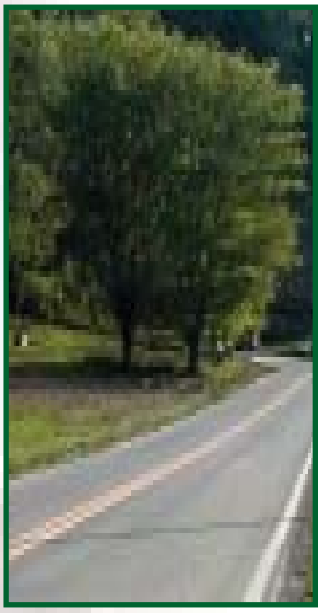
Nick J. Rahall, II

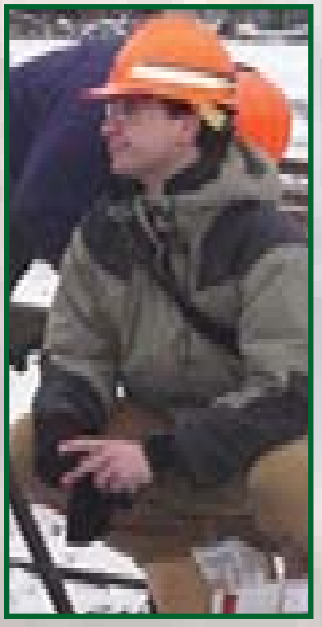
Appalachian Transportation Institute at Marshall University

2001-2002
Annual Report










Transportation and Economic Development in Mountain Regions

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Contents

Credits

Editor:	Richard Begley
Copy Editing:	Pam Hamilton
	Brandon Totten
Layout and Design:	Errin Jewell
Contributors:	Kimberley Baker
Production Assistants:	Wendy Anderson
	Brian Dowler
	Lori Smith
	Brandon Totten
Photographs:	Errin Jewell
	John Ball
	Donna Brown
	Richard Chambers
	Rick Haye
	Brian Dowler

One John Marshall Drive
Huntington, WV
25755-2195-80

Phone: (304) 696-7098
Fax: (304) 696-6661

www.marshall.edu/rti

Center Theme

"Transportation and Economic Development in Mountain Regions"

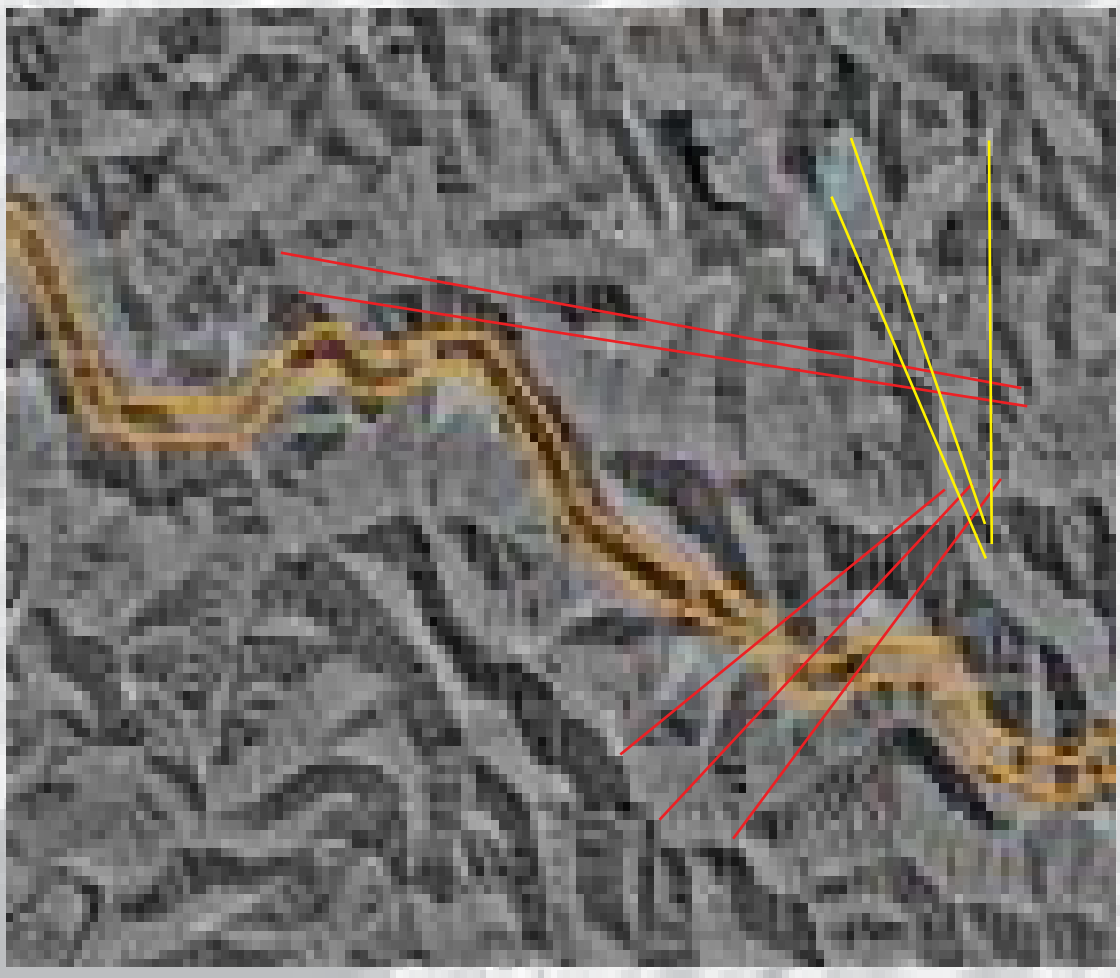
The mountainous terrain and dispersed population of Southern West Virginia and other parts of Appalachia have presented and continue to present unique challenges to planning, construction, and maintenance of safe, cost-effective transportation infrastructure.

In addition, the implementation of post-mining land use, which can create flat land suitable for economic development in the region, has been hindered by transportation systems inadequate for commercial and industrial purposes.

RTI has been empowered through its designation as a University Transportation Center to:

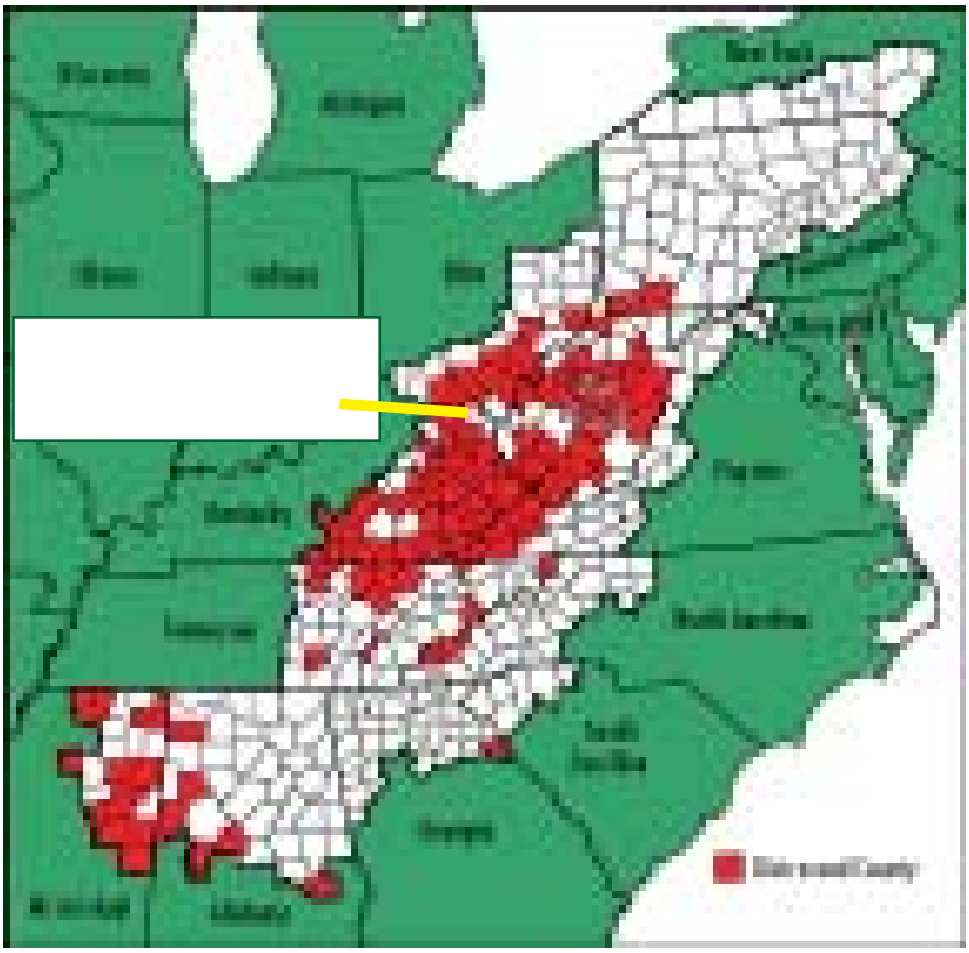
- Focus a comprehensive, broadly based, multi-disciplinary research, education and technology transfer program, on this region's transportation and transportation related economic development challenges.

- The programmatic activities will include but will not be limited to



Left: Orange lines indicate the proposed route of the I-73 High Priority Corridor through portions of Southern West Virginia superimposed over high resolution aerial imagery. Red lines indicate rural communities and yellow lines indicate mining activity.

