SOUTH CAROLINA STATE UNIVERSITY

JAMES E. CLYBURN UNIVERSITY TRANSPORTATION CENTER

a new state of mind

Division of Research
and Economic Development

James E. Clyburn
University
Transportation
Center

2009 Annual Progress Report

December 2009

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SUCCESS STORIES

Director's Statement

There are many critical issues which continue to confront the transportation industry: Congestion; Safety and Security; Infrastructure; Energy and Environment; Equity; Emergencies; Finance; and Human and Intellectual capacity. Since its inception in 1998, the James E. Clyburn University Transportation Center (JECUTC) has examined many of these critical issues through research, education, training, technology transfer, professional development conferences, seminars and other forums that provided recommendations for solutions. All of the above are important issues facing America's transportation industry. Adding to the list is America's dependence on foreign fuel to meet our nation's transportation needs.

The James E. Clyburn University Transportation Center's research focus now lends itself to concentrate on decreasing our nation's dependence on foreign fuel. The Center is committed to research initiatives that are exploring alternatives for innovative and sustainable fuels in the transportation industry. We believe that the Center is uniquely prepared to recruit and train professionals to meet the future needs of the nations' transportation industry, and engaged in developing cutting edge research opportunities.

The JECUTC's research agenda includes the development of alternative transportation fuels through biofuels production: Cellulosic Biomass; Development of a GIS-Based Decision Support System for Biomass Transportation Analysis, and Bio-Catalytic Production of Hydrogen from Agriculture Processes. The JECUTC is committed to conducting research initiatives that will result in alternative innovative and sustainable fuels in the transportation industry.

TECHNOLOGY TRANSFER ACTIVITIES

Transportation Technology Transfer (T^3)

The T^3 program at the James E. Clyburn Transportation Center is a sub-grant recipient with Clemson University. This program serves to provide technical aid to local government transportation agencies in the operation of transportation technology transfer service in South Carolina.

The T^3 services:

- Assist local government by responding to requests for publications, information and technical advice related to the implementation and operation of public transportation systems and facilities.
- Assist in the preparation of semi-annual progress reports to be provided to the South Carolina Department of Transportation.
- Maintain a current mailing list of individuals and organizations in South Carolina involved in operating public transportation programs.
- Assist in the development and implementation of an evaluation plan for the public transportation-relate elements of the t3 Program.
- Assist in the planning and presentation of seminars and training programs related to public transportation systems as defined by the training needs of public transportation agencies in South Carolina.

1. Asphalt paving
2. Concrete paving and reclamation
3. Bridge replacement

Orangeburg County Transit Study

The James E. Clyburn University Transportation Center (JECUTC) conducted the Orangeburg/Calhoun Transit Study with a $50,000.00 grant from the Lower Savannah Council of Government. The purpose of the study was to determine the feasibility of implementing public transit services in the Orangeburg/ Calhoun County area.

A survey designed to solicit community input into the implementation of a public transit system was taken in the targeted area. The data indicated a need for transit service to serve school, work, medical, and shopping trips. Based on community profile and survey data collected, an overall demand for one-way passenger trips for the area was discovered. The number of riders will depend on service areas, frequency and fares. Based on the surveys of the stakeholders, the transit routes should serve the internal hub of Orangeburg and Calhoun Counties as well as the outlying major towns using Santee Wateree Transit System as a provider for the new transit system.

It was recommended that this proposed transit system seek to maximize available federal and state funding. The transit system will operate as one coordinated operating system, but each county will have a separate name and financial accounting system.

The next step in the implantation process is to engage the local colleges and universities in the areas involved with the plan. A meeting was held on January 11, 2008 at the First Baptist Service Center in Orangeburg, South Carolina. The purpose of the meeting was to review the revised budget and request the Steering Committee to approve the funding request from South Carolina Department of Transportation and Federal Highway Administration. The Orangeburg/Calhoun Transit system is now in operation.

Technical Advisory Council

The purpose of Technical Advisory Council (TAC) is to conduct business using a committee structure and review programs, recommend actions, and assist in recommending the annual research agenda for the JECUTC. Theses activities include developing the Center's programmatic material, the annual plan, as well as, keeping records of all activities and actions. The following is a list of TAC members:

Members of the TAC:

Dr. G. Dale Wesson
Vice President for
Research and Economic Development
South Carolina State University
Orangeburg, SC 29117

Congressman James E. Clyburn
6th Congressional District of SC
1703 Gervais Street
Columbia, SC 29201

The Honorable John W. Matthews, Jr.
SC Senate District 39
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Columbia, SC 29202

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Senator J. Yancey Mc Gill
SC Senate District 32
508 Gressette Building
Columbia, SC 29202

The Honorable Jerry N. Govan Jr.
SC House District 95
404B Blatt Building
Columbia, SC 29211

Mr. Curtis Thomas
Division Administrator
SC Federal Motor Carrier Safety
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Columbia, SC 29201

The Honorable Lonnie Hosey
SC House District 91
404A Blatt Building
Columbia, SC 29211

Mr. Phillip J. Lemmon, Sr.
Horace Mann Agency
9 Gardner Loop
Kingstree, SC 29556

CONFERENCES AND WORKSHOPS

Eighth Annual Statewide Transportation Curriculum and Research Needs Conference

The James E. Clyburn University Transportation Center (JECUTC) at SC State hosted the Eighth Seventh Annual Statewide Transportation Curriculum and Research Needs Conference was held, April 16- 17, 2009 at the Hilton Myrtle Beach Resort in Myrtle Beach, S.C. The theme for the conference was "South Carolina's Future Transportation Needs."

The purpose of this Conference was to unite transportation officials, local, state, and federal government, colleges, universities and emergency respondents to develop a sustainable transit system that will allow South Carolina citizens, tourists and retirement communities the maximum public transportation benefits.

The mission of the Transportation Center is to educate, support and develop outreach and mass transit initiatives. This was a great opportunity to bring transportation professionals together to address South Carolina's current and future rural transit needs.

During the Conference, topics such as land use development, sprawls, re-developments, Transit Oriented Developments (TODs), light rail and emergency preparedness were discussed.

The Conference keynote speaker was Julie Cunningham, president and CEO of the Conference of Minority Transportation Officials (COMTO) located in Washington, D.C.

Other presenters include: Dr. Yvette Taylor, regional administrator of the Federal Transit Administration Regional office in Atlanta, Ga., David Burgess, transit planner for the SC Department of Transportation, Bruce Watts of Portland Oregon, Disadvantage Business Enterprise (DBE) presenter and Dan Burden, principal and senior urban designer, Glatting Jackson & Kercher Anglin and co-founder of Walkable Communities, Inc.

ADA Driver Training Workshop/Transporting Disabled Passengers

The James E. Clyburn University Transportation Center conducts several Americans with Disabilities Act (ADA) training sessions annually which focuses on passenger assistance techniques for transporting persons with disabilities and special needs.

The objective of this training is to make the driver aware of potential problems that may occur while transporting a person(s) with disabilities. The training consists of classroom instruction and hands-on practice. Topics includes: functional deficits, assistive devices, lift and securing wheelchairs. The driver will become familiar and proficient with providing assistance, sensitive issues and important evacuation techniques to be followed when transporting persons with disabilities. The potential benefits of this training are:

- Reduce the injuries of elderly and disabled passengers;
- Minimize driver injuries;
- Improve system efficiency in loading and unloading disabled passengers;
- Reduce insurance premiums for transit providers;
- Earn continuing education credits and re-certification through Community Transportation Association of America (CTAA).

Since the inception of this program, the James E. Clyburn University Transportation Center has trained over 360 drivers through out South Carolina. Transit drivers are charged a registration fee of $125.00 to participate in this program.

Conference of Minority Transportation Officials

The South Carolina Chapter of the Conference of Minority Transportation Officials (SCCOMTO) is a chapter of the National Conference of Minority Transportation Officials which was first founded at Howard University in Washington, DC in January, 1971. The organization now boasts membership of more than 3,500 through approximately forty (40) chapters throughout the United States.

The South Carolina Chapter of the Conference of Minority Transportation Officials (SCCOMTO) is celebrating its seventh year of professional service and support to transportation officials in the state of South Carolina. The SCCOMTO continues to recruit undergraduate and graduate students that express an interest in pursuing a transportation-related career. Membership growth, professional development and fundraising remain the Chapter's primary goals. The membership composition of SCCOMTO currently is two-thirds transportation professionals and one-third students.

The South Carolina Chapter, with the support of the James E. Clyburn University Transportation Center, continues to partner with other local, state and federal agencies to recruit, develop and provide professional opportunities for transportation professionals throughout South Carolina. In addition to membership growth and professional development, the Chapter sponsored several fundraising activities to support and expand education initiatives for interested students at the local and national level. The Chapter is on course to increase its membership by fifty percent (50%) and increase fundraising goals by twenty five percent (25%).

Construction Project

James E. Clyburn Transportation Research and Conference Center

Phase 1A – Site Package Preparation- 7 Star Construction Company has completed all site preparation work for construction of the transit research center and chiller plant. University Officials closed out its contract with 7 Star Construction Company, Inc. February 2, 2009.

Phase 1B- Transit Research Center and Chiller Plant

Construction Dynamics Incorporation (CDI), Construction Management Advisor for the project staff informed university Officials on December 18, 2009 that the South Carolina Office of State Engineer and the Federal Highway Administration gave approval to the University to advertise for construction of the transit research center and chiller plant. University Officials submitted an ad to the South Carolina Business Opportunities publication on December 21, 2009 to solicit interested bidders for the construction contract. University Officials held a formal bid opening on January 28, 2010. An apparent low bidder has been selected. A final decision on a contractor will be made after all protest concerns have been addressed. Construction is projected to begin April 2010.

Land Acquisition for the James E. Clyburn Transportation Research and Conference Center

Mr. Kenneth Davis, attorney, informed University Officials on April 16, 2008 that all land acquisitions and road closing requests relevant to the construction of the James E. Clyburn Transportation Research and Conference Center have been reviewed and approved by the Orangeburg County court system.

EDUCATION

Fellowships, Scholarships and Research Assistantships

The James E. Clyburn University Transportation Center's Eisenhower Fellowship Program recipients attended the Dwight David Eisenhower Fellowship Program Research Showcase on January 11-14, 2009 in Washington, DC at the 88th Annual Meeting of the Transportation Research Board. The Eisenhower Fellowship recipients were given the opportunity to attend research project presentations, introductions of new transportation technology and software, and review the work of past fellowship recipients in academia that conducted transportation related education research.

Mr. Courtney Green, a South Carolina State University student and Eisenhower Fellowship recipient, was chosen by the Federal Highway Administration Universities and Grants Program Officials to participate in the Poster Board Showcase presentation. Mr. Green's research project entitled: "An Analysis of Fuel Efficient Car and Plane Engines via Exfoliated Graphite Nanoplatelets (XGnP)". Mr. Green's presentation showcase illustrated the potential for (XGnP) to make future cars and planes more sustainable, safer, more energy efficient, and reduce pollution. Fellow Eisenhower recipients, and university administrative staff accompanied Mr. Green at the poster presentation.

The 2008-2009 Eisenhower Fellowship Program at South Carolina State University (JECUTC) consists of five students. Listed are the Eisenhower Fellowship recipients and their respective majors.

Joseph Carson - Electrical Engineering Technology
Jalpa Patel - Mechanical Engineering Tech
Courtney Green - Civil Engineering Technology
Clemson Wright - Sociology
Zachary Middleton - Business Management

The 2009-2010 Eisenhower Fellowship Program at South Carolina State University (JECUTC) consists of four students. The following are the Eisenhower Fellowship recipients and their respective majors, which will be attending the 2010 Annual TRB Conference in Washington, DC.

Janson O. Bell - Visual & Performing Arts

Courtney Green - Civil Engineering

Kirsten Pratt - Business

Anthony Reed - Civil Engineering
Presenter:
"Hydrogen Fuel Cars vs. Electric Cars: Which Car is Better for the Future?"

Assistantships were offered in the following categories:

Graduate Research Assistant

Graduate Research Assistants are full-time students who receives a research assistantship in transportation-related research areas and perform research-related tasks under the supervision of a faculty/fellow. Nine (9) graduate research assistantships were awarded to students in the Master of Science Degree in Transportation Program. The faculty researchers who worked with these students are:

Dr. Hasanul Basher, Professor, Industrial & Electrical Engineering Technology
Dr. Nasrollah Hamidi, Professor, Department of Biological & Physical Sciences
Dr. Jae Hong, Professor, Industrial & Electrical Engineering Technology
Dr. Abdul Miah, Assistant Professor, Industrial & Electrical Engineering Technology
Dr. Tom Whitney, Associate Professor, Industrial & Electrical Engineering Technology
Dr. Yuanchang Xie, Assistant Professor, Industrial & Electrical Engineering Technology

Graduate Assistant
A graduate assistant is a full-time student enrolled in the MST Degree Program performing research and administrative tasks under the supervision of the JECUTC staff or faculty researchers.

Undergraduate Assistant
An undergraduate assistant performs work tasks under the supervision of JECUTC staff or faculty researchers. One undergraduate student was awarded an assistantship.

Master of Science in Transportation Program

The Master of Science in Transportation (MST) Degree Program continues to attract students with a variety of majors and academic backgrounds. Currently, Fifteen (15) students are enrolled in the (MST) program. The goal of the Department of Civil & Mechanical Engineering and Nuclear Engineering is to enroll twenty five (25) students by Fall 2010. Two students, Phyllis Pelzer and Lamar Tisdale graduated from the MST program in December 2008. Lakia Mustipher and Teresa Parker-Hightower received their MST degree during the 2009 Spring Semester.

The James E. Clyburn University Transportation Center awarded fourteen (14) students transportation fellowships for the MST program during the fiscal year period July 2008 through June 30, 2009. The James E. Clyburn University Transportation Center has also partnered with Jackson State University's Department of Homeland Security Center of Excellence to provide additional transportation assistance to MST students with an interest in transportation safety in coastal areas. As a result, MST students may apply for the National Disasters, Coastal Infrastructure and Emergency Management (NDCIEM) Transportation Fellowship.

