSU - Civil Engineering</strong></td>
<td><strong>NCSU - Civil Engineering</strong></td>
</tr>
<tr>
<td>Transport Eng. II = 15%</td>
<td>- Transportation Eng. II = 35%</td>
</tr>
<tr>
<td>Municipal Engineering = 25%</td>
<td>(Subdivision, Project, Environmental, Thoroughfare Planning-Conceptual Design)</td>
</tr>
<tr>
<td>Transportation Planning = 50%</td>
<td>- Transportation System Analysis = 75%</td>
</tr>
<tr>
<td><strong>CHARLOTTE - U</strong></td>
<td>(Analysis of multi-modal Trans. Methods of Evaluation. Types of studies)</td>
</tr>
<tr>
<td>C.E. - Trans. Eng I &amp; II = 15%</td>
<td>- Transportation Planning = 50%</td>
</tr>
<tr>
<td>Eng. Tech. Intro Urban Eng = 20%</td>
<td>(State Planning, Economic planning, Rural highway planning, EIS, Financial)</td>
</tr>
<tr>
<td><strong>NCA&amp;T - Mechanical Engineering</strong></td>
<td>- Urban Transportation Planning</td>
</tr>
<tr>
<td>Trans. Eng. I &amp; II = 15%</td>
<td>(Traffic Modeling, assignment, distribution, Demand. Design of Thoroughfare Plans, Conceptual and Detail)</td>
</tr>
<tr>
<td>- Driver Education U &amp; G</td>
<td>- Transportation Planning Models</td>
</tr>
<tr>
<td>Intro to Highway Traffic Administration</td>
<td>(Predicting Transportation Demand distribution &amp; Assignment)</td>
</tr>
<tr>
<td>Highway and Transportation Systems</td>
<td>- Transportation Planning Seminar</td>
</tr>
<tr>
<td><strong>EAST CAROLINA - Driver Education</strong></td>
<td><strong>NCAT - Architectural Engineering</strong></td>
</tr>
<tr>
<td><strong>APPALACHIAN - Driver Education</strong></td>
<td><strong>NCAT - Architectural Engineering</strong></td>
</tr>
<tr>
<td>U &amp; G</td>
<td>U &amp; G</td>
</tr>
<tr>
<td>U &amp; G</td>
<td>U &amp; G</td>
</tr>
<tr>
<td>The Highway Transportation System</td>
<td>- City Planning and Urban Design</td>
</tr>
<tr>
<td>- Transportation Eng. I &amp; II = 10%</td>
<td>(Conceptual and general only = 15%)</td>
</tr>
<tr>
<td></td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td></td>
<td>- Transportation Engineering I &amp; II = 25%</td>
</tr>
<tr>
<td></td>
<td>(Traffic distribution &amp; Assignment)</td>
</tr>
<tr>
<td></td>
<td>Urban Layout, Planning of Trans. Facil.)</td>
</tr>
<tr>
<td><strong>CHARLOTTE - Civil Engineering</strong></td>
<td><strong>CHAPEL HILL - City and Reg. Planning</strong></td>
</tr>
<tr>
<td>U</td>
<td>- Urban Transportation Planning</td>
</tr>
<tr>
<td>CHAPEL HILL - City and Reg. Planning</td>
<td>(Urban Transportation System Techniques for analysis of problems and evaluation of plans)</td>
</tr>
<tr>
<td><strong>CHAPEL HILL - City and Reg. Planning</strong></td>
<td>- Transportation Planning Models</td>
</tr>
<tr>
<td>U</td>
<td>(Predicting Transportation Demand distribution &amp; Assignment)</td>
</tr>
<tr>
<td>- Transportation Planning Seminar</td>
<td>- Transportation Planning Seminar</td>
</tr>
<tr>
<td>Chapel Hill - City and Regional Plan-M.D.</td>
<td>Appalachian-Planning - U</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Intro Urbanism and Planning</td>
<td>Regional and Urban Planning</td>
</tr>
<tr>
<td>Design of the Urban Environment</td>
<td>Spatial Economics</td>
</tr>
<tr>
<td>Location and Space Economics</td>
<td>Planning Techniques I &amp; II</td>
</tr>
<tr>
<td>Regional Science Techniques</td>
<td>The Planning Process</td>
</tr>
<tr>
<td>Planning and Government</td>
<td>Environmental Site Planning &amp; Design</td>
</tr>
<tr>
<td>Theory of Planning I &amp; II</td>
<td>(EC) Urban and Regional Development</td>
</tr>
<tr>
<td>Site Planning and Design</td>
<td>NCSU - DESIGN, LANDSCAPE, POL.SC. G</td>
</tr>
<tr>
<td>Planning Analysis and Design</td>
<td>Site Planning</td>
</tr>
<tr>
<td>Planning Problems</td>
<td>Community Design Policy</td>
</tr>
<tr>
<td>Dimension Land Use Planning and Mgmt</td>
<td>Land Development</td>
</tr>