Center Theme



Right: The yellow dot represents RTI headquarters in Huntington, W.Va. White-shaded areas indicate state and county boundaries that comprise the Appalachian region. Red-shaded counties are economically distressed according to national standards (more than 150% of the national unemployment rate).

identifying and deploying the "best available technologies and practices" in case studies that address the socio-economical, environmental and geo-technical uniqueness of the region.

The program results will help ensure that maximum economic benefits can be realized from past and future transportation investments in Southern West Virginia and other parts of Appalachia. Findings will be applicable to other mountainous and rural areas in the United States.

The Appalachian Regional Commission reports:

- 42% of the Appalachian Region's population is rural, compared to 20% of the national population.
- The modern economy of the Region is gradually diversifying, with a heavier emphasis on services and widespread development of tourism, especially in more remote areas where there is no other viable industry.
- Coal remains an important resource, but it is not a major provider of jobs. Manufacturing is still an economic mainstay but is no longer concentrated in a few major industries.

RTI Enables Marshall University to Receive Designation as a National Maritime Enhancement Institute

Marshall University was recently designated as a National Maritime Enhancement Institute (NMEI) as part of the UTC program at RTI. The Maritime Administration was authorized under Public Law 101-115 to designate National Maritime Enhancement Institute (Institutes) at US universities or university consortia with capabilities for "providing leadership in the solution of national problems."

Marshall University received the designation at the same time as the US Merchant Marine Academy increasing the number of NMEI from five to seven. The following NMEI were previously designated over the life of the program that started in 1990.

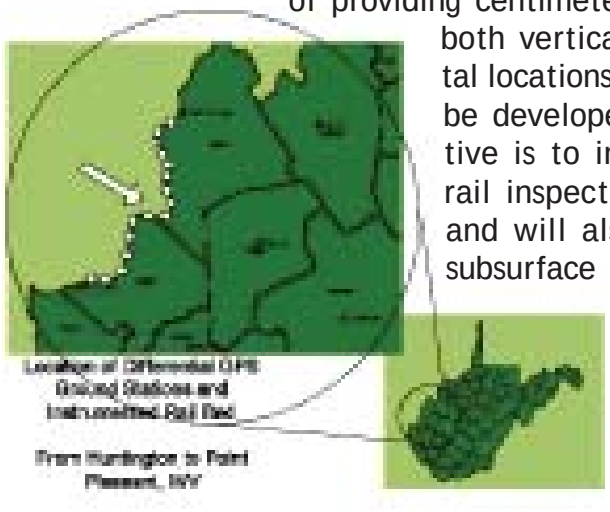
- University of California at Berkley as part of the Region IX USDOT University Transportation Center
- Louisiana State University in conjunction with George Washington University
- Massachusetts Institute of Technology as part of the Region 1 USDOT University Transportation Center
- Memphis State University as part of a consortium with University of Tennessee and University of Kentucky
- Texas Transportation Institute as part of a consortium which includes Lamar University and several specialized research centers and institutes at Texas A&M University and the University of Texas

The application submitted by RTI was required to show proof of specialized unique program areas complimentary to the maritime industry in addition to established programs, reputation and national relationships with industry. RTI received approval as a Consortium for Navigation Support and Analysis using the same expertise that evolved through the RTI research, education and training program on surface transportation. The broad based multi-disciplinary approach with focus areas on socio-economical, environmental/ geotechnical, and transportation technologies proved immediately useful to the local maritime industry which supported each of the areas on individual projects. The NMEI designation gives a national recognition to the University's proven capabilities to support multi-modal transportation challenges through research education and technology endeavors that would not have been possible without the support and the level of support provided through the UTC program.

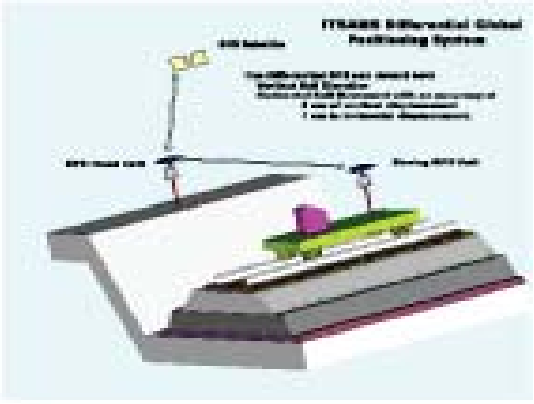
Federal Railroad Administration Provides $1,100,000 for RTI and University of Nebraska Lincoln Rail Safety Research Program

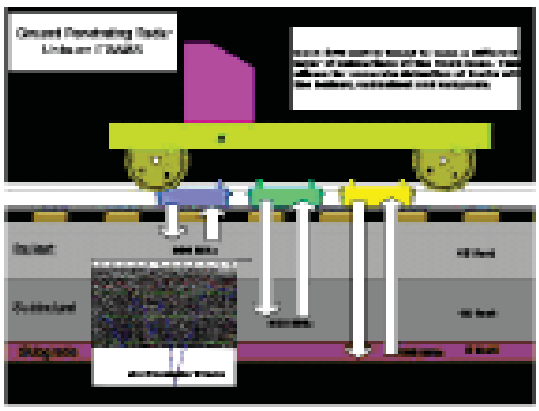
The FY2002 budget for the Federal Railroad Administration included $1,100,000 to expand the current research partnership between RTI and the College of Engineering and Technology at the University of Nebraska- Lincoln.

The funding will continue the advancement of track inspection technologies through the use of remote sensing technologies, but was also expanded to human factors in rail safety operations. All of the human factors research is being performed at UN-L and most of the track inspection research is being performed by RTI. This partnership has been well supported by the railroad industry through equipment utilization and access to active rail lines for experimentation.



These funds will allow one of the first short rail line Differential Geographical Position Systems (DGPS) with fixed GPS base stations capable of providing centimeter accuracy for both vertical and horizontal locations of the track to be developed. The objective is to improve mobile rail inspection technology and will also incorporate subsurface remote sensing technologies. The instrumentation being deployed in the experiments will also facilitate collecting baseline data about the rail line in WV that will initiate the utilization of Geographical Information Systems for the railroad industry.





New Research Associate Joins RTI Staff

David Cartwright joined RTI summer 2002 as a Research Associate in Engineering.

He was previously a full-time assistant professor in the Marshall University College of Science where he taught integrated science and technology with a manufacturing emphasis and pre-engineering courses.

He earned his master's degree in mechanical engineering from the University of Dayton. He has also met all of the course requirements for a Ph.D. from Ohio State University.

Cartwright is working on several projects at RTI that involve modeling and computer simulation in addition to supporting pre-K-12 activities and serving as RTI's webmaster. David previously worked with RTI as a project manager for the "Design a Future Vehicle" K-12 outreach activities.

Transportation Research Board to Sponsor First National Conference on Transportation and Economic Development

RTI joined with the Transportation and Research Board, Committee on Transportation and Economic Development, A1A06 to sponsor the first conference on transportation and economic development in Portland, Oregon May 5-7 2002.

Other sponsors included the American Association of State Highway and Transportation Officials (AASHTO), Appalachian Regional Commission, and the Federal Highway Administration.

The purpose of this conference was to provide transportation, economic development, and planning professionals with a broader understanding of the most timely and important issues in the linkage between transportation and economic development.

Several RTI researchers presented papers and RTI produced the proceedings, which included more than fifty papers representing a "state of the art" resource. This will be distributed nationally in cooperation with the Transportation Research Board.

RTI Partners with the

RTI Establishes Three New Partnerships

Agreements, Signed with Tennessee Valley Authority (TVA), Appalachian Regional Commission (ARC) and US Department of Energy (USDOE)

Agreements were recently signed with TVA, ARC and USDOE to pursue cooperative transportation research and technology transfer endeavors of mutual benefits. These agreements: open opportunities for additional project support: increase the regional visibility of the RTI; and are indicative of the increasing recognition of the RTI as a resource for transportation and transportation related economic development issues.

Tennessee Valley Authority (TVA)

RTI and the TVA have agreed to work cooperatively on projects in the Tennessee River basin related to:

· The exploration of intermodal transportation opportunities that include a waterborne route segment;

· Research designed to assess and mitigate flood risks – particularly as these risks apply to transportation infrastructures; and

· The general integration of Geographic Information Systems (GIS) into transportation assessment and planning processes.

Appalachian Regional Commission (ARC)

The RTI and ARC have agreed to work cooperatively on projects in the 13 state Appalachian Region related to:

· Jointly identifying and conducting research on transportation issues and the impact of transportation on the economic development of the Appalachian region.

· Jointly developing and implementing data systems that provide baseline data on the Appalachian Development Highway System.

· Jointly developing geographic information systems (GIS) that visually portray the complex engineering, environmental, and economic development issues of the region.

· Jointly sponsoring and developing conferences, workshops, and forums that educate and inform the public regarding the critical linkages between transportation and economic development.

US Department of Energy (USDOE)

RTI and USDOE have agreed to lead the dialogue, debates and planning for the industrial park of the future

Success Stories

through a Cooperative Research and Development Agreement (CRADA) that included a WV industrial partner.

The anchor tenant of the 21rst Century Industrial Park is proposed to be a small scale electricity co-generation plant with neighbor tenants that utilize the waste heat from the electricity plant for space and process heat.

The electricity generation technology is proposed to take advantage of recently proven combustion technology that can utilize waste material for part of its fuel requirements. Therefore as proposed, one of the tenant's waste material could be a source of fuel for the electricity generation plant.