The College of Science, Mathematics and Engineering Technology and the James E. Clyburn University Transportation Center have been active participants in recruitment opportunities throughout the state and in surrounding states of South Carolina. Some of the major recruitment efforts include visits to graduate school and career fair days at the following colleges and universities: South Carolina State University, University of South Carolina, Bluffton, Morris College, Claflin University, Voorhees College, Benedict College, Allen University, Lander University, Virginia Tech, East Tennessee State University, and the University of Georgia.

Dr. Kenneth Lewis, Dean of the College of Science, Mathematics and Engineering Technology, applied for and received a federal grant in the amount $3,500,000 for a six period from the US Department of Education. The purpose of this grant is to enhance and improve the quality and quantity of MST students, faculty development and research efforts in the MST program. The overall goal of the grant is to strengthen the MST program by increasing enrollment to include a more geographical and technically diverse student body and to expand the avenues of graduate level research.

MST Courses- Spring 2009

Course	Instructor
TRP 540-01 Trans. Econ./Finance	Dr. Tom Whitney
TRP 601-01 Transportation Thesis	Dr. Tom Whitney
TRP 603-01 Transportation Seminar	Dr. Tom Whitney
TRP 550-01 Systems Anal. In Trans.	Dr. Yuanchang Xie
TRP 530-01 Transportation Planning	Dr. Yuanchang Xie
TRP 663-01 Data Comm. And Com Netwk	Dr. Yuanchang Xie

FIRST Tech 4th Annual Robotics Competition

The fourth annual FIRST Tech Competition was held on Friday, February 20, 2009 on the campus of South Carolina State University. FIRST Tech is considered a mid-level competition, above Lego League but not quite as large as the full FIRST Competition. FIRST is an acronym for "For Inspiration and Recognition of Science and Technology." The competition is designed to challenge students to use creative problem-solving skills by enabling them to design and build radio-controlled robotic devices with amazing capabilities to perform various tasks.

The competition was hosted by the James E. Clyburn University Transportation Center, at SCSU. The Felton Laboratory School Gymnasium came alive on the day of competition accommodating several high schools from all over South Carolina. Several high schools brought students to observe and cheerlead, in addition to these competing on robotics teams. There were approximately 600 students who competed, with over 1200 patrons in attendance. Of the fifty-four teams registered, forty-eight teams actually participated. The FIRST Tech Competition at South Carolina State University continues to be one of the largest competitions in the nation.

The students' robots were limited to the dimensions of 18 inches by 18 inches by 18 inches, and had to undergo inspection upon registering. The rules limited the robots to 11 motors, which along with the robots size ensured that all teams participated with the same basic advantages and disadvantages. The FIRST Tech Challenge game for the 2008 season was called FIRST Face Off. Two alliances – one "red" and one "blue" – composed of two teams each, compete in each match. The object of the game was to attain a higher score than your opposing alliance by removing colored hockey pucks from eight different racks around the field and placing them in various locations in the center scoring area. Teams were also challenged by traversing over rough and/or slippery terrain located in four different areas of the field. They had to navigate onto the field at the start of a match and back off the field at the end of the match.

In the Autonomous Period, pucks scored in the center scoring area were totaled and each alliance kept those points whether the pucks are descored, (pucks count once) or not (pucks scored a second time)... Bonus points were awarded to alliances for knocking pucks down from their racks based on their location from the Starting Location. There were 70 pucks (35 red & 35 blue) available as scoring objects in the game.

Science and Technology Day

Orangeburg, S.C. - More than 500 middle and high school students from across the state of South Carolina participated in the annual Science and Technology Day that was held on Friday, April 24, 2009 from 8 a.m. to 5 p.m. at the Felton Laboratory School Gymnasium.

Hosted by the James E. Clyburn Transportation Center (JECUTC) at SC State, Science and Technology Day was established as a means of promoting middle and high school students' interest in science, mathematics, engineering, transportation and technology. It also exposes them to SC State's programs and curricula.

During the 2009 competition, three member teams, entered pre-assembled science projects, represented each school. These included CO2 Dragsters, Solar Powered Cars, Media Design, and Hovercrafts. Students were judged on speed and load bearing capabilities. SC State faculty, staff and students of the College of Science, Mathematics and Engineering Technology and Nuclear Engineering and the JECUTC were available for each team as mentors and technical advisors.

The enthusiasm and ingenuity of both middle and high school students interested mathematics, science and technology was demonstrated through-out the competition, as they competed to meet their objectives to be winners and leaders in a global demands for a more technically oriented society. A first, second and third place prize was awarded to each project category. Each first place team member received a $500 savings bond, each second place winner received a $300 savings bond, and each third place winner received a $100 savings bond.

Summer Transportation Institute

The purpose of the Summer Transportation Institute (STI) held on the campus of South Carolina State University (SCSU) is to create awareness and stimulate interest in secondary school students for careers in the transportation profession. The Institute was held **July 5 – July 31, 2009**, on the campus of South Carolina State University. Educational Adventures emphasized inter-modalism as well as career opportunities in the transportation industry. Participants enjoyed several transportation-related trips, including a two-day trip to Atlanta, Georgia, to learn about the Metropolitan Atlanta Rapid Transit Authority (MARTA), as well as the transportation systems at Stone Mountain National Park, the Bavarian Motor Works North America Facility (BMW), Greer, SC; S.C. Public Safety Department, Columbia, SC; Patriots Point Naval and Maritime Museum, Charleston, SC; Mc Entire Air National Guard Base, Sumter, SC and the Columbia Metropolitan Airport, Columbia, SC.

The research component afforded the participants an opportunity to exercise analytical skills, research skills, and computer skills. The enhancement component was designed to prepare the STI participants for post secondary matriculation. The enhancement component utilized computer skills, transportation web-based research, as well as fundamental writing skills to meet the goals and objectives of the institute. The sports and recreation component promoted good sportsmanship and encouraged participants to explore new areas for growth and development, personally and professionally.

The James E. Clyburn University Transportation Center (JECUTC) Summer Transportation Institute at South Carolina State University continues to monitor the post secondary decisions of institute participants by administering the Senior Year Survey. The **Twenty (20) 2009 high school graduates** in pursuit of their career objectives are noted in the appendix of this report.

An Intermodal Advisory committee (I.A.C.) was established to assist with planning and coordinating institute activities and professional speakers. The IAC was very instrumental in the success of the institute's goals and objectives. The institute's faculty and staff successfully implemented the curriculum in the quest to expose the participants to an array of transportation related information. Special thanks to those JECUTC staff that assisted the institute without financial compensation (*).

B. RESEARCH PROJECT STATUS

New Research

Biocatalytic Production of Hydrogen for Rural Transportation: Pilot Studies

Principal Investigator: Dr. Joe Emily

Project Abstract: The U.S. economy currently depends on a transportation system which is heavily reliant upon the petroleum based internal combustion engine. Large bodies of evidence are being presented which indicate that efforts should be made to move toward more environmentally friendly and renewable energy sources. The project will address these issues by conducting research leading to the development of a biohydrogen reactor utilizing agricultural feedstock and microbial digestion. The work will take place in the "The Center for Energy Studies" which is located in Hodge Hall on the campus of South Carolina State University. Research in this area would contribute significantly to the national security, environmental well being and economics of South Carolina, the nation and the world. The Center will offer tremendous benefits to the University, surrounding institutions, the private sector, public schools, the state of South Carolina, and to the nation.

A Robust Transportation and Facility Location Model for Optimally Locating Emergency Response Facilities

Principal Investigator: Dr. Jae D. Hong

Project Abstract: After disastrous events such as hurricanes, floods, or terrorist attacks hit one area, it would be critical to have disastrous recovery centers nearby for a rapid recovery. This proposed research is intended to develop a robust transportation and facility location model to optimally locate emergency response facilities. For areas using this proposed model, relief goods will be distributed to the affected population in a timely and efficiently manner in events of disasters or terrorist attacks. The emergency response facilities include warehouses (where emergency relief goods are stored), distribution centers such as Disaster Recovery Centers (DRCs), and neighborhood locations. The proposed transportation and facility location model will be able to optimize the locations of warehoused and DRCs simultaneously, to provide the efficient transportation linkage scheme between the critical elements of the relief goods supply chain. Since it is very common for bridge collapses and roadway flooding to happen during disastrous events, this model will be designed in a very robust manner such that it can help develop contingency plans for different scenarios including failures of key transportation infrastructure. The developed model will be applied to a case study to demonstrate its ability to model uncertainties in transportation networks.

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Analysis of Operational, Environmental and Economic Impacts of Transportation Alternative Fuels

Principal Investigator: Dr. Yunachang Xie

Project Abstract:
The United States recently has been investing heavily in renewable energy technologies to reduce our nation's dependence on foreign oil, cut greenhouse gas emissions, and to improve the environmental condition. There is no doubt that shifting form gasoline and diesel to alternative transportation fuels can reduce air pollution, improve quality of life, and also create green jobs. However, so far no in depth research has been done to quantify such impact. In light of this, the research team is proposing to develop a macroscopic model to evaluate the operational, environmental, and economic impacts of alternative transportation fuels. This model can be utilized to determine how alternative fueled vehicle can make a substantial regional and national impact at the macroscopic level in terms of daily fuel savings and emission reduction. An interface between the Environmental Protection Agency (EPA) vehicle emission model MOVES and the PARAMICS microscopic traffic simulation tool will be developed to analyze the environmental impact of alternative transportation fuels. The source code of MOVES will
also be modified to enable it in modeling various alternative fuels, not just diesel and gasoline. As the US and the entire world is moving toward long-term sustainable development, there will be more and more research efforts undertaken to investigate the impacts of alternative energy to the transportation systems. Therefore, this study will provide a very important foundation for transportation agencies and researchers across the country and even the world to conduct further research and analysis in this area.

An Agent-Based Ramp Metering Approach to Improve Highway Safety and Efficiency using a Dynamic Traffic Assignment Framework

Principal Investigator: Dr. Yunachang Xie

Project Abstract: The application of agent-based models to coordinate freeway ramps in a real-time dynamic traffic assignment (DTA) system is investigated. The motivation is to improve the traffic flow in response to recurring and non-recurring freeway traffic congestion and thereby increase system safety and efficiency. This project will explore the use of coordination mechanism such as game theory, principled negotiation, and market based auction to provide a scheme for coordination the different ramps in the event of congestion build-up. The developed coordination mechanism will be coupled with a DTA system, namely DYNASMART-P, to enable realistic representation of traffic flow and traveler behavior. Simulation-based experiments will be carried out on a South Carolina network corridor (exact location to be determined based on data availability). These experiments will be designed to evaluate the agent-based ramp metering performance and to gain insight into its operational properties under different traffic conditions. If successful, the results of this research will provide state departments of freeways to minimize freeway congestion. Most notably, this research has the potential to save lives, improve freeway level of service, and increase travel time reliability. The insight gained from this research will be applicable to many other scientific fields.

Investigating Dynamic Routing and Information Communication Methods to Minimize Evacuation Clearance Times

Principal Investigator: Dr. Sandra K. Garrett
Co-Principal Investigator: Dr. Kevin M. Taaffe

Project Abstract: Emergency evacuations are time-critical, dynamic events which involve complex coordination decisions. In additional to mass population evacuations, hospitals and other healthcare facilities must address the decision of how and when they must evacuate their facilities. Only recently have simulation models of traffic evacuations pattern taken into consideration the combined effect of health care facility evacuations with a community-wide evacuation. In addition, many simulation models are static in that they do not consider the impact of dynamic decision making, including how and when alternative evacuation route choices are made, and their consequent impact on clearance time. We propose to extend the 2008-2009 JECUTC projects to address this issue critical to improving the safety and care provided to health care facility patients and the expeditious evacuation of the general population.
The objective of our research is to improve both patient and general population safety during an evacuation by (1) identifying preferred exit route switching times to reduce individual evacuation trip times; and (2) identifying the methods for communication this dynamic evacuation and transportation information to minimize evacuation clearance times. A major outcome from this work will be a modeling environment that examines the impact of communication technologies and dynamic evacuation decision making while incorporating health care evacuation with community-wide evaluation. Having a simulation model that can account for healthcare-specific information involved in the routing of ambulances and special populations with the flexibility of modeling behavioral preferences and dynamic decision s will enable emergency planners to evaluate a much larger and more realistic set of policy choices.

Should Elderly Drivers keep their car keys? A Study on the perceptions of a sample of South Carolina Elderly Regarding Road and Highway Driving Safety.

Principal Investigator: Dr. Eva Njoku and Dr. Innocent Nkwocha

Project Abstract: This is an exploratory study with a sample of license drivers 65 of age and over to determine their understanding of road safety signs and their perceptions of driving hazards and dangers on South Carolina roads and highways. The study will also explore their ability to avoid crashes that could lead to serious injury and possible death. The study method will include reviewing existing data and conducting survey on recognition of highway/road signs, road hazards and dangers, and driving behaviors of the elderly. Existing data of drivers 65 of age and older will be drawn from the South Carolina Department of Motor Vehicle (DMV) records to identify a sample of license drivers 65 of age and over. Additional data will be gathered by student interns through face-to-face survey interviews with a sample of elderly persons in select counties of South Carolina to determine if there are any significant differences in their ability to recognize highway and road signs and their response time in reacting to hazardous driving conditions.

Current Research Projects

Improving Transportation Safety and Security- Seat Belts

R-07-UTC- ITSSB-FCS-03

Principal Investigator: Dr. William Whitaker Jr., College of Business and Applied Professional Sciences Department of Family and Consumer Sciences, South Carolina State University.

Project Abstract: As of December 9th, 2005, South Carolina's safety belt law changed to require that "every driver and every occupant of a motor vehicle, when it is being operated on the public streets and highways of this State, must wear a fastened safety belt that complies with all provisions of federal law for its use" (Buckle Up SC, SCDPS). The upgraded status of seat belt use to a primary enforcement law makes it imperative to educate the driving population, using creative, persuasive communications and educational mechanisms. SCSU will serve as the research site. Students will provide the framework from which this project establishes a baseline of seat belt use via an observational methodology. This practical program of student-based activities in its final form – a proposed guidebook, provided online through JECUTC's website – can be used globally, with appropriate modifications, to pro-actively.