<tr>
<td>Regional Development Planning</td>
<td>Government and Planning</td>
</tr>
<tr>
<td>Public Investment Theory in Planning</td>
<td>N.C. Central- GEOGRAPHY AND POL SC. U</td>
</tr>
<tr>
<td>Land Use Planning</td>
<td>Urban Geography</td>
</tr>
<tr>
<td>Urban Spatial Structure</td>
<td>Urban Planning &amp; Public Administration</td>
</tr>
<tr>
<td>New Towns Seminar</td>
<td>Western Carolina- GEOGRAPHY U &amp; G</td>
</tr>
<tr>
<td>Urban Design Methods and Technique</td>
<td>Urban Geography</td>
</tr>
<tr>
<td>Planning and Service Delivery Systems</td>
<td>N.C. A. &amp; T. - ARCH ENGINEERING U &amp; G</td>
</tr>
<tr>
<td>Transportation Geography</td>
<td>City Planning and Urban Design I &amp; II</td>
</tr>
<tr>
<td>Urban Geography</td>
<td>Winston-Salem -- Urban Geography</td>
</tr>
<tr>
<td>Greensboro -- Geography</td>
<td>Pembroke -- Urban Geography</td>
</tr>
<tr>
<td>Urban Patterns</td>
<td>Wilmington -- Regional Growth and Devel.</td>
</tr>
<tr>
<td>Urban Land Use</td>
<td>Urban Geography</td>
</tr>
<tr>
<td></td>
<td>Economic Geography</td>
</tr>
<tr>
<td></td>
<td>Urban and Regional Land Use Planning</td>
</tr>
</tbody>
</table>
EXHIBIT F. THE TRANSPORTATION BUSINESS - BUSINESS ADMINISTRATION AND RELATED ECONOMICS COURSES

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The American Transportation System</td>
<td>Public Finance</td>
<td>Economics of Transportation</td>
</tr>
<tr>
<td>Transportation as a Regulated Industry</td>
<td>Theory of Public Finance</td>
<td>Physical Distribution Analysis</td>
</tr>
<tr>
<td>Transportation Problems &amp; Policies</td>
<td>WILMINGTON U</td>
<td>Introduction to Transportation</td>
</tr>
<tr>
<td>Dynamics of Transportation</td>
<td></td>
<td>Motor Carrier Management</td>
</tr>
<tr>
<td>Distribution Management</td>
<td></td>
<td>Traffic Management</td>
</tr>
<tr>
<td>Public Finance (and Advanced)</td>
<td></td>
<td>Transportation Law</td>
</tr>
<tr>
<td>Economics of Regulated Industries</td>
<td></td>
<td>Politics of Transportation</td>
</tr>
<tr>
<td>Transportation Management</td>
<td></td>
<td>National Transportation Policy</td>
</tr>
<tr>
<td>Public Finance</td>
<td></td>
<td>Transportation Seminar</td>
</tr>
<tr>
<td>Greensboro - Public Finance U</td>
<td></td>
<td>Winston - Salem - Public Finance U</td>
</tr>
<tr>
<td>Appalachian - Distribution and Trans-</td>
<td>Principles of Transportation</td>
<td>Western Carolina U &amp; G</td>
</tr>
<tr>
<td>portation Management</td>
<td>Public Finance</td>
<td>Economics of Transportation</td>
</tr>
<tr>
<td>Fayetteville - Public Finance U</td>
<td></td>
<td>Public Finance</td>
</tr>
<tr>
<td>Pembroke - Public Finance U</td>
<td>ASHEVILLE - Public Finance U</td>
<td></td>
</tr>
</tbody>
</table>
### EXHIBIT G. TRANSPORTATION - RELATED COURSES IN GOVERNMENT AND ADMINISTRATION (POLITICAL SCIENCE AND ECONOMICS)

<table>
<thead>
<tr>
<th>Chapel Hill U &amp; G</th>
<th>N. C. S. U. U &amp; G</th>
<th>Greensboro U &amp; G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Politics</td>
<td>American Government System</td>
<td>Intro Public Policy and Administration</td>
</tr>
<tr>
<td>State and Local Government in the U.S.</td>
<td>Politics and Policies of Am Govt, Sys.</td>
<td>Urban Governments and Politics</td>
</tr>
<tr>
<td>Public Opinion and Participation</td>
<td>Urban Politics</td>
<td>Public Law and Policy Administration</td>
</tr>
<tr>
<td>Public Policy Analysis</td>
<td>Problems in Urban and Metro Government</td>
<td>American State Politics</td>
</tr>
<tr>
<td>Principles of Public Policy Analysis</td>
<td>Public Administration</td>
<td>Urban Problems &amp; Decision Making</td>
</tr>
<tr>
<td>Public Administration</td>
<td>Public Policy Analysis</td>
<td>Selected Topics in Urban Politics</td>
</tr>
<tr>
<td>Comparative National Politics</td>
<td>Seminar in Urban Management</td>