Designed from the bottom up, a totally integrated park could produce significant energy savings and greatly reduce the environmental impact of the 21rst century industrial park. RTI is coordinating the many transportation and economic development elements necessary to launch such an ambitious project.

Education

of 37 semester hours.

TM 600	Program Introduction
TM 610	Technology and Inno-
TM 612	Economic and Financial
TM 615	Information Technology
TM 620	Technology Planning*
TM 630	Quality and Prod- uctivity Methods*
TM 650	Human Resources in Technology Man-
age-	ment*
EM 660	Project Management*

4 Area of Emphasis Courses selected from the following options:

SED 550	Traffic Engineering
SED 601	Safety in Transportation
SED 660	Human Factors in Acc- ident Prevention

gies integrates course work and experiential learning to prepare students to support transportation systems in Appalachia and the United States.

Assistantships

RTI awards a limited number of Graduate Research Assistantships (GRA) to full-time students pursuing the M. S. in Technology Management degree program and area of emphasis in Transportation. The GRA provides a tuition waiver and a stipend to fully-admitted students who meet eligibility criteria. Graduate students have a unique opportunity to earn and learn of the best practices in the transportation arena.

Courses

Degree requirements consist of 8 core courses (22 hours), 4 area-of-emphasis courses (12 hours), and 1 capstone project (3 hours) for a total

Seminar*
vation Management*
Analysis*
Strategies*

- Master of Science in Technology Management with Emphasis in Transportation Systems and Technologies

- Master of Business Administration with and Emphasis in Transportation and Logistics (Accelerated

Education

Education Goal:

A multi-disciplinary program of course work and experiential learning that reinforces the transportation theme of the Center in addition to an increased number of students, faculty, and staff who are attracted to and substantially involved in the undergraduate, graduate and professional programs of the Center.

RTI CO-SPONSORED GRADUATE TRANSPORTATION PROGRAMS

Partnerships between RTI and Marshall University Graduate College (MUGC), MU College of Information Technology and Engineering (CITE) and the MU Lewis College of Business (LCOB), allow students to pursue two new transportation programs, a Master of Science in Technology Management with Emphasis in Transportation Systems and Technologies or a Master of Business Administration with an Emphasis in Transportation and Logistics (Accelerated Executive Program):

M.S. in Technology Management with Emphasis in Transportation Systems and Technologies

Technology Management combines concepts and methods from management, business, science and engineering, with a specific technology emphasis to address organizational needs. The M.S. in Technology Management with an emphasis in Transportation Systems and Technolo-

Education

SED 669 Traffic Safety Management GEO 510 Urban Geography
GEO 515 Regional Planning and Development
IE 639 Operations Research I IE 640 Operations Research II
IS 645 Geographic Information Systems
TM 640 Intelligent Transportation Systems*
TM 699 Capstone Project*_ (Required*)

Education

Master of Business Administration with an Emphasis in Transportation and Logistics (Accelerated Executive Program)

Foundations Courses:

MKT 511	Marketing & Management
MGT 500	Statistics/Calculus
ECN 501	Economic Analysis
ACC 510	Financial Accounting
FIN 510	Finance

MBA Courses:

ECN 650* Transportation Economics [Replaces: Managerial Economics-ECN 630] Profit Planning and Controls-ACC 613

MKT 650 Transportation Law and Public Policy [Replaces: LE 691 Government and Business Relationships]

MGT 601 Quantitative Controls in Business MIS 687 Management Information Systems

MGT 672 Theories of Management

MGT 674 Production/Operations Management

MKT 651* Carrier Management [Replaces: MKT 682 Advanced Marketing Management]

FIN 620 Financial Management

MGT 699 Business Policy (Capstone with Transportation Emphasis)*

International Experience:
10-14 Day Study Tour of European Rail and Distribution

*** New Transportation Courses Under Development**

A variety of course sequences and alternatives are available. All course sequences can be completed in two years, except for Alternative 5, which can be completed in 1 year, 9 months. Other alternatives can be pursued as needed. Additional transportation graduate and undergraduate programs are under development.

EXECUTIVE MBA PROGRAM DELIVERY ALTERNATIVES

One Course at a Time Sequences

Alternative 1:
Standard 5 Weeks Schedule
8 hr. Saturday Class
8 hr. Saturday Class
8 hr. Saturday Class
8 hr. Saturday Class
8 hr. Saturday Class
Weekend Off
Repeat

Alternative 2:
Standard 5 Weeks Schedule with Internet
8 hr. Saturday Class
2 Weeks Internet (No Saturday Class)
8 hr. Saturday Class
2 Weeks Internet (No Saturday Class)
8 hr. Saturday Class
Weekend Off
Repeat

11

RTI RESEARCH/EDUCATION FACULTY AND PROFESSIONAL ASSOCIATES

Marshall University College of Business

Dr. Mark Burton Professor of Economics
Dr. Michael Hicks Associate Professor in Economics
Dr. Marc Simpson Associate Professor in Economics

Marshall University College of Information Technology and Engineering

Dr. Richard Begley Professor in Engineering
Dr. Anthony Szwilski Professor in Engineering
Betsy Dulin, J.D. Professor and Associate Dean
Dr. Bill Pierson Professor in Engineering
Dr. Herb Tesser Professor in Computer Science
Dr. Michael Robinson Assistant Professor in Engineering

Marshall University College of Science

Dr. Dan Evans
Professor in Biology
Dr. Frank Gilliam
Professor in Biology
Dr. James Joy
Professor in Biology
Dr. Michael Norton
Professor in Chemistry
Dr. Dewey Sanderson
Professor in Geology
Dr. James Brumfield Associate Profeesor in Geology
Mr. David Cartwright
Associate Professor in Integrated Science and Technology
Ms. Linda Hamilton
Assistant Professor in Mathematics
Dr. Liz Murray
Assistant Professor Integrated Science and Technology
Dr. Ashok Vaseashta
Assistant Professor in Physics

Other Marshall University Entities

enrolled in the PLS curriculum. Students enrolled in other majors may pursue a minor in Off-Highway Vehicle Recreation or take individual OHV courses as electives.

Alternative 3:
Condensed 4 Weeks Schedule
4 hr. Friday- 8 hr. Saturday
8 hr. Saturday
8 hr. Saturday
4 hr. Friday-8 hr. Saturday
2 Weekends Off
Repeat

Alternative 4:
Condensed 4 Weeks Schedule with Internet
4 hr. Friday- 8 hr. Saturday
1.5 Weeks Internet (No Saturday Class)
1.5 Weeks Internet (No Saturday Class)
4 hr. Friday-8 hr. Saturday
2 Weekends Off
Repeat

3 Courses at a Time Sequence

Alternative 5:
Tri-mester (Finish in 1 Year, 9 months)
3 Semesters during the Year (Fall, Spring, Summer)
Take 3 Classes Each Tri-mester
Each Class Meets 3 Times in Person
Additional courses are taught via the Internet

Graduate or Undergraduate Minor in Off-Highway Vehicle Recreation:

PLS 540/440 Introduction to Off-Highway Vehicle Recreation

PLS 541/441 Planning Off-Highway Vehicle Recreation

PLS 542/442 Managing for Quality OHV Recreation

These courses may may fulfill the specialization requirement for students

Education

Reed, LeAndria
Robohm, Eric
Schlenker, Brooke
Skeide, Eline Marie
Tourre, Mark
Simpkins, Trina
Vance, Amber
Vaughn, Kristy
Ward, Damon
Williamson, David
Workman, Jason

Major

Elementary Education
Physical Science
Environmental Science

Business Administration
Physical Science
Geography
Chemistry
Geography
Physical Science
Technology Management
Business Administration
Physical Science
Forensic Science
Education
Geography
Ph.D. Biomedical Sciences
Adult and Technical Education
Forensic Science
Physical Science
Biological Sciences
Journalism
Forensics
Counseling
Information Systems
Information Systems
Physical Science
Mathematics
Adult and Technical Education
Forensic Science
Business Administration
Safety Technology
Forensics
Physical Science
Business Administration
Technology Management
Forensic Science
Health Care Administration
Adult & Technical Education

Woody, Joshua
Safety Technology
Yoo, Sanghong
Physical Science
Zhang, Fan
Information Systems

RTI Undergraduate Assistants 2001-2002

Name
Major

Anderson, Wendy
Journalism and Mass Communications
Cains, Brad
Integrated Science and Technology
Cook, Timothy
Geology
Danzer, Joseph
Integrated Science and Technology
Day, Kelley
Nursing
Dudding, Greg
Integrated Science and Technology
Gonsowski, Courtney
Environmental Science
Husted, Ursula
Art
Keenan, Benjamin
Undecided
Kennedy, Brooke
Biology
Mwaura, Ab

RTI Graduate Assistants 2001-2002

Name

Artemyev, Roman
Bailey, Josette
Barrios, Juan de Dios
Boggess, Farrah
Boggess, Megan
Bowe, Nathan
Barrios, Juan de Dios
Bueno, Juan
Channell, Katherine
Chapman, Cristy
Crawford, Kellie
Durrah, Steven
Dykes, Ava Caudill
Estel, Herbert
Feazell, Erin
Ferguson, John
Hanna, Afif
Jewell, Errin
Knubel, Adam
Lewis, Kim
Lewis, Mark
Li, Tianning
Litteral, Theresa
Mills, Randall
Murphy, Kelli
Naugle, Bart
Pascual, Fernando

STUDENT OF THE YEAR

Left: Litteral receives RTI's 2001 Student of the Year Award.