Bio Catalytic Production of Hydrogen from Agricultural Processes

R-07-UTC-BPOH-BPS-03

Principal Investigator: Dr. Joe Emily, Department of Biological and Physical Sciences, South Carolina State University

Project Abstract: The U.S. economy currently depends on a transportation system which is heavily reliant upon the petroleum based internal combustion engine. Large bodies of evidence are being presented which indicate that efforts should be made to move toward more environmentally friendly and renewable energy sources. This has lead the President to issue his "Hydrogen Initiative" which supports transportation solutions that enhance the community and protect the natural and built environment to encourage energy efficiency and alternative fuels. This project will address these issues by conducting research leading to the development of a biohydrogen reactor utilizing agriculture feedstocks and microbial digestion. The work will take place in the newly established "Biomass and Renewable Fuels Laboratory" which is located on the campus of SCSU.

Minimizing Patient Transport Times during Mass Evacuations

R-07-UTC-MPTDMPE-CMET-03

Principal Investigator: Dr. Tom Whitney, Department of Civil and Mechanical Engineering Technology, South Carolina State University

Co-Principal Investigator: Dr. Kevin Taaffe, Department of Industrial Engineering, Clemson University

Project Abstract: Hospital evacuation planning is critical in providing improved patient safety before, during, and after an Evacuation call. There has been significant progress made under the initial JECUTC project directed by Dr. Whitney and Taaffe. Their research team has been developing a modeling framework to appropriately assign limited resources during a hurricane evacuation. However, one limitation is that these models require input from the mass population evacuation in order to determine road congestion and ultimately, the Transportation time required for hospital patients. We propose to extend the current JECUTC project to address this issue critical to improving the safety and care provided to health care facility patients. Due to the amount of time required to test out any one evacuation plan, risk managers can only test a limited number of scenarios. For these reasons, we feel hospitals will greatly benefit from the ability to test many more outcomes via quantitative tools (e.g., simulation analysis) in an effort to develop an evacuation plan that will perform well under a much larger set of scenarios.

Evacuating Patients from Health Care Facilities- Who Goes First

R-07-UTC-EPFHCF-MCS-03

Principal Investigator: Dr. Eva M. Njoku, Department of Social Work, South Carolina State University

Co-Principal Investigator: Dr. Innocent Nkwocha, Department of Business Administration, South Carolina State University and Dr. Kevin Taaffe, Department of Industrial Engineering, Clemson University

Project Abstract: All health care facilities are mandated to have evacuation plans in place and, in some cases, specific facilities have carried out drills to prepare for an evacuation. However, a typical underlying planning assumption is that all patients are to be evacuated. There is no documentation for which patient should be transported first, or if transporting the patient actually adds more risk than sheltering the patient in place. In addition, the available plans usually have a single course of action with little or no redundancies in place, and it is often unclear how the human service workers can effectively interact with management to provide an efficient evacuation

Switchgrass Biofuel Project

Research Number:

Principal Investigator: Mr. Elbert Malone, Sponsored Programs

Project Abstract: Today, one of the most pressing energy problems is the increasingly expensive oil for the transportation industries. It is a known fact that one of the primary causes of global warming is the high use of petroleum products for transportation. The energy dilemma is not a short-term problem, but one that has taken years to develop new techniques to address the issues and will take years to solve. As biomass energy technologies continue to develop, a broad array of potential end uses and end products can be envisioned. The chemical and physical properties of the dedicated energy plants such as switchgrass will ultimately be a source to produce a significant amount biofuel necessary to address, to some extent, the energy crisis.

Completed Research Projects

December 2008- June 30 2009

A Model to Enhance Transportation and Food/Nutrition Needs of the Elderly Population in 12 Select Counties in South Carolina

Principal Investigator: Dr. Innocent Nkwocha, Department of Business Administration, South Carolina State University

Co-Principal Investigator: Dr. Cassandra Sligh DeWalt, Department of Human Services, South Carolina State University & Mrs. Kimberly McClain, Department of Family & Consumer Science, South Carolina State University

Project Abstract: In the century, the growth rate of the elderly American (persons 65 years old and over) has greatly exceeded the growth rate of the population of the country as a whole. South Carolina's elderly population shows similar trend. Given its close proximity to the ocean, strong tourism industry, mild climate and low cost of living South Carolina is an ideal retirement destination for many senior citizens and/or retirees.

While the affluent retirees will fuel the economy as they move to the state, the less fortunate retirees will put a strain on the state services including transportation, food/nutrition, and other social services. Given this report, does the state of South Carolina, in particular, the 12 select minority counties of South Carolina have the resources to make a valuable contribution (i.e., food and nutrition services, and transportation services) and support a sustainable quality of life for the state's elderly population?

In this project, we propose to assure the well being of the state's elderly; (1) gathering available data from the counties on transportation and food/nutrition programs for the elderly; (2) visiting/interviewing elderly facilities; and (3) developing a preferred method of promotion and information dissemination for the elderly population that can be implemented across the countries.

Several impacts benefiting the state of South Carolina will result from the project. These include: (a) developing a transportation model from the existing resources available in the counties to assist with the food and nutrition programs for the state's rapidly growing less-fortunate elderly population; (b) establishing collaborative community outreach project among county service providers and the academic community, as well as closer relationships between the 12 select counties, (c) developing a preferred method of promotion and information dissemination that can be implemented across the counties; and (d) providing valuable report on transportation and food/nutrition programs for future public policy decision in the state.

Development of Truck Trip Generation Models

Principal Investigator: Dr. Yuanchang Xie., Department of Civil & Mechanical Engineering Technology and Nuclear Engineering, South Carolina State University

Co-Principal Investigator: Dr. Nathan Huynh, Department of Civil and Environmental Engineering, University of South Carolina and Dr. Mecit Cetin, Department of Civil and Environmental Engineering, Old Dominion University.

Project Abstract: Being one of the busiest ports on the East Coast, the Port of Charleston generates a great deal of truck traffic to and from the Port. With the Port's plan to add a new container terminal at the former Naval Base truck traffic will increase significantly. This growth in truck traffic, coupled with the growth in both population (8%) and travel (27%) in the Charleston area in the period 1999-2000, will create more bottlenecks in the region, especially along the 1-26 corridor, which feeds into other major highways like I-95, I-77, and I -20. Despite being vital to the economic health of the region and the entire state, the I-26 corridor is increasingly becoming more congested and therefore posing a threat to the economic development. These realities render it imperative that the transportation planners and public agencies in South Carolina have a good understanding of the impacts of new port developments. This project proposes to deliver a truck trip generation model that can be used by planners and public agencies such as SCDOT and BCDCOG (Berkeley-Charleston-Dorchester Council of Governments) to forecast port-generated daily inbound and outbound truck traffic in the short to medium terms. The outcome of this research will help these agencies predict the daily truck traffic which in turn will allow them to more effectively allocate scarce resources to expand and maintain the transportation infrastructure in the region.

Microbial BioButanol Production from Cellulose and Corn Starch

Principal Investigator: Dr. Mahtabbuddin Ahmed, Department of Biological and Physical Sciences, South Carolina State University

Project Abstract: Due to increased cost and diminishing sources of petroleum based fuel materials, the conversion of biomass into butanol, ethanol, hydrogen etc is receiving considerable attention as alternative energy sources. We plan to study the production of Biobutanol using microbial fermentation procedure and carbohydrate raw materials such as switchgrass, corn starch, agriculture waste and other biomass. Butanol has a published energy content that is 92% as high as gasoline and also about three times mileage performance efficiency when butanol is used instead of ethanol in a test automobile performance feat. In addition, due to low solubility of butanol in water cost for recovery of this fuel material form fermentation broth will also be minimal compared to other processes. The research will focus attention to optimize enzymic saccharification of pretreated biomass and ultimately ferment the sugars to butanol and other chemicals by *C. acetobutylicum*. The process is called simultaneous saccharification and fermentation (SSF). The principal benefits of performing SSF instead of in a separate step after the hydrolysis are reduced end product inhibition of the enzymatic hydrolysis and reduce the fermentation costs.

Development of a GIS-Based Decision Support System for Biomass Transportation Analysis

Principal Investigator: Dr. Tom Whitney., Department of Civil & Mechanical Engineering Technology and Nuclear Engineering, South Carolina State University

Co-Principal Investigator: Dr. Yuanchang (Young) Xie, Department of Civil & Mechanical Engineering Technology and Nuclear Engineering, and Dr. Kaiguang Zhao, Department of Ecosystem Science and Management, Texas A&M University

Project Abstract: In President Bush's 2006 State of the Union address, he described switchgrass as a clean and efficient source for biofuel that may reduce America's dependence on foreign oil in the future, and encouraged more research in this area. Since then many research have been conducted on switchgrass. Most of these studies are focused on methods of producing ethanol from switchgrass, costs of growing switchgrass, chemical components of switchgrass, and switchgrass co-firing with coals. As discussed previously, ethanol production from switchgrass involves the transportation of a huge amount of switchgrass form farms to ethanol plants. For a large ethanol plant, the switchgrass transportation cost could be very significant. To make the ethanol production form switchgrass economically more feasible, it is very important to conduct research to investigate different ways of reducing the transportation cost of switchgrass as well as the cost of distributing ethanol products. However, switchgrass transportation has received much less attention compared to research on other areas of switchgrass. In addition, all previous biomass transportation studies (7, 8, and 9) only considered the cost of transporting biomass from farms to ethanol plants, and they did not take into account the cost of distributing ethanol when optimizing the locations of ethanol plants. This research proposed to develop a GIS-based decision support system (DSS) for analyze switchgrass transportation cost. Given siwtchgrass distribution data, the DSS can automatically estimate the potential transportation cost.

Improving Transportation Safety and Security- Seat Belts

R-07-UTC- ITSSB-FCS-03

Principal Investigator: Dr. William Whitaker Jr., College of Business and Applied Professional Sciences Department of Family and Consumer Sciences, South Carolina State University.

Project Abstract: As of December 9th, 2005, South Carolina's safety belt law changed to require that "every driver and every occupant of a motor vehicle, when it is being operated on the public streets and highways of this State, must wear a fastened safety belt that complies with all provisions of federal law for its use" (Buckle Up SC, SCDPS). The upgraded status of seat belt use to a primary enforcement law makes it imperative to educate the driving population, using creative, persuasive communications and educational mechanisms. SCSU will serve as the research site. Students will provide the framework from which this project establishes a baseline of seat belt use via an observational methodology. This practical program of student-based activities in its final form – a proposed guidebook, provided online through JECUTC's website – can be used globally, with appropriate modifications, to pro-actively.

Bio Catalytic Production of Hydrogen from Agricultural Processes

R-07-UTC-BPOH-BPS-03

Principal Investigator: Dr. Joe Emily, Department of Biological and Physical Sciences, South Carolina State University

Project Abstract: The U.S. economy currently depends on a transportation system which is heavily reliant upon the petroleum based internal combustion engine. Large bodies of evidence are being presented which indicate that efforts should be made to move toward more environmentally friendly and renewable energy sources. This has lead the President to issue his "Hydrogen Initiative" which supports transportation solutions that enhance the community and protect the natural and built environment to encourage energy efficiency and alternative fuels. This project will address these issues by conducting research leading to the development of a biohydrogen reactor utilizing agriculture feedstocks and microbial digestion. The work will take place in the newly established "Biomass and Renewable Fuels Laboratory" which is located on the campus of SCSU.

Minimizing Patient Transport Times during Mass Evacuations

R-07-UTC-MPTDMPE-CMET-03

Principal Investigator: Dr. Tom Whitney, Department of Civil and Mechanical Engineering Technology, South Carolina State University

Co-Principal Investigator: Dr. Kevin Taaffe, Department of Industrial Engineering, Clemson University

Project Abstract: Hospital evacuation planning is critical in providing improved patient safety before, during, and after an Evacuation call. There has been significant progress made under the initial JECUTC project directed by Dr. Whitney and Taaffe. Their research team has been developing a modeling framework to appropriately assign limited resources during a hurricane evacuation. However, one limitation is that these models require input from the mass population evacuation in order to determine road congestion and ultimately, the Transportation time required for hospital patients. We propose to extend the current JECUTC project to address this issue critical to improving the safety and care provided to health care facility patients. Due to the amount of time required to test out any one evacuation plan, risk managers can only test a limited number of scenarios. For these reasons, we feel
hospitals will greatly benefit from the ability to test many more outcomes via quantitative tools (e.g., simulation analysis) in an effort to develop an evacuation plan that will perform well under a much larger set of scenarios.

Evacuating Patients From Health Care Facilities- Who Goes First

R-07-UTC-EPFHCF-MCS-03

Principal Investigator: Dr. Eva M. Njoku, Department of Social Work, South Carolina State University

Co-Principal Investigator: Dr. Innocent Nkwocha, Department of Business Administration, South Carolina State University and Dr. Kevin Taaffe, Department of Industrial Engineering, Clemson University

Project Abstract: All health care facilities are mandated to have evacuation plans in place and, in some cases, specific facilities have carried out drills to prepare for an evacuation. However, a typical underlying planning assumption is that all patients are to be evacuated. There is no documentation for which patient should be transported first, or if transporting the patient actually adds more risk than sheltering the patient in place. In addition, the available plans usually have a single course of action with little or no redundancies in place, and it is often unclear how the human service workers can effectively interact with management to provide an efficient evacuation.

Switchgrass Biofuel Project

R-07-UTC-SGBP-OSP-03

Principal Investigator: Mr. Elbert Malone, Sponsored Programs

Project Abstract: Today, one of the most pressing energy problems is the increasingly expensive oil for the transportation industries. It is a known fact that one of the primary causes of global warming is the high use of petroleum products for transportation. The energy dilemma is not a short-term problem, but one that has taken years to develop new techniques to address the issues and will take years to solve. As biomass energy technologies continue to develop, a broad array of potential end uses and end products can be envisioned. The chemical and physical properties of the dedicated energy plants such as switchgrass will ultimately be a source to produce a significant amount biofuel necessary to address, to some extent, the energy crisis.