<td>Topics in Public Policy</td>
</tr>
<tr>
<td>Municipal Administration</td>
<td>The Budgetary Process</td>
<td>Local Government Administration</td>
</tr>
<tr>
<td>Population, Environment &amp; Politics</td>
<td>The Government and Planning</td>
<td>Urban Service Administration</td>
</tr>
<tr>
<td>Issues of National Policy</td>
<td>Seminar in Policy Administration</td>
<td>The Urban Political System</td>
</tr>
<tr>
<td>Public Administration in Policy Making</td>
<td>Urban Economics</td>
<td>Citizen Participation in Policy</td>
</tr>
<tr>
<td>Budgetary and Financial Management</td>
<td>Environmental Economics</td>
<td>State and Local Finance</td>
</tr>
<tr>
<td>Comparative Urban Politics</td>
<td></td>
<td>Urban and Regional Economics</td>
</tr>
<tr>
<td>Urban Economics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Spatial Economics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Appalachian U &amp; G</th>
<th>N. C. A. &amp; T. U</th>
</tr>
</thead>
<tbody>
<tr>
<td>State and Local Government</td>
<td>American Government and Politics</td>
</tr>
<tr>
<td>Introduction to Public Administration</td>
<td></td>
</tr>
<tr>
<td>Urban Politics</td>
<td></td>
</tr>
<tr>
<td>Problems in Public Administration</td>
<td></td>
</tr>
<tr>
<td>Problems in State and Local Govt.</td>
<td>Urban Problems</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>N. C. Central U &amp; G</th>
<th>Charlotte U &amp; G</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Government in the United States</td>
<td>State and Local Government</td>
</tr>
<tr>
<td>Public Administration</td>
<td>Public Administration</td>
</tr>
<tr>
<td>Public Financial Administration</td>
<td>Urban Politics and Government</td>
</tr>
<tr>
<td>Municipal Government</td>
<td>Urban Problems</td>
</tr>
<tr>
<td>Urban Administration</td>
<td></td>
</tr>
<tr>
<td>Public Administration &amp; Public Policy</td>
<td></td>
</tr>
<tr>
<td>Public Administration Internship</td>
<td></td>
</tr>
<tr>
<td>Urban Economics</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>East Carolina U &amp; G</th>
<th>Asheville U</th>
<th>Winston-Salem U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Political Systems</td>
<td>Urban Politics</td>
<td>American National Government</td>
</tr>
<tr>
<td>Public Administration</td>
<td>Urban Politics</td>
<td>Am State Government and Politics</td>
</tr>
<tr>
<td>Government Fiscal Administration</td>
<td>Contemporary Urban Problems</td>
<td>Am Urban Government and Politics</td>
</tr>
<tr>
<td>Problems in State Government</td>
<td>Urban Administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public Administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public Administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban Administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban Administration-Resource Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public Administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public Administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban Administration System Analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban Administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban Public Policy Analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban Public Policy Analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fayetteville U</th>
<th>N. C. A. &amp; T. U</th>
</tr>
</thead>
<tbody>
<tr>
<td>State and Local Government</td>
<td>American Government and Politics</td>
</tr>
<tr>
<td>Public Administration</td>
<td></td>
</tr>
<tr>
<td>Public Financial Management</td>
<td></td>
</tr>
<tr>
<td>Principles of Public Administration</td>
<td>Urban Problems</td>
</tr>
<tr>
<td>Comparative Public Administration</td>
<td></td>
</tr>
<tr>
<td>Urban Economics</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>