Sean Keith Litteral was born Jan. 28, 1972, in Ashland, Kentucky. Mr. Litteral earned a Bachelor of Science Degree in Geology (1998) and continued his education at Marshall University earning a the Master of Science Degree in Physical Science.

He began working with RTI as a graduate assistant on a project titled: "Endangered Species Identification along Roads, Planned in West Virginia Using Geographic Information Systems and Remote Sensing."

Working with a multi-disciplinary team of Principal Investigators from Biology, Physical Sciences, Geology, Geography and Engineering, Litteral developed an online, integrated image based Geographic Information System (GIS) for Transportation Systems and the Environment.

The system includes satellite imagery for the entire state of West Virginia and higher resolution aerial imagery in certain areas of concern in the state and integrates the imagery with other data such as physical infrastructure and surface coal mining activity. Users can assess this online Geographical Information System (GIS), which is among the first to contain data queries, with little or no GIS experience. The system is under consideration for further development and expansion to provide needed information for all agencies working in transportation and economic development.

Litteral was recently hired as full-time Research Associate with RTI to assist Principal Investigators, provide GIS project assistance and help in the development of GIS-related education and training programs.

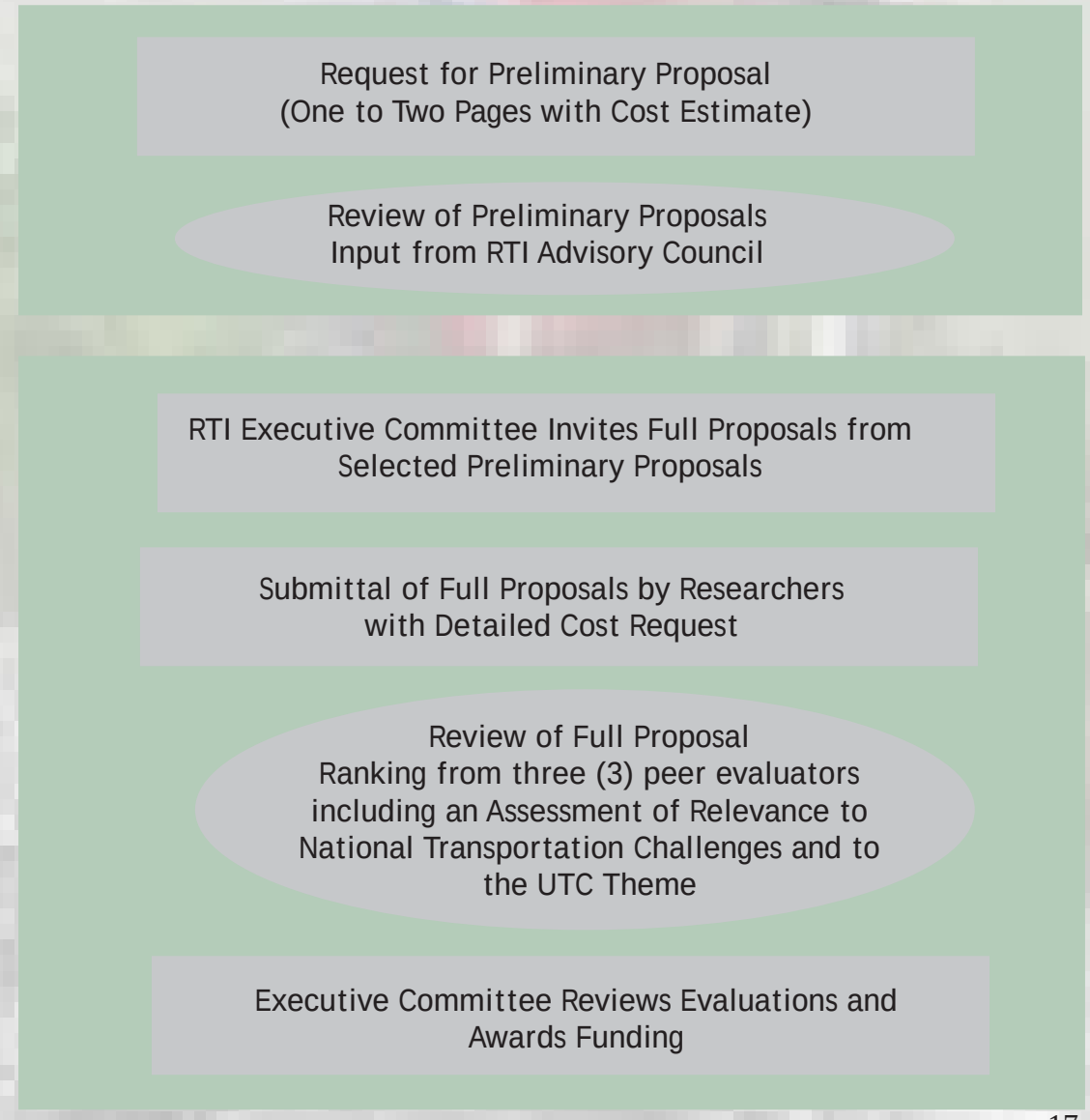
Research

The UTC Research Goals Include:

1) an objective process for selecting and reviewing basic and applied research; and

2) a process for judging by peers or other experts in the field to advance the body of knowledge in transporta-

RTI Research Solicitation and Selection Process Flowchart



con- tinued growth of the emerging tourism industry;

Right: Members of an RTI Project Advisory Team (from left): Barbara Roberts-RTI, Alex McLaughlin-WV Development Office; Scott Hercik-Appalachian Regional Commission (ARC); Norman Roush-WVDOT, Dr. Mark Burton-RTI Principal Investigator, Rob Watson-WVDOT, Ed Terry-ARC, Mark Felton- Business and Industrial Development Corporation, Rebecca Davison-WVDOT, Jon Ventura-FHWA and Vincent Post-Mid-Ohio Valley Planning Commission.

- the development and testing of new technologies and or products that can improve transportation safety and efficiency in rural settings and support the diversification of the regional economy simultaneously;

- assistance in the preparation of the future transportation workforce in the region.

RTI seeks to leverage its federal funding through a variety of sources, and in certain cases a traditional cyclical solicitation process may not be able to incorporate all of the opportunities to assist in doubling the value and acceleration of the institutionalization of the UTC.

Examples may include, but may not be limited to: the opportunity to respond to requests for proposals from non-federal entities; availability of non-federal funding to resolve local climatic emergencies and or issues related to safety of the motoring public; certain private sector and or non-governmental agency partnership opportunities and projects of the transportation technology demonstration and/or transfer nature in addition to projects that may have a positive impact on the transportation workforce.

However, consistency with the RTI theme, staff expertise, research goals and general goals of the UTC program are always considered. Projects that materialize from this approach will include a project advisory team from project conception to completion. Representatives

RTI RESEARCH PROGRAM GOALS

RTI research goals, in addition to objective selection with peer review and monitoring, include performing site specific research projects that can contribute to:

- a reduced design, construction and maintenance costs with improved safety and minimal environmental impacts for the transportation system in the region;
- the identification of the best locations for future industrial parks and initiation of their development;
- ensuring opportunities for concurrent infrastructure and info-structure development during road construction are realized;
- improving access to health care, work and education for rural communities through public transit;
- an enhanced trail/scenic byway system that will support

Research

Commodity Flows and Transportation Inventory for 13 Counties in Southern West Virginia
This project gathered information that describes commodity flows and cost of transportation services and identified inter-modal infrastructure improvements that may reduce transportation costs for a 13-county region in Southern W.Va.

RTI TRP 99-01
Automated Road Extraction and Update System
This project will aid in the development of an automated road extraction and update system (AREUS), which can recognize and extract roads, bridges, railroads and similar transportation-related structures from satellite imagery.

RTI TRP 99-02
Preserving Branch-Line Railroad Capacity in Southern W. Va.
This project identified branch rail lines most likely to be abandoned in response to diminished coal production in Southern W.Va. and evaluated available alternatives to maintaining the branch line capacity in that region.

RTI TRP 99-03
Lincoln County Transportation Project
This project will assess, develop and evaluate an efficient inter-modal transportation system for access to health care using currently available public vehicles for rural and economically-depressed areas in Lincoln County, W.Va.

RTI TRP 99-04
An Assessment of Site-Specific Geotechnical, Spatial and Climatic Parameters that Influence the Integrity and Stability of Railroad Track
This project will aid in the development of an improved integrated system for monitoring the stability of railroad tracks using remote sensing instrumentation including ground-penetrating radar and laser interferometry.

RTI TRP 99-05
Use of Electroluminescent Technology for Highway Signage
Objectives for this project are to develop a suitable prototype for highway signs based upon electroluminescent technology and to assess the economic development potential from the successful integration of this technology into the national transportation system.

Research

RTI RESEARCH PROGRAM OVERVIEW

FOCUS AREAS

TYPES OF PROJECTS RECENTLY COMPLETED, ONGOING OR UNDER DEVELOPMENT

Socio-Economical/Political
Commodity Flows and Transportation Infrastructure Assessments
Transportation Planning, Financing and Public Policies
Rural, Intermodal/Public Transportation Issues
Land Use Planning
Tourism and Recreational Travel
Rural Transportation Safety

Geotechnical/Environmental
Wetland Mitigation
Endangered Species Assessments
Rock Cut/Slope Stability
Inventories and Health Risk Assessments from Abandoned Tires
Tunnel Expansions
Rail Track and Road Bed Stability

Technology/ Transportation
Geographical Information Systems/**Product Development/Testing**
Mapping Technologies
Automatic Vehicle Tracking in Rural Settings
Integration of Remote Sensing Technologies
Optimizing Recoverable Materials in Transportation Components
Intelligent Highway Signage with Improved Visibility and Energy Savings

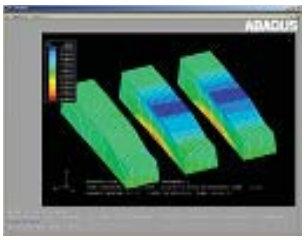
Transportation Research Initiation
Small start-up grants within the areas above.