Ongoing

Safe Diving in Consideration of the Blind and Visually Impaired Traveler

R-06-UTC-SDCBVIT-HS-01

Principal Investigator: Dr. Shirley Madison, South Carolina State University, Department of Human Services

Co-Principal Investigator: Mr. Eddie G. Bryant, S.E. Bryant Consulting

Project Abstract: This proposal seeks funding from the Transportation Research Board (TRB) as required by the U.S. Department of Transportation (USDOT) Research Innovative Transportation Administration (RITA) entitled "Improving Transportation Safety and Security in South Carolina." The focus of the problem in this research addresses the need for the dissemination of information, training and education of licensed drivers as it relates to the safety of individuals with disabilities, particularly blind and visually impaired pedestrians traveling safe and secure in our state. According to the South Carolina Legislature Code of Laws Title 43, Section 43-33-10, it is the policy of this state to encourage and enable the blind, the visually handicapped, and the otherwise physically disabled to participate fully in the social and economic life of the State, and to engage in remunerative employment. Furthermore, under title 42, Section 43-33-20, individuals who are blind and visually impaired, and otherwise physically disabled have the right of use to public facilities and accommodations for blind, other special needs persons and guide dog trainers. The blind, the visually handicapped, and the otherwise physically disabled have the same right as the able bodied to the full and free use of streets, highways, sidewalks, walkways, public facilities, and other public places. This research seeks to establish and facilitate collaboration between The Master of Science Degree in Transportation and the Orientation and Mobility Graduate certificate program at South Carolina State University, as a vehicle for improving the safety and security for individuals who are blind and visually impaired in our state.

Improving Transportation Safety and Security in South Carolina: A Practical Examination of High School Students' Seat Belt Use

R-06-UTC-ITSSSC-FCS-01

Principal Investigator: Dr. William Whitaker, Jr., College of Business and Applied Professional Sciences Department of Family and Consumer Sciences, South Carolina State University

Project Abstract: The purpose of this study is to identify the effect of a seatbelt use promotion program to increase seat belt usage among high school students at Orangeburg-Wilkinson High School (OWHS), a rural campus in South Carolina. The program's desired outcome is to pro-actively influence seatbelt usage over the term of the grant, and beyond.

Effective December 9, 2005, South Carolina's safety belt law changed to require that "every driver and every occupant of a motor vehicle, when it is being operated on the public streets and highways of this State, must wear a fastened safety belt that complies with all provisions of federal law for its use" (Buckle Up South Carolina, SCDPS). Adjusting to the upgraded status of seatbelt use to a primary enforcement law makes it imperative to educate the driving

population, with emphasis on those most at risk to resistance, notably teenage drivers. Behavioral changes and attitude adjustments must be encouraged using creative, persuasive communication and educational mechanisms. Driven by strong peer involvement, incentives and rewards, the proposed program, the "Cool Click Club," offers strategies to increase compliance with the law, thereby improving transportation safety and security statistics.

Orangeburg-Wilkinson High School (OWHS) will serve as the research site in South Carolina. OWHS' policies pertaining to student on-campus vehicle privileges will provide the framework for which this project will establish a baseline of seatbelt usage among the target group via an observational methodology.

This practical program of student-based activities in its final form - the proposed guidebook- can be used globally, with appropriate modifications, to pro-actively influence personal and social at-risk behaviors.

Ensuring Safe and Efficient Transport of Patients during Healthcare Evacuations

R-06-UTC-ESETPDHFE-CMET-01

Principal Investigator: Dr. Tom Whitney, Department of Civil and Mechanical Engineering Technology, South Carolina State University

Health care facility evacuation is often a last-resort measure, especially for many hospitals. In fact, some will go as far as saying that "we will not evacuate." A hospital is typically an integral part of the emergency response plan, which means that hospital officials would often prefer not to shut down. Moreover, in their emergency preparedness efforts, many hospitals have provided system redundancies to protect against catastrophic failure. However, experiences during recent hurricanes identified many hospitals having to perform last-minute pre-storm evacuations, as well as, post-storm evacuations. During the 2004 hurricane season, over a dozen hospitals in Florida and Alabama were damaged and their operations interrupted by the effects of hurricanes. As a result of Hurricanes Katrina and Rita, at least 178 patients died in hospitals and special-needs facilities that needed to make evacuation-related decisions. *There is an urgent need to provide hospital operators with improved hospital evacuation planning capabilities, a subject that few researchers have actually addressed.*

The objective of our research is three-fold: (1) to create a simulation/optimization modeling framework that will guide hospital operators in deciding the effectiveness of a particular evacuation plan; (2) to develop a Graphical Information System routing application using updated geocoding information that accounts for flooding during an emergency event; and (3) to provide an initial assessment of hurricane evacuation planning and response for South Carolina health care facilities other than hospitals. This analysis will assist in identifying more robust sheltering, transport, and staffing guidelines that can be implemented as health care facilities across the state of South Carolina.

All health care facilities are mandated to have evacuation plans in place, and, in particular, many hospitals carry out evacuation drills and tests to prepare for a future evacuation. However, risk managers can only test a limited number of scenarios, due to time constraints or complexity in performing the tests. *For these reasons, we feel hospitals will greatly benefit from the ability*

to test many more outcomes via quantitative tools (e.g. simulation analysis) in an effort to develop an evacuation plan that will perform well under a much larger set of scenarios. Health care facilities other than hospitals may have quite different needs and requirements during an evacuation. Since there is no known standard for how these facilities will approach this problem, we will survey a number of facilities (nursing homes and other special-needs facilities) as a first-step in understanding the issues that the staff and patients/residents face.

The significance of our research will be in: (a) providing a safe and effective means for continuing care to those patients in need during a disaster, (b) establishing collaborative relationships between regional hospitals and neighboring health care facilities, and (c) further promoting undergraduate student research by involving an already-formed student team in the data gathering and research efforts. This research will be a catalyst for advancing the research collaborations between Clemson University and South Carolina State University.

Project E.S.C.A.P.E. Evacuation of South Carolina's Aging Population in Emergencies: A Study of Transportation and Roadway Accessibility to the Rural Elderly in Times of Environmental Disaster

R-06-UTC-ESCAPE-SW-01

Principal Investigator: Dr. Eva M. Njoku, Department of Social Work, South Carolina State University

Co-Principal Investigator: Dr. Innocent Nkwocha, Department of Business Administration South Carolina State University

The study is a follow up to grant #R-03-UTC-EMGMGT-SW-02 that addressed the knowledge and understanding of our rural elderly population (persons age 65 and over) about emergency preparedness and emergency evacuation procedures in their specific counties. Specifically, the current study will explore the emergency preparedness of EMS agencies to determine the "best practices" for evacuating elderly citizens in South Carolina in times of disasters. As the elderly population in South Carolina increases and as the records of tropical cyclone (e.g. tropical storms, hurricanes) landfalls become more frequent in the coastal states, the need to establish a proactive plan of emergency preparedness relative to evacuation and transportation of the elderly residents of South Carolina becomes of paramount importance. We propose to evaluate major EMS services in selected counties in South Carolina along with preparedness and the condition of the roadways in the targeted areas.

The project will utilize two major sources of data collection: first, secondary data will be collected regarding road conditions and the accessibility of roads in and out of rural areas that are highly populated by the elderly. We will then conduct agency surveys with EMS agencies and related agencies to determine what evacuation practices are utilized to identify the elderly residents of rural areas. Results of this project will impact and benefit several stakeholders in the state, including EMS agencies and the South Carolina Department of Highway Safety, support legislation for emergency preparedness, and serve as a training tool for disaster educators and social workers.

Integrated Simulation Platform for Evaluating Wireless Traffic Sensor Network for Traffic Safety and Security Response

R-06-UTC-ISPEWTSNTSSR-MCS-01

Principal Investigator: Dr. Young Kim, Department of Math and Computer Science
South Carolina State University

Co-Principal Investigator: Dr. Mashrur (Ronnie) Chowdhury, Department of Civil/Electrical Engineering, Clemson University

To assure the continuous safety and efficiency of ground vehicle transportation over the extensive highway systems of the United States, transportation authorities have long relied on a wide range of sensor technologies to monitor traffic conditions, perform real-time traffic management, maintain traffic safety during incidents, and facilitate effective evacuation in security crises. However, the many sensor technologies currently in use require extensive and costly communication infrastructures, which have inevitably resulted in a very limited scope of deployment. Consequently, transportation authorities nationwide have begun investigating the use of wireless traffic sensors to accelerate sensing coverage of the highway systems. Despite the extensive research efforts in both the wireless communications and the transportation engineering communities, the vision of a large wireless traffic sensor network remains unfulfilled. This shortfall is partly due to the lack of a unified view of traffic sensing, control, and wireless networking operations that must occur in such a system. Because it is unclear how state-of-the-art wireless sensor network technologies can facilitate traffic control methodologies in maintaining safer highway traffic and security responses, there is a critical need to develop an integrated simulation platform to allow traffic control operations to be designed within a wireless sensor network system and evaluated with an accurate wireless network model. That is the subject of this research. With such an integrated platform, transportation engineers can study the efficacy of a multitude of traffic control methods, transportation authorities can evaluate the feasibility of the implementation plans of such systems, and wireless network engineers can explore enhanced solutions for a traffic sensor network.

In spite of the promoted visions of the use of large wireless sensor networks for distributed traffic monitoring, the architecture, protocols, and deployment topologies for such systems have yet to be exploited. Nevertheless, it is expected that such systems will be initially used as data collection mechanisms for the centralized traffic control at legacy transportation management centers. Ultimately, they are expected to be used as a fully distributed control mechanism with distributed decision-making data collected from wireless sensors. The project intends to develop the integrated simulation platform to permit the analysis of both scenarios, with support for implementation of traffic control algorithms and wireless network protocols. By integrating state-of-the-art simulators in both PARAMICS traffic simulator and the Network Simulator ns-2, the intended objective will be achieved. With the resulting platform, the project will conduct systematic evaluation studies to fully exercise a large set of design factors involved in a wireless traffic sensor network design, portraying the communications performance and algorithmic efficiency of known centralized traffic control methods. In line with our long-term goal of developing a fully distributed traffic sensor system, we will investigate a reference *hierarchical* wireless sensor network design and a distributed traffic control mechanism based on Case Based Reasoning (CBR). The expected project outcomes will include an integrated simulation platform and an implementation plan for practitioners for a wireless sensor network for traffic safety and security operations. The project addresses the critical and immediate challenges faced by corporate, government, and research communities that will benefit from this work via disseminated publications and open source software.

Analyzing Road Safety Using Optimal Queries

R-06-UTC-ARSUOQ-MCS-01

Principal Investigator: Dr. Mrutyunjaya Swain, Department of Math and Computer Science
South Carolina State University

Co-Principal Investigators: Dr. Kuhananda Mahalingam, Dr. Somasundaram Velummylum,
Department of Math and Computer Science, Claflin University

Traveler information is a key component of the service that National Highway Traffic Safety Administration (NHTSA) provides to the traveling public. Information is disseminated about weather, road conditions, chain requirements, incidents, construction, detours, and load restrictions, etc. Behind the technologies that provide traveler information there are databases that collect, store, and disseminate the information. NHTSA currently uses too many database systems to feed this information. These databases come with varieties of statistical tools, query builder tools, and reporting tools to select, analyze and present the information. By analyzing these available data, the NHTSA makes decisions about their future requirements on transportation safety, security and a number of other transportation related projects. Most of these databases are now available on the web, so that the average person can also benefit from transportation issues such as safety, road conditions, incidents etc.

In this information age, there are excessive amounts of information available relating to an event or an object. To incorporate this information, the database size grows bigger and bigger everyday. Also, the query builder tools that come with these databases are not that optimal. With the current setting, when a person does a search on a topic, they are presented with a vast array of information. Out of that information very few topics are directly relevant to the user's search. It is also hard to recognize necessary information from such a vast collection. While a researcher or a decision maker may need all the information presented for their research, or for making some critical decision, the average person does not.

By making available the safety databases on the Web, the NHTSA intended to generate public awareness about the transportation safety. However, a lack of integration and data representation of these database systems makes for inefficient system operation and delivery. Furthermore, these systems have limited reporting capabilities. Although it is clear that both the use and complexity of technology in our daily life have increased, the available information is significant enough to public safety.

In this project, our goal is to analyze and build a novel web based system for querying and presenting the information in a more detailed way. More importantly, this project will reduce the burden on the user with optimized queries so that users can get relevant data with simple queries. Our system model will address these current concerns and will be flexible for future enhancements.

Ongoing Research

2005-2006

Automated Traffic Surveillance Using Low-Angle Cameras

R-05-UTC-Automated Traffic-CAMET-01

Principal Investigator: Dr. Stanley Birchfield, Department of Electrical and Computer Engineering, Clemson University; Dr. Wayne Sarasua, Department of Civil Engineering, Clemson University

Co-Principal Investigator: Dr. Tom Whitney, Civil and Mechanical Engineering Technology, SCSU

Project Abstract: This research will result in the development of a novel method to conduct machine vision monitoring of vehicle activity using low-angle cameras. A major achievement of this research will be to overcome poor perspective effects that cannot be currently overcome by commercially available machine vision based traffic monitoring systems such as Autoscope. The approach will be to track feature points throughout a block of frames from a video image sequence. The researchers have recently developed a system capable of tracking vehicles in highway video from a low angle. The proposed project will build on this earlier success by significantly enhancing the algorithms to work at traffic intersections, and by validating their effectiveness through field testing. The resulting system will be able to conduct automated turn movement counts that are vital inputs to a number of transportation applications. It is anticipated that this work will lead to a series of scholarly papers.

Integration of Vehicle Detection Systems and Variable Message Signs for Traffic Management

R-05-UTC-Integration of Vehicle-IEE-01

Principal Investigator: Dr. Hasanul A. Basher, Department of Industrial Engineering`

Project Abstract: Various traffic problems present safety hazards as well as result in extensive delays for motorists. The integration of a VDS system using video sensor technology and a VMS system offers the possibility to warn motorists automatically, in real-time, of impending problems and to suggest alternatives routes . The proposed project consists of extending the capability of a VDS System through integration with a VMS System and evaluating the performance of the integrated unit so that the traffic data from the VDS System will automatically activate the VMS System for display in real-time. The project also includes studying existing video sensor- based VDS and VMS Systems and conducting tests for validation and performance evaluation of these systems under different operating conditions. The project will be broken into four tasks. In the first task, the performance indices of different video sensor systems (such as AUTOSCOPE, CCATS) will be studied with special focus on their performances in inclement weather, detection accuracy, false alarm rate or missed incidents, and video quality. In the second phase, a VDS and a VMS System will be procured, the operating principles of the systems will be studied and the systems' performances will be evaluated thoroughly for the proposed integration. The third phase will include studying the

formats of data transmission from and into the VDS and VMS Systems, integrating the two systems, and evaluating the performance of the integrated system under various scenarios. The fourth task will consist of transferring the results of the project to the transportation community through presentations at industry meetings, participation in seminars, and publication in appropriate journals.

Powered Non-Destructive Evaluation of Transportation Infrastructures using Wireless Embedded Sensors

R-05-UTC-Powered Non-Destru-IEE-01

Principal Investigator: Dr. Abdul Malek Miah, Department of Industrial & Electrical Engineering Technology, SCSU

Co-Principal Investigator: Dr. Mohammod Ali, Department of Electrical Engineering, University of South Carolina

Project Abstract: Routine evaluation and prediction of the health of infrastructures, such as bridges and overpasses is crucial to transportation safety. Currently this is done by expensive and labor-intensive procedures such as spot checking and ground penetrating radar (GPR). Researchers have proposed the use of wireless embeddable sensors for infrastructure health monitoring. Unquestionably, to drive the electronics of the wireless transceiver, an inexhaustible supply of power will be needed; which must be supplied to the sensors wirelessly because once the sensors are embedded within the concrete they cannot be accessed physically. The topic of powering embedded sensors within bridges or other infrastructures will play a tremendous role in the future development, deployment and possible breakthrough in cost savings in wireless infrastructure health monitoring technology. Recently we have introduced a novel multifunctional sensor antenna module which can be used to receive wireless power at one frequency (5.8 GHz) and high-speed data at another (2.4 GHz). Based on our preliminary results on this topic, we propose to investigate the feasibility of beaming microwave energy to power an embedded sensor within concrete. Full-wave electromagnetic simulations will be conducted on our newly developed multifunctional antenna module inside an air- hole of a realistic model of concrete slab.

A Web-Based Transportation Network Optimization Model in South Carolina

R-05-UTC-Web Based-IEE-01

Principal Investigator: Dr. Jae-Dong Hong, Department of Industrial & Electrical Technology, SCSU

Co-Principal Investigator: Dr. Young G. Kim, Department of Mathematic and Computer Sciences, SCSU

Project Abstract: This research will consider a problem where the logistics network consists of supplies, warehouses, distribution centers, and retail outlets. A network model will be develop using Microsoft Excel with VBA to find the optimal way to transport products from suppliers to customers through various transshipment points in the State of South Carolina. VBA codes will be used to retrieve data from the database, develop a flexible network flow model, and run the Solver to find the optimal transporting routes, the amount of flow, and the corresponding total

transportation costs. Also, sensitivity analysis will be performed to examine the influence of various factors on the optimal solution. There will be three phases to the study. Phase I will comprise the accumulation of a pilot database. Phase II will be the development of the Excel Model. Phase III will develop the design for the web site; the results of which will allow the users to provide their inputs to run the program.

COMPLETED RESEARCH

2004-2005

Pedal Force Analysis for Bicycling at the Onset of Fatigue

R-03-UTC-PEDAL FORCE-PE-01

Principal Investigator: Dr. Barry Frishberg, Department of Health and Physical Education, SCSU

Co-Principal Investigators: Dr. Leon Cohen, Department of Physics and Graduate Center, Hunter College and Dr. Lorenzo Galleani, Politecnico di Torino, Corso Duca degli, Abruzzi,

Project Abstract: Bicycles are a major means of transportation and many programs throughout the country are encouraging their use for many reasons. Fatigue is a cause of injury and its understanding and characterization are crucial. We propose a new method, time-frequency analysis, to study fatigue by characterizing it by new time-series methods, which have been shown to be very effective in other biomedical non-stationary time series data sets. An experimental apparatus will be set up that will measure foot pedal force, rotation rates, among other features, and all of which will be measured as a function of time. These time-series will be analyzed using these new methods and will be used to characterize the time series with the onset of fatigue. The combination of apparatus and analysis will produce a state of the art facility and produce results, which are important to the field. Results will be submitted for publication in standard refereed journals and presented at professional conferences. The combination of experiments, computer analysis, and the study of biomedical time-series is ideally suited for student involvement. Potential benefits are addressed, the main one being that a measure and understanding of fatigue could prevent injuries and could also help in the design of better bicycles to encourage their use. In addition, simple time-frequency measure such as time dependent standard deviations will be ascertained for the suitability of a simple measure of fatigue.

A Safer Driving Under Poor Atmospheric Conditions by Improving the Visibility Measurements Based on Wave List Analysis

R-03-UTC-WAVELET-MAT-01

Principal Investigator: Dr. Kuzman Adzievski, Department of Mathematics and Computer Science, SCSU

Co-Principal Investigator: Dr. Zlatkop Zografski, Dept. of Mathematics and Computer Science, SCSU

Project Abstract: It is estimated that one-third of all fatalities and two-thirds of rural are facilities involve run-off-the-road type crashes. Poor visibility of road markings in the dark,

fog, and rainy weather is one of the main causes for these fatalities. Visibility reduction, due to inclement weather conditions, is one of the main causes of traffic accidents; therefore, accurate visibility measurement is an important area of research in transportation. The overall objective is to improve the safety of rural roads in South Carolina by providing real time information and risk warnings for driving under poor visibility conditions.

Intelligent Transportation Systems (ITS) for Automated Pavement-Distress Feature Extraction and Characterization Using Machine Learning

R-04-UTC-ITS-UTC-01

Principal Investigator: Dr. Nikunja K. Swain, Department of Industrial/Electrical Engineering Technology, SCSU

Co-Principal Investigator: Mr. Andrew R. Tolleson, President, Geometrics, Inc.

Project Abstract: The proposed technique will significantly enhance the automated pavement condition by coupling state-of-the-art computer vision, pattern recognition and machine learning with downward looking roadway mages used for pavement management systems. The objective of this research utilizes Intelligent Transportation System (ITS) technology coupled with feature recognition to develop an automated digital image pavement condition rating system that will utilize existing state-of-the-art feature extraction technology to extract quantitative pavement distress data from pavement surface images.

This effort will help advance the current pavement management system into real time response by reducing the time lag in reporting the state of repair in the transportation highway system (s).

2003-2004

An Assessment of Emergency Transportation Management Centers for Rural Populations in South Carolina

R-03-UTC-EMGMGT-SW-02

Principal Investigator: Dr. Eva Njoku, Department of Social Work, SCSU

Co-Principal Investigator: Dr. Innocent Nkwocha,, Visiting Assistant Professor, School of Business

Project Abstract: This was an exploratory study to determine how knowledgeable persons 65 and older are about emergency preparedness and transportation evacuation procedures in times of environmental disasters. The study focused on five key factors related emergency evacuation. They were: (1) use and frequency of emergency services, (2) knowledge of emergency situations, (3) awareness of emergency services, (4) accessibility of emergency management services, and (5) demographic information describing location of elderly residents. Student interns were used to conduct face-to-face interviews with a sample of elderly persons who resided in the rural areas of selected counties in South Carolina.

The study found that the elderly were very limited in their understanding of emergency preparedness and may be vulnerable during disasters. They depended very heavily on others within their family and community to alert and get them to safety when disasters occurred. This dependence on family and the community does not suggest lack of interest information about emergency evacuation and safety in times of disaster. On the contrary, most of the respondents indicate a need for more information about emergency preparedness programs and how to get to safety in times of disaster. The study suggests the need for more technologies geared to increase communication, education, and links between emergency management centers and the local communities. The study also suggests the need for emergency management centers to review their current strategies to assure that they can identify, locate and assist all special needs populations in times of disaster.

Inlet/Outlet Manifold Design Improvements for PEM Fuel Cell Performance

R-03UTC-FUEL4-IET-04

Principal Investigator: Dr. Hamid Naseri-Neshat, Department of Civil and Mechanical Engineering, SCSU

Project Abstract: A three-dimensional triple pass PEMFC model will be developed with different inlet and outlet configurations for a 25-cm^2 membrane area. The model will include the anode and cathode flow channels, diffusion layers, and the membrane. A 4.472-cm by 4.472 -cm sub-gasket will be included on the membrane for case I, which reduces the active membrane area to 20-cm^2. Cell performance and without the sub-gasket Numerical prediction of PEMFC behavior will show the effects of different inlet and outlet manifold designs in its performance (total current produced) when the cell is operating under several loading conditions. The numerical results for four inlet and outlet design configurations will include polarization curves that show the relationship between cell voltage and current for four loading conditions. The predictions will be compared to the available data to verify and test the model parameters and the model itself. In the cell, the reacting gases (water vapor and will be investigated.

hydrogen gas in the anode side and water vapor along with air in the cathode side) are supplied into serpentine channels and gas diffusion layers on both sides of the membrane. Interaction of Hydrogen and Oxygen gases across the membrane, and also the conversion of water vapor into liquid, and vise versa, is also modeled within the cell. The numerical model will incorporate all previous experimental parameters available for the diffusion layers on the anode and cathodes sides of the membrane. It is anticipated that the results of this investigation will give guidance in the design of fuel cells built for transportation applications.

South Carolina's Rural Labor Market and its Dependence on Public Transportation

R-03-UTC-RURAL-MAT-01

Principal Investigator: Mr. Sam McDonald, Department of Mathematics and Computer Science, SCSU

Co-Principal Investigators: Dr. Jochen Albrecht, Department of Geology, University of Maryland and Vinesh Gupta, Department of Geology, University of Maryland

Project Abstract: Rural South Carolina is undergoing significant demographic and economic changes, which, in concert with new transportation technologies, give potential rise to new opportunities for rural transportation systems. The research proposed here will identify those areas that have the highest likelihood for viable rural public transport. This is seen as a key determinant for promoting sustainable economic growth in South Carolina, beyond traditional tourist and metropolitan areas. Building upon the expertise of three complementary researchers, this project combines transportation geography, economics, statistics, and the latest geo-spatial information technology to inform local and regional decision makers throughout rural South Carolina. In the course of this project, UTC research students will acquire a range of new skills, while the center itself will become the host of a GIS-based repository of raw data and derived analyses.

Investigation of Bridge Abutment Scour

R-03-UTC-BRIDGE-Abutment-SETS-01

Principal Investigator: Dr. Abdul Malek Miah, Department of Industrial and Electrical Engineering Tech., SCSU

Co-Principal Investigator: Dr. Jasim Imran, Environmental Engineering, University of South Carolina

Project Abstract: During the last 30 years, more than 1,000 bridges have failed and 60% of those failures are due to scour around abutments and piers. The existing guideline for predicting abutment scour gives an unrealistic estimate of scour depth especially for bridges founded on cohesive soil. A significant number of bridge crossings in South Carolina are founded on cohesive soil. Yet very little 0 research has been done on pier or abutment scour in cohesive soils.

Current research efforts at the University of South Carolina (USC) have led to the successful development of a new methodology for scour prediction around bridge piers in cohesive soil. The proposed research will extend the methodology to abutment scour. This research will allow bridge engineers to properly estimate scour depth around abutments and develop cost effective and safe designs of new bridges. The study will combine advanced numerical modeling,

experimental study, and traditional scour evaluation techniques. This is a joint project between USC and South Carolina State University (SCSU). It involves one PT and one female graduate student from USC, and one P1 and one female African American undergraduate student from SCSU. The methodology developed will be made available to SCDOT and FHWA engineers. The results will be presented at the Transportation Research Board Annual Meeting. The proposed research will improve passenger safety on the existing South Carolina bridge crossings by providing advanced warning on potential degradation of bridge alignment and bridge failure due to abutment scour.

Risk Management of Hazardous Materials Transportation in South Carolina: An Action Plan

R-02-UTC-HAZMAT-CET-02

Principal Investigator: Dr. Clarence Hill, Director JECUTC

Co-Principal Investigator: Dr. Tom Whitney, Interim-Chair, Department of Civil and Mechanical Engineering Technology, SCSU

Project Abstract: The purpose of this study is: 1) to identify the underserved segment of the population in Orangeburg County; 2) to determine the level of transportation services needed as a result of sprawl development. Survey results, U. S. census data, state statistical records and local county records clearly indicated that Orangeburg County has increased its population by 21.5% between 1970 and 1990. Further review of local county documents indicates that the number of building, residential, commercial, and industrial permits has nearly doubled in the last ten years. As a result of these factors, an increased number of residents are settling in suburban areas that create significant distances between home, work, and basic human service centers. The distances directly impact transportation, individual mobility, as well as access to transportation services in any given location.

A Feasibility Study to Determine the Effective Deployment of Simulation Training to Enhance CDL Class A Training and Re-Certification in Order to Reduce Accidents and Improve Highway Safety

R-04-UTC-A Feasibility Study-UTC-01

Principal Investigator: Mr. Lamar Tisdale, JECUTC

Co-Principal Investigator: Dr. Jack Selter, Center for Advanced Transportation System Simulation, and Mr. Ron Tarr, Center for Advanced Transportation System Simulation, University of Central Florida

Project Abstract: The U.S. Department of Transportation, Federal Motor Carrier Safety Administration (FMCSA), South Carolina Department of Public Safety, State Transport Police, and the South Carolina Department of Transportation have all identified safety and enhanced operator performance of heavy trucks as major goals in addressing intermodal transportation requirements of the State and nation. State FMCSA representatives and the South Carolina Department of Motor Vehicles are working diligently to address the issues of safety on South Carolina roads through better practices of strengthening and enforcing standards and certification of CDL training. Likewise, the American Trucking Association, Truckload Carriers Association and the South Carolina Trucking Association are equally concerned with issues of safety and driver training and the operational performance of drivers. Clearly, driver selection and training, recertification, safety, security, and accident reduction are priority

concerns in the entire trucking community. These concerns have also been expressed by the transit and motor coach industry as well. The objective of this project is to develop a feasibility study to determine the effective deployment of simulation-based training, evaluation and re-certification model project in enhancing training effectiveness, and continuing education for the Class A Certified Driver License (CDL). This project is designed to decrease accidents, improve highway safety and enhance training effectiveness, and improve re-certification activities.