RTI Research Project Summaries

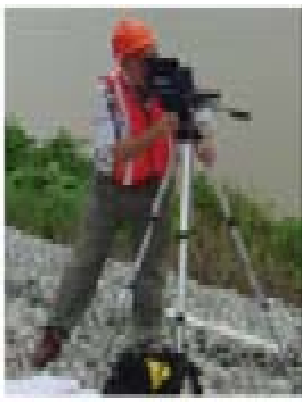
RTI TRP 99-00

wetland mitigation site in Wayne County, W.Va.

RTI TRP 99-10
Endangered Species Identification Along Roads Planned for W.Va. Using GIS
This project will establish the infrastructure for a web-delivered, interactive mapping system developed from satellite imagery and integrated with Geographical Information Systems (GIS) that will locate endemic, threatened or endangered species affected by transportation systems in W.Va.



RTI TRP 99-11
Maximizing Economic Benefits from a Rails to Trails Project in Southern W.Va.: Case Study of the Greenbrier River Trail
This project collected data from trail users surveys and public meetings to determine the economic feasibility of creating a "Rails to Trails" project in Greenbrier County, W.Va. Results from this project may be used to identify and expand the local economic impact of recreation trail systems in other W.Va. locations and to mobilize community support in the marketing and promotion of such trail systems.

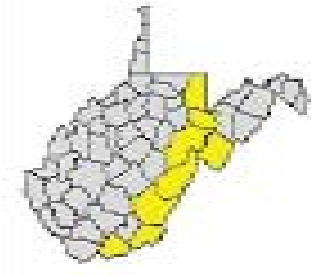


RTI TRP 99-13
Commodity Flows in Northern W.Va.
This project will gather information describing commodity flows and the cost of transportation services and identify inter-modal infrastructure improvements that could reduce transportation costs for a 19-county region in Northwestern West Virginia.

RTI TRP 99-14
Drowsy/Fatigued Driving: Prevelance and Under-Reporting in W.Va.
This project will first compare accident data related to drowsy driving in W. Va. to data from the remainder of the United States and then suggest preventive strategies including targeted outreach activities to reduce drowsy-driving accidents.

Research

RTI TRP 99-06
Potential Uses of Fly Ash and Other Recoverable Materials in New Transportation Infrastructure Components
This project will develop and assess candidate prototypical applications for developing transportation and infrastructure components using recoverable materials. Initial emphasis will be placed on creating concrete railroad ties using coal combustion by-products (CCPS) including fly ash; however, using the materials to make other concrete-like transportation components will also be addressed. In addition, preliminary stability analysis of the prototype will be performed with computer modeling software.



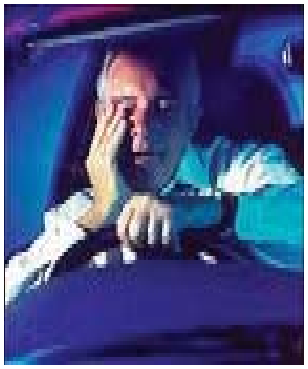
RTI TRP 99-07
Rock Fall Rating, Evaluation and Data Management Systems for Highway and Railway Rock Slopes
Using technologies such as laser scanning, electromagnetic induction, GPS and GIS systems, this project developed methodologies for evaluating the safety of rock cuts and slopes.

RTI TRP 99-08
Abandoned Tire Health Risk Survey/Analysis
Researchers for this project will locate, identify and inventory abandoned tire sites in Nicholas County, W. Va., and assess the health risks to the citizens from mosquitoes that breed at these abandoned tire dumps. Findings from the project will provide the WVDOT with additional information on the locations and characterizations of abandoned tire pile accumulations.

RTI TRP 99-09
Establishment of Pre-Construction Baseline Data as a Control for Evalution of the Long- Term Success of a Mitigated Constructed Wetland Site (Case Study along the Tolsia Highway)
The objective of this proposal is to establish pre-construction baseline data for the US 52 (Tolsia Highway)

Research

RTI TRP 99-15
Impacts of the Appalachian Corridor on Small Business Development
This project will develop statistical methodology capable of estimating the relationship between micro-business development and access to highway transportation in Appalachia.

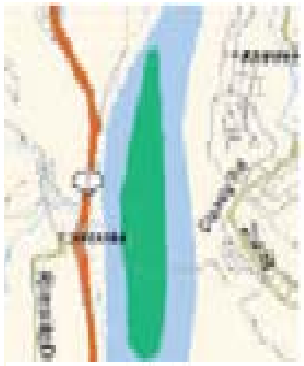


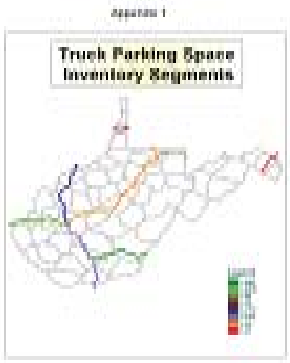
RTI TRP 99-16
McDowell County Transportation Project
This project will assess, develop and evaluate an efficient inter-modal transportation system for access to health care using currently available public vehicles for rural and economically depressed McDowell County in Southern West Virginia.

RTI TRP 99-17
Magnetic Levitation Transportation and Economic Development Opportunities for W.Va.
This project will review the various applications of magnetic levitation around the United States and assess its applicability as a potential mode of transportation in W. Va.

RTI TRP 99-18
ITS Research Initiation Project
This project will review a variety of Intelligent Traffic Monitoring Systems and suggest the most applicable project to propose a demonstration project in Huntington,W.Va. Findings may provide a better and interactive navigation mechanism to facilitate the increasing traffic flow in W. Va. and other areas.

Research





RTI TRP 99-19
Public/Private Port Case Studies
The proposed research is aimed at assessing the economic efficiency of public port development with the hope of clarifying the roles that might be best played by public and private sector entities.

RTI TRP 99-23
Survey of Truck Parking Places (Private) in W.Va.
This project sought to conduct a survey of available public and private parking spaces and the amenities available at each site in W.Va. It also reviewed the designs of current rest areas to determine possible upgrades that would increase parking and amenities and reviewed the design of the DOH weigh stations for innovations to allow for better use of the surrounding acreage and improvements to the overall facilities.

RTI TRP 99-24
Railroad Tunnel Size Restrictions
This project will identify the costs and benefits of modifying railroad trackage to accommodate double-stack equipment by increasing the size of railroad tunnels in W.Va.

RTI TRP 99-25
Bolt Installations at Railroad Crossings
This project will identify, develop and test procedures for reduciing maintenance costs and reducing safety risks at railroad crossings as a function of the bolt and nut connections currently employed.

RTI TRP 99-26
Beckley Exhibition Mine Expansion: Project Management and Evaluation for a Transportation Enhancement Project to Be Built along a National Scenic Byway in W.Va.
The objective of this project is to provide project management assistance for a Southern West Virginia community to ensure environmental quality and logistical feasibility for a transportation enhancement project along the Coal Heritage Trail. The project will also propose a model to other transportation enhancement projects that will be constructed along this National Scenic Byway related to matching funds determinations

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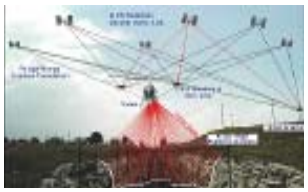
and project selection processes.



RTI TRP 99-27
Using FLI-MAP Technology for Transportation Applications: Research Initiation Demonstration Project
This project will review the uses of FLI-MAP software by various states' Departments of Transportation and identify steps for the West Virginia Department of Transportation to consider how to implement this technology in work completed by the West Virginia Division of Highways.

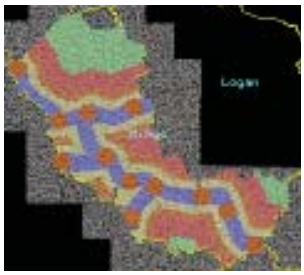
RTI TRP 99-29
Development of a Plan for a Non-Motorized Transportation Corridor in Southern W.Va.: Case Study for Alternate Sources of Transportation between Huntington and Charleston
The objective of this project is to explore the possibility of developing a "greenway," or non-motorized transportation corridor, between Charleston and Huntington W.Va. The proposed greenway will contain natural, open space, bikeways and walking or jogging paths.

RTI TRP 99-32
Development of a GIS Implementation Strategy for WVDOT
This project will review the uses of Geographical Information Systems (GIS) software by various states' Departments of Transportation and identify steps for the WVDOT to consider for GIS implementation

RTI TRP 99-33
Major Corridor Financing Options
This project will identify options used around the United States to finance major corridor construction and assess the applicability for consideration and implementation in West Virginia. This study will help provide the most cost effective plan to help acquire critically needed improve-

RTI TRP 00-01
Integrated Track Stability Assessment and Monitoring System (ITSAMS): Phase II
The first objective of this project is to continue the development of a remote sensing technology that will rapidly assess the integrity of various track structure and substructure layers, such as the ballast, the sub ballast and the subgrade, and to locate, identify and quantify weak track segments. The project's second objective is

to continue the development of a new technology for the real-time measurement of vertical track deflection, based on the use of the laser interferometer.