Rapid-Setting Controlled Low-Strength Material for Routine and Emergency Rehabilitation of Transportation Facilities

R-03-UTC-Material-USC-01

Principal Investigator: Dr. Charles Pierce, Civil and Environmental Engineering, University of South Carolina

Co-Principal Investigator: Dr. Stanley Ihekweazu, Department of Civil and Mechanical Engineering Technology, SCSU

Project Abstract: This project is entitled "A Rapid-Setting Controlled Low-Strength Material for Routine and Emergency Rehabilitation of Transportation Facilities." Dr. Charles Pierce of the University of South Carolina and Dr. Stanley lhekweazu of South Carolina State University are the principal investigators. Two students, one from USC and one from SCSU, will be integral to the success of the project because the work is highly experimental. In this study, a series of laboratory experiments will be conducted to investigate the influence of different accelerating admixtures on controlled low-strength materials. Such materials are commonly referred to as flowable fills and are often mixtures of cement, fly ash, sand, and water. The proportions of these ingredients are designed in such a way to produce a very flowable material that sets and hardens to strengths higher than compacted earth but lower than concrete. The high flowability and low-strength make this a unique building material that is rapidly gaining more attention and use in transportation construction and maintenance. By adding chemical admixtures, it is proposed that the setting time can be reduced to two hours or less, and that the early strengths (at 24 hours, for example) can be substantially increased. Development of this material would lead to a significant change in how controlled low-strength materials are applied in civil works. To initiate such a change, the investigators intend to publish their findings in research journals, present at American Concrete Institute and Transportation Research Board meetings, and arrange for a special meeting with the South Carolina Department of Transportation. All research started in prior grant years are completed.

An Assessment of Emergency Transportation Management for the Rural Elderly

R-03-UTC-EMGMGT-SW-02

Principal Investigator: Dr. Eva Njoku, Department of Social Work, SCSU

Co-Principal Investigator: Dr. Innocent Nkwocha, Visiting Assistant Professor, School of Business

Project Abstract: The proposal is to identify what emergency transportation management system (s) exist to assist in the evacuation of special needs groups in the rural areas should an

environmental disaster or terrorist act occur in South Carolina. The special needs groups include the elderly (65 and over), persons living alone, and persons unable to drive or those without personal transportation. The study will target a sample of ten counties in the state that have an elderly special needs population of 40% or more. The study will use secondary data on statistics and demographic information; other methods include survey and face-to-face interviews for data collection.

The data analysis will use standard quantitative methods with demographic data and descriptive statistics, frequency distributions, and some correlation analysis of qualitative and survey data.

Inlet/Outlet Manifold Design Improvements for PEM Fuel Cell Performance

R-03-UTC-FUEL4-IET-04

Principal Investigator: Dr. Hamid Naseri-Neshat, Department of Civil and Mechanical Engineering, SCSU

Project Abstract: A three-dimensional triple pass PEMFC model will be developed with different inlet and outlet configurations for a 25-cm^2 membrane area. The model will include the anode and cathode flow channels, diffusion layers, and the membrane. A 4.472-cm by 4.472 -cm sub-gasket will be included on the membrane for case I, which reduces the active membrane area to 20-cm^2. Cell performance with and without the sub-gasket will be investigated. Numerical prediction of PEMFC behavior will show the effects of different inlet and outlet manifold designs in its performance (total current produced) when the cell is operating under several loading conditions. The numerical results for four inlet and outlet design configurations will include polarization curves that show the relationship between cell voltage and current for four loading conditions. The predictions will be compared to the available data to verify and test the model parameters and the model itself. In the cell, the reacting gases (water vapor and hydrogen gas in the anode side and water vapor along with air in the cathode side) are supplied into serpentine channels and gas diffusion layers on both sides of the membrane. Interaction of Hydrogen and Oxygen gases across the membrane, and also the conversion of water vapor into liquid, and vise versa, is also modeled within the cell. The numerical model will incorporate all previous experimental parameters available for the diffusion layers on the anode and cathodes sides of the membrane. It is anticipated that the results of this investigation will give guidance in the design of fuel cells built for transportation applications.

Isolating and Managing the Urban Island Effects for Selected Southeastern Cities

R-03-UTC-HeatIsland-MAT-01

Principal Investigator: Mrs. Cynthia T. Davis, Department of Math and Computer Science, SCSU

Co-Principal Investigator: Dr. Vereda King, North Carolina A & T University

Project Abstract: It has been known for some time that cities are generally warmer than the surrounding, more rural areas. Because of this relative warmth, a city may be referred to as an urban heat island. Journal and newspaper articles have highlighted the interaction between air quality, energy, toxic issues, and transportation infrastructures. Heat islands are formed when pavement, buildings, transportation infrastructure, and other structures necessary to

accommodate growing populations replace vegetation. These surfaces absorb, rather than reflect, the sun's heat, causing surface temperatures and overall ambient temperatures rise. As temperatures increase due to the heat island effect, more electricity is required for indoor air conditioning and other cooling purposes. Greenhouse gases increase as fossil fuels are burned to produce this cooling energy ozone. By implementing heat island reduction measures, we can have more efficient and sustainable highway management as well as a reduction in the electricity demand and climate-altering emissions.

The specific objectives of this study are to: (1) analyze the highway infrastructure in selected urban southeastern states; (2) isolate the role of the highway infrastructure in the heat island effect; (3) create proactive solutions for these urban areas, which will lead to improved management for new and existing highways; and (4) use the findings of this study as the foundation for an interdisciplinary senior seminar course for related majors including transportation, economics, and engineering.

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R-03-UTC-RURAL-MAT-01

Principal Investigator: Mr. Sam McDonald, Department of Math and Computer Science, SCSU

Co-Principal Investigators: Dr. Jochen Albrecht, Department of Geology, University of Maryland and Vinesh Gupta, Department of Geology, University of Maryland

Project Abstract: Rural South Carolina is undergoing significant demographic and economic changes, which, in concert with new transportation technologies, give potential rise to new opportunities for rural transportation systems. The research proposed here will identify those areas that have the highest likelihood for viable rural public transport. This is seen as a key determinant for promoting sustainable economic growth in South Carolina, beyond traditional tourist and metropolitan areas. Building upon the expertise of three complementary researchers, this project combines transportation geography, economics, statistics, and the latest geo-spatial information technology to inform local and regional decision makers throughout rural South Carolina. In the course of this project, UTC research students will acquire a range of new skills, while the center itself will become the host of a GIS-based repository of raw data and derived analyses.

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Project Abstract: During the last 30 years, more than 1,000 bridges have failed and 60% of those failures are due to scour around abutments and piers. The existing guideline for predicting abutment scour gives an unrealistic estimate of scour depth especially for bridges founded on cohesive soil. A significant number of bridge crossings in South Carolina are founded on cohesive soil. Yet very little 0 research has been done on pier or abutment scour in cohesive soils.

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The proposed research will extend the methodology to abutment scour. This research will allow bridge engineers to properly estimate scour depth around abutments and develop cost effective and safe designs of new bridges. The study will combine advanced numerical modeling, experimental study, and traditional scour evaluation techniques. This is a joint project between USC and South Carolina State University (SCSU). It involves one PT and one female graduate student from USC, and one P1 and one female African American undergraduate student from SCSU. The methodology developed will be made available to SCDOT and FHWA engineers. The results will be presented at the Transportation Research Board Annual Meeting. The proposed research will improve passenger safety on the existing South Carolina bridge crossings by providing advanced warning on potential degradation of bridge alignment and bridge failure due to abutment scour.

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Project Abstract: The purpose of this study is: 1) to identify the underserved segment of the population in Orangeburg County; 2) to determine the level of transportation services needed as a result of sprawl development.

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Project Abstract: The U.S. Department of Transportation, Federal Motor Carrier Safety Administration (FMCSA), South Carolina Department of Public Safety, State Transport Police, and the South Carolina Department of Transportation have all identified safety and enhanced

operator performance of heavy trucks as major goals in addressing intermodal transportation requirements of the State and nation. State FMCSA representatives and the South Carolina Department of Motor Vehicles are working diligently to address the issues of safety on South Carolina roads through better practices of strengthening and enforcing standards and certification of CDL training. Likewise, the American Trucking Association, Truckload Carriers Association and the South Carolina Trucking Association are equally concerned with issues of safety and driver training and the operational performance of drivers. Clearly, driver selection and training, recertification, safety, security, and accident reduction are priority concerns in the entire trucking community. These concerns have also been expressed by the transit and motor coach industry as well. The objective of this project is to develop a feasibility study to determine the effective deployment of simulation-based training, evaluation and re-certification model project in enhancing training effectiveness, and continuing education for the Class A Certified Driver License (CDL). This project is designed to decrease accidents, improve highway safety and enhance training effectiveness, and improve re-certification activities.

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Inlet/Outlet Manifold Design Improvements for PEM Fuel Cell Performance

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Project Abstract: A three-dimensional triple pass PEMFC model will be developed with different inlet and outlet configurations for a 25-cm^2 membrane area. The model will include the anode and cathode flow channels, diffusion layers, and the membrane. A 4.472-cm by 4.472 -cm sub-gasket will be included on the membrane for case I, which reduces the active membrane area to 20-cm^2. Cell performance with and without the sub-gasket will be investigated. Numerical prediction of PEMFC behavior will show the effects of different inlet and outlet manifold designs in its performance (total current produced) when the cell is operating under several loading conditions. The numerical results for four inlet and outlet design configurations will include polarization curves that show the relationship between cell voltage and current for four loading conditions. The predictions will be compared to the available data to verify and test the model parameters and the model itself. In the cell, the reacting gases (water vapor and hydrogen gas in the anode side and water vapor along with air in the cathode side) are supplied into serpentine channels and gas diffusion layers on both sides of the membrane. Interaction of Hydrogen and Oxygen gases across the membrane, and also the conversion of water vapor into liquid, and vise versa, is also modeled within the cell. The numerical model will incorporate all previous experimental parameters available for the diffusion layers on the anode and cathodes sides of the membrane. It is anticipated that the results of this investigation will give guidance in the design of fuel cells built for transportation applications.

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The results will be presented at the Transportation Research Board Annual Meeting. The proposed research will improve passenger safety on the existing South Carolina bridge crossing by providing advanced warning on potential degradation of bridge alignment and bridge failure due to abutment scour.

2002-2003

An Evaluation of Strength Change on Subgrade Soils Stabilized with an Enzyme Catalyst Solution Using CBR and SSG Comparisons

R-03-UTC-ALTERPAVE-GEO-01

Principal Investigator: Andrew Tolleson, ME, PE

Co-Principal Investigators: Elahe Mahdavian, Ph.D.

Project Abstract: A laboratory bench scale testing program was conducted to evaluate the effectiveness of enzyme treatment on subgrade soil. The objective of this testing program was to study the potential applicability of the tested enzyme for unpaved road in-situ stabilization. The effectiveness of enzyme treatment was evaluated on the basis of statistical measurement of change in CBR strength, soil stiffness, and soil modulus. Sample preparation was achieved by a controlled mixture of a liquid/aqueous enzyme solution with a series of selected subgrade samples exhibiting a wide range of grain size distributions and plasticity characteristics. The laboratory mixing process was conducted in a manner to simulate field paving operations. Standard density and optimum moisture content was established for each sample via AASHTO T-99 criteria. All laboratory work was performed under controlled conditions in an AASHTO certified laboratory. The soil specimens were subjected to the California Bearing Ratio (i.e. CBR per AASHTO T-193) test, and the stiffness and modulus of the specimen were measured by means of the Humboldt Soil Stiffness GeoGauge (Humboldt model H-4140). Analysis of the test results for the treated and control specimens for each soil sample were conducted and a comparison of the test results was correlated. Based on a population size of 5, the strength change under the soaked condition ranged from negligible change for the samples with high fines content up to 140% strength gain for the soil sample with approximately 30% fines. The average strength gain was approximately 52% with a standard deviation of 58%. The test results for the subgrade soil samples tested under both dry and soaked CBR conditions indicated a greater average strength gain as a result of enzyme treatment under the dry condition compared to the average strength gain under the soaked condition. However, based on the combined strength indices (i.e. CBR, and SSG) only 30% of the dry samples gained more than 20% strength while 80% of the soaked samples gained more than 20% strength as a result of treatment. Nearly 45% of the CBR tests conducted failed to give conclusive results on the effectiveness of enzyme treatment largely due to surface disturbance inherent in the soaked CBR procedure. It was concluded that the CBR test appeared to be a relatively poor indicator of direct soil strength for the testing conditions in this research. Notwithstanding, the test results showed CBR strength gain, and to a lesser degree strength gain measured by means of the SSG equipment resulting from the application of the enzyme solution on most soils tested, indicating a promising potential for subgrade stabilization using the enzyme solution. However, additional testing to determine the effectiveness of the enzyme solution should be conducted using field non-destructive techniques such as FWD or other direct strength methods.

Designing Fuel Cells for Improved Transportation Safety and Security

R-02-UTC-FUEL-CET-04

Principal Investigator: Dr. Hamid Naseri-Neshat

Project Abstract: Proton exchange membrane fuel cell (PEMFC) is one of the most promising candidates as a power source for electric vehicles and on-site power plants, because of its high power densities and energy conversion efficiencies at relatively low temperatures. The hydrogen rich fuel, approximately 40% H_2, 43% N_2, and 17% CO_2, contains anywhere from 5 ppm to 1% CO in the stream. Although Pt has been proven to be the most effective catalyst for the hydrogen oxidation, even fewer parts per million of CO produces a substantial degradation of the fuel cell performance with this catalyst. This performance degradation is associated with a CO adsorption on the Pt catalyst. Fuel cell companies are actively researching the effects of reformate on fuel cell performance. The focus of this study is to develop design techniques, mathematical models, and experimental data that aid in the proper design of PEMFCs. Experimental and numerical investigations of effects of reformate on the performance of the PEMFCs should be of assistance to fuel cell manufacturers, and in particular the transportation applications.

Both the experimental and numerical results corroborate decreased current density production of about 20% to 30% due to the presence of reformate. In general, higher current density regions are attributed to the migration of water vapor from the anode to cathode side. In the inlet region of the membrane, the effect of electro-osmotic drag is more predominant; however, the back diffusion becomes more important in the outlet region of the membrane. Decreasing concentration of hydrogen in anode stream reduces the PEMFC performance due to kinetic over potential changes and increased anode flooding.

Feasibility Study of an On-Board Traffic Problem Notification System

R-02-UTC-ONBOARD-IET-01

Principal Investigator: Dr. Hasanul Basher

Co-Principal Investigators: Dr. Stéphane Guillard

The purpose of the project was to determine the feasibility of developing an Intelligent Traffic System (ITS) capable of delivering en-route guidance to drivers through on-board navigation units. Such en-route traffic information relay systems provide dynamic route guidance and advice based on general warnings about traffic incidents, inclement weather patterns, and traffic congestion problems.

Relaying traffic information to driver's en-route is part of a larger body of research and development known as Intelligent Transportation Systems (ITS). ITS brings together Emergency Management Services (EMS), Information Service Providers (ISPs), Electronic Toll and Traffic Management (ETTM) systems, roadside beacons, communication systems, and "wired" vehicles to manage vehicle fleets, avoid collisions, automate vehicle control, track the transportation of weapons and hazardous materials, collect tolls, coordinate transit schedules, and provide driver/traveler information.[1] In a short paper summarizing a global vision for ITS entitled *Intelligent Transport Systems and the Future*, leading ITS organizations state, "ITS integrates users, transport systems, and vehicles through state-of-the-art information and

Intelligent Transportation Systems for the Rural Highway System of South Carolina

R-02-ITS-ABSS-01

Principal Investigator: Dr. Clarence W. Hill

Project Abstract: The National Intelligent Transportation Systems (ITS) Architecture was developed for the US Department of Transportation (USDOT) as the framework for implementing modern transportation operations systems.

The National ITS Architecture provides a common structure for the design of intelligent transportation systems. It defines the framework around which different design approaches can be developed, each one specifically tailored to meet specific regional requirements, while maintaining the benefits of a common architecture within current (legacy) and planned systems.

The National Architecture can provide short-term benefits by saving time and money in the development of a project from its inception through its implementation, since it:

1. Correlates requirements and problems to services that must be performed, thus providing trace ability for a project to overall transportation needs.

2. Illustrates efficiencies that can be gained by eliminating redundant implementations of similar functions.

3. Provides a view into the future to identify services and functionality that may not have been initially considered, currently needed, or even feasible. This provides a checklist of future capabilities that could be planned for now in anticipation of future requirements.

This document is used to specify the understanding of requirements between the Stakeholders and SCSU Research Principal Investigators for the purpose of implementing a Rural ITS Solution for the Lower Savannah Region to meet the following objectives: Improve transportation safety and to Improve transportation security. The document is divided into three parts: 1.) Project Objects, 2.) General requirements and constraints, and 3.) Specific requirements and constraints. The National ITS Architecture was developed for the US Department of Transportation (USDOT) as the framework for implementing modern transportation operations systems suggested that most parents found the cost of infant safety seats affordable however, a significant 5% found them unaffordable and difficult to install correctly. Ninety percent (90%) of the parents surveyed identified the most difficult problem for them with infant seats were trying to attend to an infant in the back seat while driving.

Rapid-Setting Controlled Low-Strength Material for Routine and Emergency Rehabilitation of Transportation Facilities

R-03-UTC-Material-USC-01

Principal Investigator: Dr. Charles Pierce, Civil and Environmental Engineering, University of South Carolina

Co-Principal Investigator: Dr. Stanley Ihekweazu, Department of Civil and Mechanical Engineering Technology, SCSU

Project Abstract: In this study, a series of laboratory experiments was conducted to investigate the influence of different accelerating admixtures on controlled low-strength materials. Such materials are commonly referred to as flowable fills and are often mixtures of cement, fly ash, sand, and water. The proportions of these ingredients were designed in such a way to produce a very flowable material that sets and hardens to strengths higher than compacted earth but lower than concrete. The high flowability and low-strength make this a unique building material that was rapidly gaining more attention and use in transportation construction and maintenance. By adding chemical admixtures, it was proposed that the setting time could reduce to two hours or less, and that the early strengths (at 24 hours, for example) can be substantially increased. Development of this material would lead to a significant change in how controlled low-strength materials are applied in civil works. To initiate such a change, the investigators intend to publish their findings in research journals, present at American Concrete Institute and Transportation Research Board meetings, and arrange for a special meeting with the South Carolina Department of Transportation.

Risk Management of Hazardous Materials Transportation in South Carolina: An Action Plan

R-02-UTC-HAZMAT-CET-02

Principal Investigator: Dr. Clarence W. Hill

Co-Principal Investigators: Dr. Tom Whitney

Project Abstract: The Nation has entered a new era of security awareness since September 11, 2001, and nowhere is that felt more strongly than in the field of transportation, from aviation to railways, highways, pipelines, and waterways. Efforts are currently underway to address hazardous materials transportation safety and security. In the wrong hands, hazardous materials can pose a significant security threat, and the security of hazardous materials in the transportation environment poses unique challenges as compared to security at fixed facilities.

The purpose of this project was to assist the South Carolina State University Transport Police to initiate the development of a statewide Hazardous Materials Transportation Risk Management Plan. An operational framework was needed within which hazardous materials (HAZMAT) transportation risks could be assessed, management of these risks could be evaluated, and resources could be focused on the most serious potential problems. A means to monitor the process and measure its effectiveness was also required.

Long before September 11, 2001, the South Carolina Department of Public Safety's Transport Police had recognized the necessity for improved efforts to promote safety and limit the risks resulting from the increasing flow of hazardous materials within and throughout the state.

Increased regulatory demands coupled with limited resources dictated that more efficient and effective methods were necessary. In the wake of September 11th and with a national concern about terrorist threats, attention also had to be directed at hazardous materials ***security*** as well as safety. South Carolina, like most states, has many organizations and agencies involved in these issues. Improving coordination among them had been an important objective from the outset, but became an imperative after September 11, 2001. The intent of this project was to devise a system or process that would incorporate all affected parties in an effort to better identify HAZMAT transportation risks, develop strategies for risk reduction, and promote broad coordination and cooperation in prevention and protection efforts.

South Carolina East Coast Greenway -Transportation Safety, Route Location and Facility Needs Study

R-02-UTC-GREENWAY-UTC-01

Principal Investigator: Wayne A. Sarasua

Co-Principal Investigators: David B. Clarke, William J. Davis, and James Gordon

Project Abstract: The East Coast Greenway is a multi-modal transportation corridor for cyclists, hikers, and other non-motorized users extending from Maine to Florida. The 230-mile section of greenway extending through the coastal areas of South Carolina is currently under various stages of development and the exact route location is still being determined. The greenway will use a variety of linkages including off-road paths, utility easements, and existing roadways. In creating a continuously linked facility, the greenway will pass through cities, cross existing bridges, and coexist along coastal highways. When non-motorized and motor vehicle traffic operate within the same right-of-way in close proximity to one another, safety is a key concern. This project identifies and addresses concerns of this nature through an evaluation of walk ability and bicycle suitability issues. Project tasks include the collection of transportation data along the length of the corridor, the analysis of non-motorized mode suitability on a segment by segment basis, the solicitation of stakeholder input and the development of a detailed master plan document useful in facilitating greenway development, and prioritizing needed improvements and obtaining transportation funding. These efforts should help establish a firm foundation for developing the integrated facilities and linkages needed to showcase the historic and pristine areas of our beautiful state by successfully accommodating the East Coast Greenway within the coastal regions of South Carolina.

Validating and Modifying Highway Accident Prevention System, and Integrating Transportation Safety in Mathematics Program

R-02-UTC-Prevention-MAT-01

Principal Investigator: Dr. Harun K. Adongo

Project Abstract: South Carolina's per mileage death rate in 2000 was 47% higher than the national average, and ranked among the worst 3 states according to the National Highway Traffic Safety Administration and South Carolina Department of Public Safety. Nationally, there were 41,821 deaths while in South Carolina there were 1,065 deaths with 39.6% alcohol related.

The study released this February by the National Center on Addiction and Substance Abuse at

Columbia University indicates that alcohol kills 1,400 college students, injures 500,000, and 2.1 million drive while under the influence of alcohol.

The highway incident management systems currently focus on detecting accidents after they occur, and attempt to minimize response and clearing times. The RiskHAPS attempts to predict, in real time, the potential for an accident occurring using probabilistic models, thus suggesting a preventive measure to avoid the occurrence of the accident. However, as noted by Dr. Veretta Sabb on the quick response travel forecasting techniques, these models are questionable for rural counties in South Carolina.

Our project will attempt to validate and improve the RiskHAPS using data from selected rural areas, and integrate transportation models in advanced mathematics courses. The models are expected to make college students more aware of the connections between theprobabilities of accident occurrence, driver's reaction time, and alcohol impairment, and also expose them to advanced study and career opportunities in the transportation field. This research has two objectives. The first is to validate and modify the Real-Time-Risk-Based Highway Accident Prevention System (RiskHAPS) being developed by the Universities of Connecticut and Vermont, using data from rural areas in South Carolina. The second is to integrate transportation safety models in two mathematics courses; Mathematical models (M407), or Operations Research (M412).

Vehicle Seat Belt Use Among AFDC Families and Their Children in South Carolina

R-02-UTC-SEATBELT-SW-01

Principal Investigator: Dr. Eva M. Njoku LMS

Project Abstract: The purpose of the study was to determine how knowledgeable parents were about the importance of using safety seats for their infants and children and if visual instruction about the dangers of unrestrained children in auto crashes would have any significant impact on the mothers about passenger safety for themselves and their children.

The target population for the study was Aid to Families with Dependent Children (AFDC) mothers in parenting classes in six counties in South Carolina. The parents were attending the classes through the county Department of Social Services. Three counties served as the experimental group who received instruction and saw a videotape regarding crashes with unrestrained passengers including children. The control group was only given instruction without viewing the tape. Both groups were given a survey that provided; (1) demographic information about the participant, (2) the knowledge level of the participants about passenger safety, and (3) their feelings, in general, about using child restraints when traveling.

A total of fifty-three parents were surveyed. The result of the study showed that 95% of the parents who participated in the survey were aware of the importance of safety seat belt use and they use infant and child safety seats for their children. However, some discrepancies occurred when traveling short distances from home and traveling with more than two children. Short distances were defined as traveling one mile or less from home. Parents in the survey were more likely to take risks and not use safety seat belts when traveling "down the road" or "to the store". Also, if they were traveling with more than two children, seating arrangements became difficult and parents had to determine which children, would be restrained. Usually the younger

children under two years were most likely to be buckled up; however, very young infants under six months when traveling short distances were preferably held by an adult. Also the study suggested that most parents found the cost of infant safety seats affordable however, a significant 5% found them unaffordable and difficult to install correctly. Ninety percent (90%) of the parents surveyed identified the most difficult problem for them with infant seats were trying to attend to an infant in the back seat while driving.

OTHER FUNDED RESEARCH PROJECTS

2004-2005

Bamberg Community Transportation Initiative

R-05-UTC-Bamberg-UTC-01

Principal Investigator: James Gordon, James E. Clyburn University Transportation Center, SCSU

Co-Principal Investigator: J. Wilbur Cave

Project Abstract: There is a true circle for the problems caused by a lack of transportation. Adults are unable to find work or medical care. Their children are forced to remain at the poverty level and often fail to attain educational achievement. Jobs will not come to the area and residents are forced to leave. The younger generation is not staying in Bamberg County. In fact, Bamberg County lost population in the 2000 Census – not an attractive selling point for industry or for persons locating in Bamberg County. A number of studies have focused on ways to help rebuild economic health and growth in the area. One major need identified is a transportation system for the public and a group of committed local citizens representatives of local service agencies, medical providers, elected officials, and others - began exploring possibilities for meeting community transportation needs. This group has come to be known, informally, as the Bamberg County Community Transportation Committee. It has been determined that two major areas are impacted by the lack of transportation – employment/ economic development and health. Both are major issues in quality of life, both significantly impact the impoverished situation in Bamberg County, and both are costly to the individual and to the public. The county's income level, medical care, and quality of life can increase with a coordinated public transportation system in place. Having a public transit system developed and overseen by local citizens, whose primary purpose is to serve people locally is the next important step to increase the quality of life in Bamberg County.

Lee County Transportation System For Adult Educational Development and Community Services

R-05-UTC-Lee County Transportation

Principal Investigator: James Gordon, James E. Clyburn University Transportation Center, SCSU

Co-Principal Investigator: Frank Garcia, Community Solution; Robin Chisolm, Rural Crossroads Institute

Project Abstract: The Lee County transportation project is designed to assist the rural community in designing a creative and customized community development strategy that will address the workforce and basic skills training needs and provide transportation to the population in need of services. Almost half of the Lee County adult population is at the lowest educational level. There is a high incidence of illness and death in the adult population that is related to preventable health problems. A Community Workforce Center has been established

that offers workforce training, basic education skills, health screening and business development assistance. Lack of public transportation is a major barrier for residents of the County to take advantage of services offered by the Center. An analysis of the adult population will provide information on individuals in need of basic educational level training, workforce training, workforce skills enhancement, and transportation to the Center. Economic development agencies and faith-based groups will cooperate in marketing the Center opportunities to those in need of services. The Santee-Wateree Regional Transit Authority that now serves Lee County will be contracted to provide transportation for Center activities. The project can provide a model for other distressed, least developed and underdeveloped rural counties in SC in identifying workforce and basic skills training, transportation and resources for economic growth.