RTI TRP 00-02
Master Land Use Plans for Six Southern WV Counties
The objective of this project is to assist in the development of long-term land use policies with utilization criteria based upon proximity to the current and proposed transportation systems in the region.

RTI TRP 00-05
Integrated Track Stability Assessment and Monitorin System (ITSAMS): Phase III
The overall objective of this project is to continue the development of remote sensing technolgies that can be integrated and deployed in a mobile inspection vehicle i.e. Integrated Track stability Assessment and Monitoring System (ITSAMS).

RTI TRP 00-10
Improving Transportation Access to Rural Health Care in Lincoln County: Process Implementation
This project's objective is to directly implement the results of a previous RTI research project that designed solutions to improving access to health care for the elderly, disabled, chronically ill and poor citizens of a rural WV county through a coordinated effort between health care providers and the public transportation system.

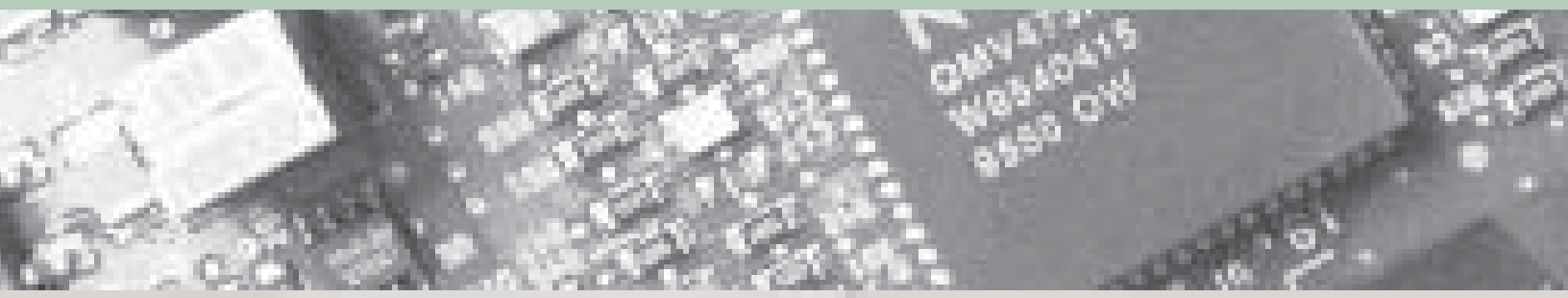
RTI TRP 00-11
Development of Transportation and Economic Development Information System (TEDIS) Delivered over the Internet for WV
The objective is to design, develop, and test a system for delivering important transportation and economic development information using GIS technology over the Internet for a variety of users including governmental agencies and the general public.

RTI TRP 00-12
A Deployment Plan for the WV High Technology Corridor
This project's objective is to support the direct implementation of expanding the "High Tech Corridor" designation for the Southeastern Virginia portion of I-64 into the state of West Virginia between Beckley and White Sulfur Springs.

Technology Transfer

5th Congress on Transportation Engineering (CIT 2002), June 11-13, 2002, Santander, Spain.

Robert B. Walker, M.D., *Transportation-related Barriers to Medi-*



ments in the transportation infrastructure of some of the most rural and economically depressed regions in W.Va. with applicability to similar regions in the United States.

Technology Transfer Goal:

Availability of research results to potential users in a form that can be directly implemented, utilized or otherwise applied.

In addition to research papers, technical reports and conference proceedings, RTI maintains a website to promote programmatic activities and to archive and disseminate research results.

RTI also sponsors workshops and seminars to promote the transfer of transportation technology and information from experts in the field to practicing transportation professionals, UTC researchers, graduate assistants and K-12 students.

PEER REVIEW PAPERS AND TECHNICAL REPORTS AS A RESULT OF UTC FUNDING

Papers Presented

Fernando Pascual, Emilio Larrodé Pellicer, Luis Castejón Herrer, Richard Begley and Tony Szwilski, *A Numerical Model for Analyzing a Concrete Crosstie's Resilient Pad Under Heavy Haul Traffic Conditions.* 5th Congress on Transportation Engineering (CIT 2002), June 11-13, 2002, Santander, Spain.

Francisco Lezaun De Ubago and Fernando Pascual, *A Dynamic Model for Studying Comfort on Locomotives Mounting Nose-Suspended Motors.*

cal Care: A Grant Supported Study of a Rural West Virginia County, Transportation and Economic Development 2002 (TED2002), May 5-7, 2002, Portland, Oregon, Transportation Research Board.

Mark L. Burton, Ph.D., *Measuring the Cost Of Incremental Railroad Capacity: A GIS Approach,* presented to the Transportation and Public Utilities Group of the American Economics Association, March 21-22, 2002, Atlanta.

Mark L. Burton, Ph.D., *Improving Access to Rail/Highway Intermodal Transport: Lessons from West Virginia,* Transportation and Economic Development 2002 (TED2002), May 5-7, 2002, Portland, Oregon, Transportation Research Board.

Mark L. Burton, Ph.D., *Assessing Transportation-Related External Costs: Valuing Decreases in PM-10 Emissions due to Mode Switching,* Transportation and Economic Devel-

Herbert Tesser, Ph.D., *RoadFinder Front End: An Automated Road Extraction System***.** Paper presented at 15th International Conference on Pattern Recognition, ICPR 2000. September 3-8, 2000, Barcelona (Spain).

Papers to be Presented

opment 2002 (TED2002), May 5-7, 2002, Portland, Oregon, Transportation Research Board.Herbert Tesser, Ph.D., Marshall University; and Theo Pavlidis, Computer Science, SUNY—Stony Brook.

Michael J. Hicks, Ph.D., *The Impact of Appalachian Highway Corridors on the Scope of Small Business Activity*, Transportation and Economic Development 2002 (TED2002), May 5-7, 2002, Portland, Oregon, Transportation Research Board.

Marc W. Simpson, Ph.D**.,** *Highway Financing: Alternatives, Mixes, ustainability and Public Policy***,** ransportation and Economic Develoent 2002 (TED2002), May 5-7, 2002, Portland, Oregon, Transportation Research Board.

Technical Reports Presented

Richard Begley, Ph.D., Anthony Szwilski, Ph.D., John Ball, P.E. and Fernando Pascual, Ph.D. Candidate. *Briefing Report: Integrated Track Stability Assessment and Monitoring System (ITSAMS).* (Spring 2002).

Richard Begley, Ph.D., Anthony Szwilski, Ph.D., John Ball, P.E. and

Fernando Pascual: *Improving Safety and Operational Conditions at Railroad Crossings—An Analysis of Bolt Installations, Designs and Torque Procedures* (November 2001).

Mark Burton, Ph.D., *Public/Private Port Case Study* (Aug. 2002)

Mark Burton, Ph.D., *Commodoties Flows and Transportation Inventory for 13 Counties in Southern WV* (Dec. 2000)

Mark Burton, Ph.D., *Improving Efficiency of Truck/Rail Intermodal Transportation* (Aug. 2003)

Raymond L. Busbee, Ph.D., *Maximizing Economic Benefits from a Rails to Trails Project in Southern West*

Technology Transfer

Tony Szwilski, Ph.D., and Richard Begley Ph.D., *Evaluating Geophysical Technologies for Real-Time Assessment of Near-Surface and Subsurface Conditions*. 7th International Symposium on Environmental Issues and Waste Management in Energy and Mineral Production Conference (SWEMP 2002), October 7-10, 2002, Cagliari, Sardinia, Italy.

Tony Szwilski, Ph.D., and Richard Begley Ph.D., *Rockfall Hazard Evaluation and Data Management System for Highway and Railway Rock Slopes.* 7th International Symposium on Environmental Issues and Waste Management in Energy and Mineral Production Conference (SWEMP 2002), October 7-10, 2002, Cagliari, Sardinia, Italy.

Tony Szwilski, Ph.D., and Richard Begley Ph.D., *Deveopling an Integrated Track Stability Assessment and Monitoring System Using Non-Invasive Techniques.* Transportation Research Board, 82nd Annual Meeting, Jan. 12-16, 2003, Washington, D.C.

Tony Szwilski, Ph.D., Richard Begley Ph.D., John Ball, P.E., Peter Dailey, Research Assoicate. *Application of Geophysical Methods to Evaluate Rail-Track Subsurface.* Symposium on the Application of Geophysics to Environmental and Engineering Problems (SAGEEP), April 6-10, 2003, San Antonio, Texas.

Virginia - A Case Study for the Greenbrier River Trail. (May 2001)

Raymond L. Busbee, Ph.D., *Development of a Plan for a Non-Motorized Transportation Corridor in Southern WV - Case Study for Alternate Sources of Transportation between Huntington and Charleston.* (Aug. 2002)

James E. Joy, Ph.D., *Abandoned Tire Health Risk Survey/Analysis.* (Jan. 2002)

Jennifer T. Plymale, M.A.; Jonathan M. Willis, M.S.; and Robert B. Walker, M.D. *Survey of Truck Parking Places (Private) in WV.* (Nov. 2001)

Michael Robinson, Ph.D., P.E.; James Wolfe, M.S.; Sean Litteral, M.S.; Kurt Donaldson, M.S.; and Trevor Harris, Ph.D. *GIS Implementation Strategy for WVDOT.* (Aug. 2002)

Robert B. Walker, M.D.; Charles Braun, Ph.D.; Mark Burton, Ph.D.; Lesley Burton, M.S.C.; Michael Hicks, Ph.D.; Jennifer T. Plymale, M.A.; Amber Vance, M.S.; and Jonathan M. Willis, M.S. *Lincoln County Transportation Study* (Nov. 2001)

Mark L. Burton, Ph.D. *Transportation and the Potential for Intermodal Efficiency Enhancements in Western West Virginia*. Final Phase I Report

Technology Transfer

Transportation Professional Development Activities

Transportation professional development courses, transportation seminar series, workshops and conferences allow practitioners, UTC researchers and students to hear from experts in the field, network with others and identify new resources while earning Continuing Education Units (CEUs).

Year 3 Transportation Professional Development Courses

1) Geological Hazards in Transportation in the Appalachian Region, Aug. 6, 2002, Huntington, W.Va.

This Technical Forum was an activity of The Appalachian States Coalition for Geological Hazards in Transportation, which was created by RTI.

Members of the Coalition are the principal geotechnical, geological and transportation professionals from the Appalachian States.

basic understanding of the key aspects of design, construction, maintenance and temporary traffic control for each other's facilities during this seminar.

Upon completion of the course, participants were:

· Aware of and understood the mission and organization of railroad

Charleston, W.Va.

The course was designed for instructors to presume attendees had no prior knowledge of computers and thus described the theory of operation and the manner in which it can be applied to traffic signal controls. Participants earned 2.4 Continuing Education Units.

Upon completion of the course, participants were able to:

- **3D Laser Scanning** by Michele Anderson, Matthew Jolly and James Van Ostran from As-Built Solutions.
- **Corridor H Section 16 from Elkins, Kerens, Randolph Co., WV: Landslides Investigation and Correction Measures** by James Fisher from WV Department of Transportation.
- **National Karst Map Project** by Jack Epstein from US Geological Service.
- **The Use of Geophysics and NDT to Locate, Investigate and Monitor Mines Beneath Roadways in Ohio** by Tom Lefchik from Federal Highway Administration.
- **Karst-Related Geologic Hazards Associated with Transportation** by James C. Currens from Kentucky Geological Service.
- **Recognition of Landslide Prone Areas** by George Hall from WV Department of Transportation.
- **Remediation of Landslide on Kentucky SR 9** by George Webb from H.C. Nutting Company.

2) Railroad and Highway Traffic Safety and Operations Seminar, April 9-10, 2002, South Charleston, W.Va.

Personnel who design, engineer and maintain West Virginia's infrastructure of railways and roadways provided a

companies and state highway agencies.

- Understood the physical and operatonal characteristics of railroad locomotives/cars and highway vehicles.
- Understood the basic criteria for intersection design.
- Understood normal maintenance practices employed by the railroad and state highway.
- Aware of the basic principles of highway traffic control devices and railroad signaling devices.
- Able to identify and establish key communications between the two entities.

3) Advanced Urban Travel Demand Forecasting, March 12-15, 2002, South Charleston, W.Va.

The course consolidated the best procedures and methodologies to estimate demand impacts of a broad range of multimodal infrastructure investment and transportation/land use policy options for system planning.

Upon completion of the course, participants were able to:

- Select appropriate procedures and model structures to improve the capability of their four-step models.
- Assess the contribution of various potential model input variables toward accuracy of their model forecasts and the sensitivity of their models to policy input variables.
- Evaluate the level of accuracy and reasonableness of model outputs.

4) Computerized Traffic Signal Systems, March 5-7, 2002, South

- Describe the basic functions and utility of a computerized signal system.
- Identify various operational functions along with cost and maintenance considerations.
- Describe the functions and integration of hardware and software components of a system.
- Identify various types of systems architecture.
- Explain Timing Plan Development and Maintenance.

- Describe Systems operation and maintenance.
- Describe System procurement methods.

5) Advanced Techniques for Managing Roadway Emergencies, Feb. 19-20, 2002, Charlestion, W.Va.

This course brought the latest and best techniques for managing all types of roadway emergencies from disabled vehicles to fatal accidents involving trucks and hazardous materials.

Upon completion of the course, participants were able to:

- Describe the need for a formalized structure for inter-agency and inter-disciplinary coordination to manage incidents.
- Help assess current local issues and build consensus for local improvements.
- Create a task force to develop or improve a planned multi-agency response to major and minor incidents.
- Implement the latest and best on-scene procedures.

6) Using the National Intelligent Transportation System (ITS) Architecture for Deployment, Oct. 31-Nov.1, 2001, Huntington, W.Va.

This course was primarily designed for a public sector audience involved in ITS planning and deployment.

Upon completion of the course, participants were able to:

- Identify user services, user service requirements and their relationship to the National ITS.
- Define ITS projects using logical and physical architecture and market packages in the evelopment of regional architecture.
- Define relationships between institutions and the ITS elements they operate using the theory of operations.
- Recognize ITS standards relevant to specific projects.
- List the U.S. DOT architecture consistency requirements and their effects upon future ITS projects.
- Define the Systems Engineering process and how it is used with the National ITS architecture.

7) Train the Trainer for the Transportation Industry Workshop, Sept. 19- 21, 2001, Huntington, W.Va.

Upon successful completion of the workshop, attendees received:

- An Adult Teaching Permit from the

Year 3 Transportation Seminar Series

The Nick J. Rahall, II Appalachian Transportation Institute (ATI) at Marshall University has created a Transportation Seminar Series that enables Marshall faculty, principal investigators for ATI funded projects, to present their research findings. The seminars are free and often include guest speakers.

Rob Maccbbin, Senior Transportation Engineer from Mitretek Systems, discussed the benefits of incorporating ITS technology into transportation agencies.

5) ITS Architecture May 21-24, 2002, South Charleston, W.Va.

Steve Clinger, Program Specialist from the FHWA in Washington, D.C., discussed Turbo and National ITS Architecture in the transportation industry.

6) Traffic Crashes: What We Know, How We Know It, What Can Be Done, Oct. 17, 2001, South Charleston, W.Va.

Dr. Leonard Evans, president of Science Serving Society, discussed the link between traffic accidents the various influences that may cause them, including age, gender and cargo mass.

1) Practical Challenges of Implementing ITS, West Virginia ITS Applications, June 20, 2002, South Charleston, W.Va.

Thomas Smith, Division Administrator; Kevin Burgess, Research T2 Engineer; and Greg Morris, Safety and Traffic Engineer; all from the Charleston Division of the FHWA, discussed ITS applications for West Virginia.

2) Public Safety, 511 and I-81 Intelligent Transportation Systems Program, June 18, 2002, South Charleston, W.Va.

Gregory Cross, Senior Research Associate at Montana State University's Western Transportation Institute, presented attendees with information about the use of ITS to provide information individuals who travel along I-81 in Virginia.

3) ITS System Engineering and Standards, June 11-13, 2002, South Charleston, W.Va.

Emiliano Lopez, an ITS Technical Specialist for FHWA in Washington, D.C., provided information about integrating ITS technology and national standards into systems engineering efforts.

4) Benefits of ITS, June 6, 2002, South Charleston, W.Va.

Year 3 Conferences

• Lead User Group Conference: Building the Vision for Kinetic Park, Feb. 25, 2002

On Feb. 25, 2002, RTI co-sponsored a regional conference, *Lead User Group Conference: Building the Vision for Kinetic Park,* in Huntington, W.Va. The purpose of the conference was to develop interest in and support for the development of a LEAD USER GROUP in the Huntington area and to foster economic growth through transportation innovation, research and technology testing.

Conference goals were to:

· Introduce the "Lead User Concept" as a method for creating a vision for Kinetic Park.

· Draft ideas for attracting, keeping and growing the niche areas in the Huntington area.

· Create a coalition of public, private and academic leaders to encourage and support the development of the proposed niche areas for KineticPark.

· Create an Electronic Rolodex of additional contacts and leads for proposed niche companies.

· Pursue the research and development capacity of Marshall University to create new linkages between researchers at the university and the private sector to encourage technological innovation and commercialization, develop applied research, and support technology transfer for KineticPark.

· Define the factors that will foster the development of Huntington's transportation industry through technology transfer, new business formation, expansion of existing businesses and business attraction by providing a synergistic environment to pursue

• Polymer Composites II, Nov. 14-16, 2001

RTI co-sponsored *Polymer Composites II* at Lakeview Scanticon Conference Center at West Virginia University in Morgantown, W.Va.

The mission of the conference was to disseminate status reports, success stories and new opportunities from specific composite applications in infrastructure renewal and the resulting economic development.

· The conference's objectives were: to bring together those involved with polymer composites including researchers, designers, manufacturers, contactors and end-users.

· To demonstrate the successful application of composites in infrastructure renewal by validating their design, construction and performance.