Lower Savannah Regional Transit Coordination Center Project

R-05-UTC-Lower Savannah-UTC-01

Principal Investigator: James Gordon, James E. Clyburn University Transportation Center, SCSU

Co-Principal Investigator: Ronald G. Humphrey

Project Abstract: The last four years, LSCOG RTMA has steadily progressed towards increasing coordination of transportation services among the autonomous health, human services and public transit systems serving the region. Although we have made many quality of life improvements for our citizens we want to continue towards our vision to be the model for rural transportation for the State of SC and the US. To make our vision a reality LSCOG would like to participate, in coordination with the Southern Rural Transportation Center at South Carolina State University, in the development of a comprehensive research project. The project will focus on three major areas and will lead to the design and implementation of a coordinated transit system for the Lower Savannah Region. The project will be conducted in three phases as follows: Phase 1: Assessment of current transit functions and capabilities in the Lower Savannah Region, Phase 2: Development of a detailed implementation plan for a transit coordination center operated by the Lower Savannah Council of Governments, Phase 3: Project implementation.

2003-2004

Allendale Community Transportation Initiative

R-04-UTC-Allendale-UTC-01

Principal Investigator: James Gordon, James E. Clyburn University Transportation Center, SCSU

Co-Principal Investigator: J. Wilbur Cave.

Project Abstract: It has been determined that two major areas are impacted by the lack of transportation: 1) employment/economic development, and 2) health. Both are major issues in the quality of life, both significantly impact the impoverished situation in Allendale County, South Carolina and both are costly to the individual and to the public. The county's income

level, medical care, and quality of life can increase with a coordinated public transportation system in place. Having a public transit system developed and overseen by local citizens, whose primary purpose is to serve people locally, is the next important step to increase the quality of life in Allendale County. It is envisioned that this project could serve as a model for other small counties in South Carolina. The mission of the project is to demonstrate effective coordination of existing resources from public, not-for-profit, and private service providers. Currently multiple service providers transport their respective riders over the same roads. The project will identify current service routes and place general public customers on existing vehicles. The new coordinated program will find the most efficient way to get riders to their destinations in a safe and timely manner and expand services without increasing costs proportionately. More residents of Allendale County will be able to access transit services. Many of these persons are low income, but may not qualify for agency services. By providing transit through existing vehicles, customers traveling between counties could transfer from one van to another, allowing a local van to better serve its own area. By bringing providers of transportation in an extremely rural area together as partners with technical support and oversight, negative aspects of competition in ridership will be reduced, and the quality and cost-effectiveness of service will be increased.

National Environmental Policy Commission Final Report to the Congressional Black Caucus September 2003 Authored by: The National Environmental Policy Commission

R-03-UTC-MUSC-SC

Principal Investigator: Dr. Clarence W. Hill, Director, JECUTC

Co-Principal Investigator: Mr. David Rivers, Director Public Information and Community Outreach Library Sciences and Informatics, Medical University of South Carolina.

Project Abstract: In order to achieve the identified objectives, the Commission will hold five Listening Sessions in strategic geographic locations around the country participate in a made-for-television dialogue based upon the Commission's findings and develop a final report for submission to the Congressional Black Caucus and other policy makers.

Advanced Learning Technology for School Bus Training Program: Design of a Multi-Level Systematic Program of Training and Certification for Instructors and Managers to Enhance Performance and Safety

R-03-UTC-Advanced Learning-CET-01

Principal Investigator: Mr. Lamar Tisdale, JECUTC

Co-Principal Investigator: Mr. James Gordon, JECUTC

Project Abstract: The South Carolina Department of Transportation and the U.S. Department of Transportation have identified safety as one of the major objectives in addressing the transportation needs across the state and nation. Paramount to this concern is the [challenge of School Bus Programs across the state for which there is neither standardized training nor certification of drivers.

In addition, there is no program for professional development and certification of the supervisors or managers of the various School Bus Programs. The SC Department of Public Safety and South Carolina Division of Motor Vehicles are working diligently to address the issue of safety on South Carolina's roads by developing and enforcing standards and certification for Commercial Driving Programs. Clearly the issue of safety and the proper training of persons who will be operating a school bus deserve no less emphasis and standardization. The research will establish a multi-level advanced learning technology program, using the latest techniques of instructional design and alternative instructional settings, advanced training program material where possible, and various target audiences to determine the best blend of training techniques. The project will result in a new level of quality training, enhanced performance, and certification resulting in a better understanding across the community, equating to more efficient and safer operators and managers of this critical and complex program. The program will be designed so that a common thread of safety and high quality performance will be integrated throughout, and make use of the latest proven aspects of various training methods, to include workshops, computer based and internet based training, project based learning, and interactive situational training. The program will look for innovative methods of offering non-traditional methods of instruction to accommodate various schedules of different employees as well as candidates for positions. Consideration for identification of mentors will be explored to allow new managers and drivers to have experienced personnel available to assist them as they learn new techniques to improve the way they do their jobs. In all cases, the program objective will be consistently focused on the goals of the overall School Bus Program; to ensure the safest possible environment for children during transit from home to school and back.

A Study to Determine Available Financial Resources for Safety and Transportation Enhancement Grant for Buckley Street at South Carolina State University

R-04-UTC-Buckley Street-UTC-01

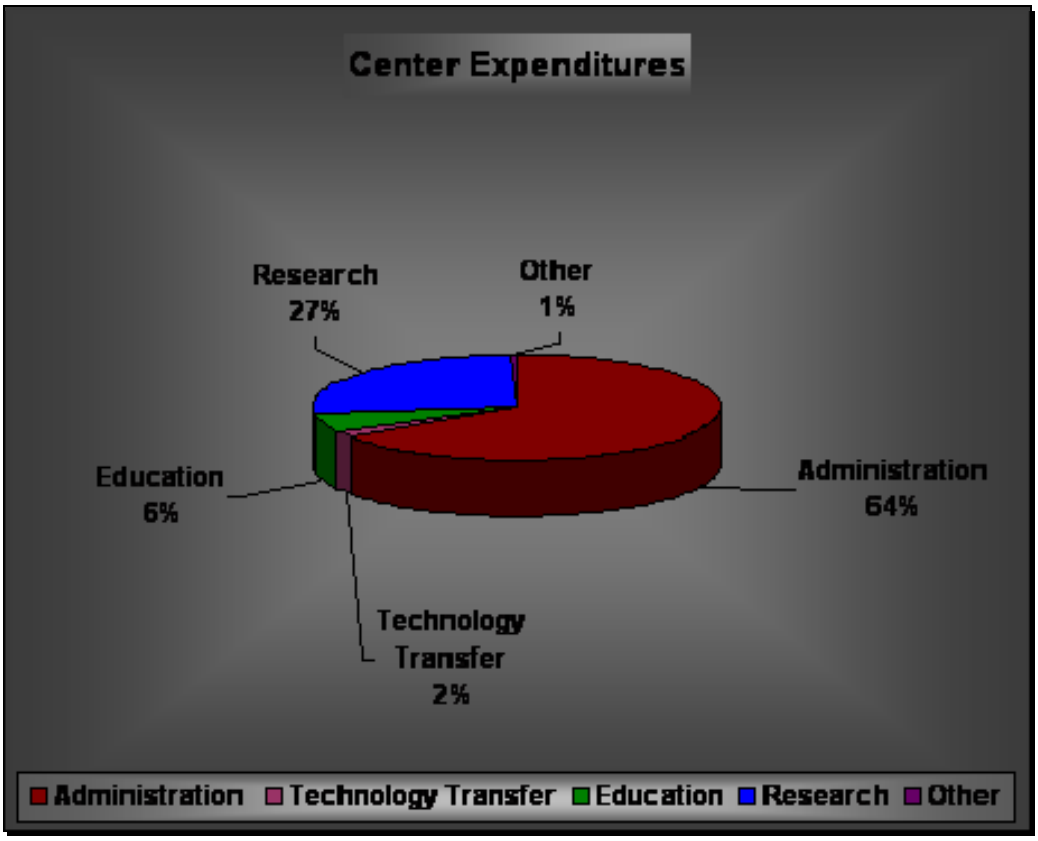
Principal Investigator: James Gordon, James E. Clyburn University Transportation Center, SCSU

Co-Principal Investigator: J. William Clark, Orangeburg County Administration.

Project Abstract: Buckley Street is a busy and sometimes congested main artery through the width and breadth of the South Carolina State University campus. This study will seek funding to change the nature of the right-of-way from a typical urban roadway to a safe and usable travel way for all types of transportation use, including pedestrians. On the day of special events, such as football games, conditions are extremely hazardous. The tasks will include: Survey existing infrastructure to show an as-built condition; Prepare schematic design and cost estimate to enable decision makers to reach informed conclusions; prepare and submit application for funding to SC Department of Transportation. An example of this specific study will be used in other studies to show how design can influence safety and beautification on similar thorough-fares. Students and government leaders will be involved to review the schematic designs and give input for the final design. A final report will discuss the safety issues addressed and also a look at the use and convenience provided by this project. This project will build infrastructure at SCSU and provide a safe and attractive environment that will promote intermodalization.

Part C
FINANCIAL STATUS

James E. Clyburn University Transportation Center Expenditures

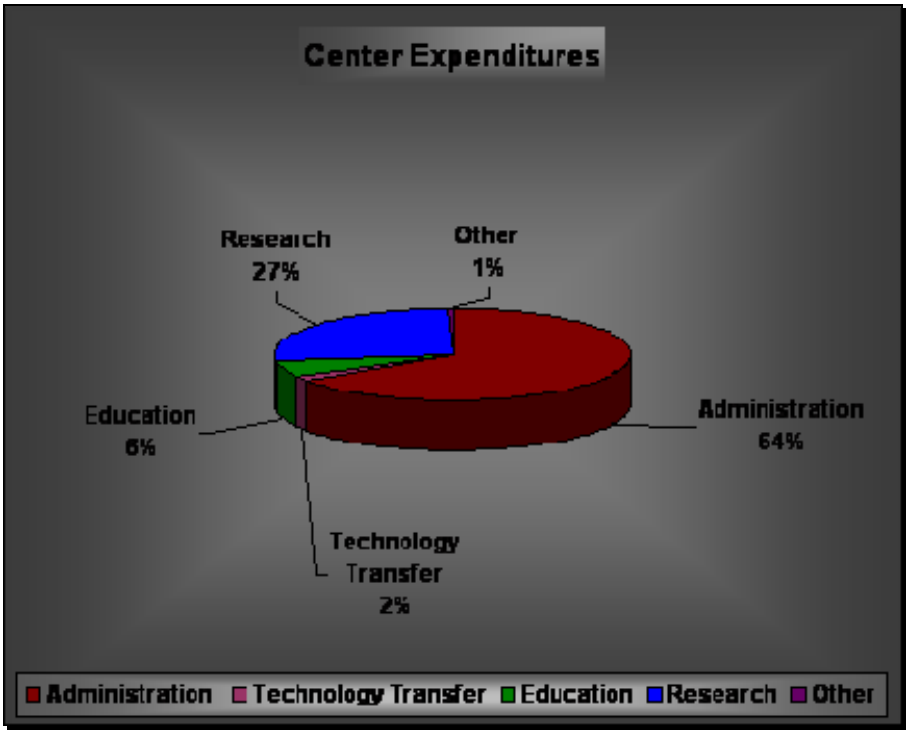


Categories	Committed To Date	Percentage of Total Expenditures
Administrative	$7,457,059.78	65.16%
Technology Transfer	$227,069.92	1.98%
Education	$634,995.00	5.55%
Research	$3,054,068.63	26.69
Other	$71,339.53	.62%
	$11,444,532.86	100.00%

Annual Financial Status Report
South Carolina State University
James E. Clyburn University Transportation Center

Name of Grantee: South Carolina State University ***Grant Years: 07/1/99 Thru 12/31/2007**

	2003-2004		2004-2005		2005-2006	
Categories	**Budget**	**Committed to Date**	**Budget**	**Committed to Date**	**Budget**	**Committed to Date**
Center Director Salary	$85,000.00	$80,746.00	$67,980.96	$88,240.00	$69,377.00	$41,961.80
Faculty/ Researchers	$375,000.00	$475,359.22	$350,384.13	$325,977.00	$387,408.00	$448,494.51
Administrative	$316,810.00	$313,593.00	$317,329.00	$344,067.00	$319,119.00	$374,413.63
Other Staff Salaries	$59,772.00	$46,768.00	$59,772.00	$71,945.71	$62,140.00	$67,661.01
Student Salaries	$72,000.00	$43,809.75	$73,500.00	$114,477.00	$73,500.00	$109,399.75
Staff Benefits	$209,145.00	$99,437.61	$215,173.57	$230,494.11	$215,174.00	$174,056.79
Total Salaries &	**$1,117,727.00**	**$1,059,713.58**	**$1,084,139.66**	**$1,175,200.82**	**$1,126,718.00**	**$1,215,987.49**
Scholarships	$50,000.00	$9,000.00	$125,314.00	$156,361.00	$132,994.00	$49,664.00
Permanent	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Expendable Property & Equipment	$513,766.00	$339,341.91	$465,383.85	$177,939.66	$459,812.00	$106,008.16
Domestic Travel	$31,800.00	$25,355.95	$31,800.00	$53,088.00	$40,000.00	$85,500.49
Foreign Travel	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Contractual	$0.00	$0.00	$0.00	$0.00	$8,600.00	$42,609.99
Other Direct	$5,000.00	$0.00	$5,000.00	$0.00	$5,000.00	$0.00
Total Direct Costs	**$1,718,293.00**	**$1,433,411.44**	**$1,711,637.51**	**$1,562,589.48**	**$1,773,124.00**	**$1,499,770.13**
Facilities & Administrative (Indirect) Costs	$114,307.00	$89,750.00	$100,362.49	$119,079.00	$130,876.00	$223,618.19
Total Costs	**$1,832,600.00**	**$1,523,161.44**	**$1,812,000.00**	**$1,681,668.48**	**$1,904,000.00**	**$1,723,388.32**
Federal Share	$916,300.00	$847,177.75	$906,000.00	$850,568.37	$952,000.00	$890,210.12
Matching Share	$916,300.00	$675,983.69	$906,000.00	$831,100.11	$952,000.00	$833,178.20


Center Expenditures
Research
27%
Other
1%
Education
6%
Administration
64%
Technology
Transfer
2%
Administration
Technology Transfer
Education
Research
Other