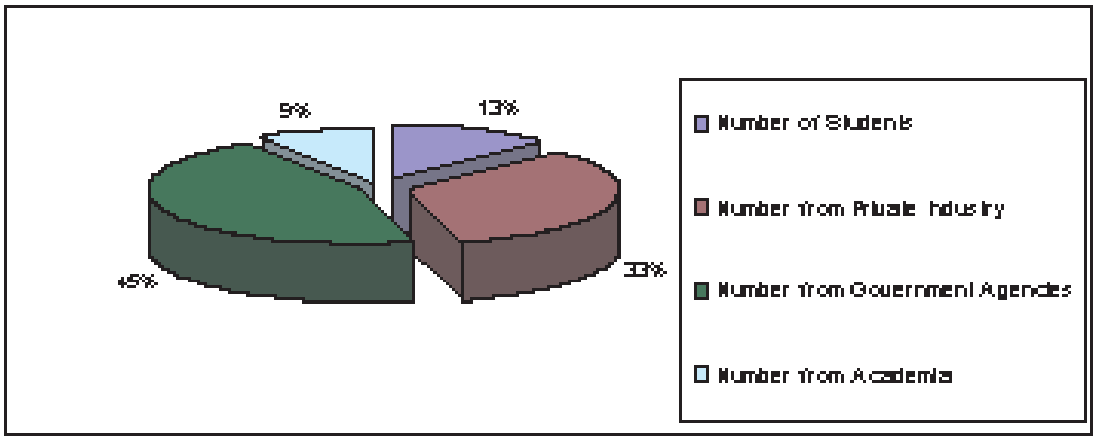
· To exchange information with the participants on the use of composite s by: (1) delineating the role that composite play in infrastructure renewal; (2) estimating the magnitude of economic development; (3) understanding technical and regulatory barriers; (4) identifying agencies that can enable the expansion of composite use.

· To identify the most relevant materials and manufacturing processes and to discuss product-process improvements and specifications necessary for safe and economically viable options.

Technology Transfer

Technology Transfer

During Grant Year 3, attendees from 32 states and Washington, D.C., attended RTI Transportation Professional Development Activities. Attendees represented government agencies, private industries and academe as indicated in the following graph:



Technology Transfer

Pre-K-12 OUTREACH

Goal: To nurture a new generation of transportation professionals by introducing transportation issues during the school years and to encourage students to consider transportation-related careers later in life. Pre-K-12 Outreach activties include: Transportation Outreach on Wheels, Transportation Outreach on the Web and other workshops and activities at Marshall University and partner schools.

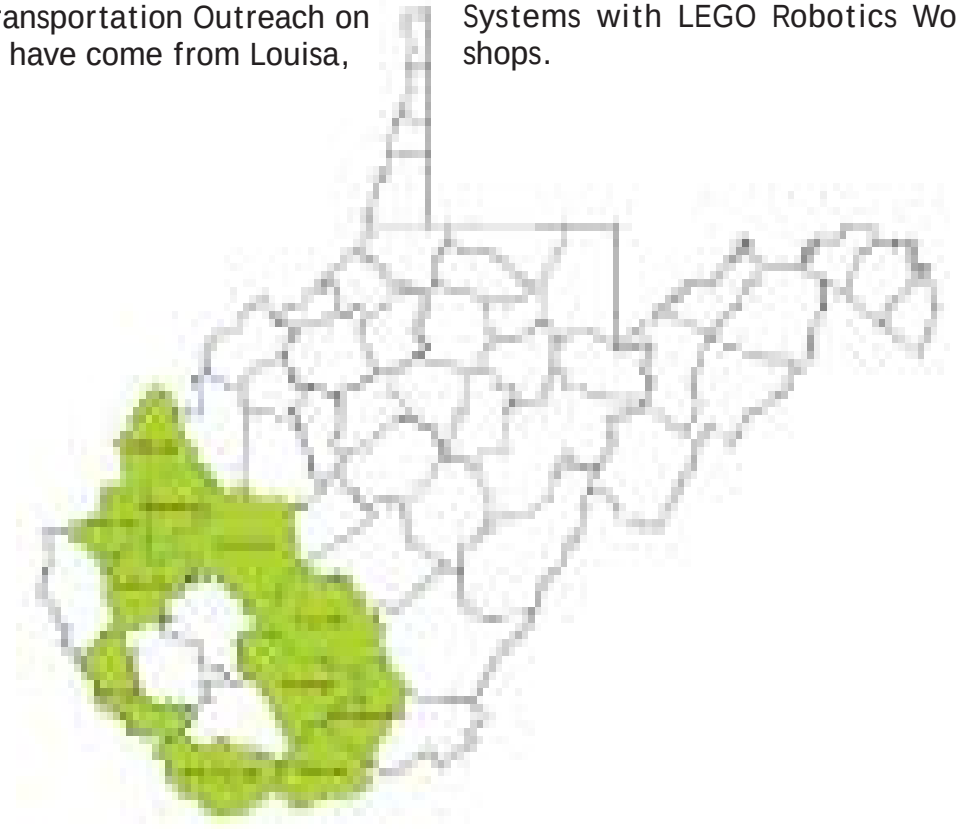
Since 1999, graduate and undergraduate education students with Rahall Transportation Institute's (RTI) Transportation Outreach on Wheels (TO^2W) program have traveled to more than 22 schools and instructed more than 2,000 pre-kindergartens through high school students in the tri-state area. These activities vary between one-half day workshops to five-day workshops.

Right: Graduate education majors from Marshall University serve as instructors for RTI's Transportation Outreach on Wheels program.

Students who have participated in RTI's Transportation Outreach on Wheels have come from Louisa, Ky, Portsmouth, Ohio, and West Virginia counties including:

- Cabell
- Fayette
- Kanawha
- Lincoln
- Mason
- Mercer
- McDowell
- Mingo
- Putnam
- Raleigh
- Summers

Transportation Outreach on Wheels activities include LEGO DUPLO Workshops and Intelligent Transportaiton Systems with LEGO Robotics Workshops.



Left: Damon Ward, a graduate education major from Marshall University, instructs students from Student Aspect Preparatory School in Huntington, W.Va. during a TO²W workshop.

LEGO DUPLO WORK-

RTI instructors use LEGO DUPLO blocks to introduce basic transportation concepts to pre-K through third grade students during workshops and other activities.

Younger students (ages 3-5) learn to assemble vehicles, tracks and cargo carriers from pictorial charts and LEGO DUPLO blocks. After creating railroad or highway systems, students move "cargo" from one location while factoring time, distance and weight into the transportation process.

Older students (ages 5-8) receive transportation-related "story challenges," which must be solved using LEGO DUPLO blocks. The students use LEGO CAD to design vehicles or simple machines, which contain gears, levers or pulleys, to solve the "story challenges."

Directly above: Pre-K students use pictorial charts to assemble vehicles from LEGO DUPLO kits. Top left: A six-year-old student moves "cargo" along a simulated railroad track. Bottom Left: Third grade students assembled a "Bubble Wrap Machine," complete with gears and pulleys, from LEGO DUPLO bricks.

Intelligent Transportation Systems with LEGO Robotics Workshops

Middle school students learn to assemble and program intelligent vehicles and automated traffic control and monitoring devices at workshops sponsored by RTI.

Pre-service teachers and graduate assistants from Marshall University guide students in assembling vehicles and traffic control components from LEGO DACTA kits and installing RCX microcomputers, light sensors, digital timing devices and motors.

Using ROBOLAB software, middle school students write computer programs and download them to the RCX equipped vehicles and traffic control devices, which include cars, gates, signals and speed measuring devices.

High school students also explore careers in automobile assembly, engineering, manufacturing, computer programming, education, transportation and robotics while learning the basics of LEGO CAD, ROBOLAB and RCX programming.

Far above: Middle school students assemble intelligent vehicles from LEGO Dacta kits during an Intelligent Transportation With LEGO Robotics workshop.
Middle above: Assembling vehicles from the LEGO DACTA kits helps students understand the basics of RCX programming.
Bottom Left: ROBOLAB software allows RCX equipped vehicle and traffic control devices to be programmed to simulate real vehicles and traffic control devices.
Bottom Right: Vehicles were programmed with RCX microcomputers, light sensors, motors and digital timing devices.

Things That Go Workshop

Thirteen four-year-old students

Left: Jessica Tingler, a Marshall University education major, helps Students from the Child Development Academy learn about transportation professions, and the history of roads and vehicle's construction.
Right: A student adds a "railroad car" to the "Rahall Express."

from the Child Development Academy at Marshall University participated in RTI's "Things That Go" program Aug. 13–14, 2002.

RTI graduate assistants and MU preservice teachers led students in discussions including the history of roads and vehicles construction. After students were informed of various transportation professions, the students constructed vehicles that reflected transportation careers to which they said they would like to aspire.

The students were supplied materials such as gravel, sand, soil and water, with which they created model roads for various types of vehicles.

RTI instructors also carried the transportation theme into snacktime by helping students make transportation-related snacks, including tires and wheels made from crackers, cheese and other foods.

Technology Transfer

As part of the Transportation Outreach on the Web, RTI has developed and hosts three interactive websites:

- **Design a Future Vehicle (DFV) Workshops & DFV Teacher's Corner**
- **Intelligent Transportation Systems - LEGO Robotics City**
- **Science and Engineering NASA Site of Remote Sensing (SENSORS City)**

in addition to direct video links with several elementary schools in the Huntington area.

Design a Future Vehicle

Transportation outreach on the WEB

RTI's Design a Future Vehicle (DFV) website contains information for students, parents and teachers about the six technologies of transportation used to create vehicles and road systems. Lesson plans that integrate transportation concepts into subjects including math, science, social studies, language arts and computer technology are available at the DFV Teacher's corner.

Lesson plans for the following activities are available on the DFV Website. Children can build these projects with items that may be purchased at a discount and electronic stores.

- **Aluminium Foil Boats**
- **Hovercraft**
- **Simple Motor**
- **Newton's Law Car**
- **Remote Control Vehicle**
- **Production Line**
- **Set Belt Egg Vehicle**
- **Solar Energy Collector**
- **Balloon-Powered Vehicles**
- **Bridge Experiment**
- **Magnetic Street Board**

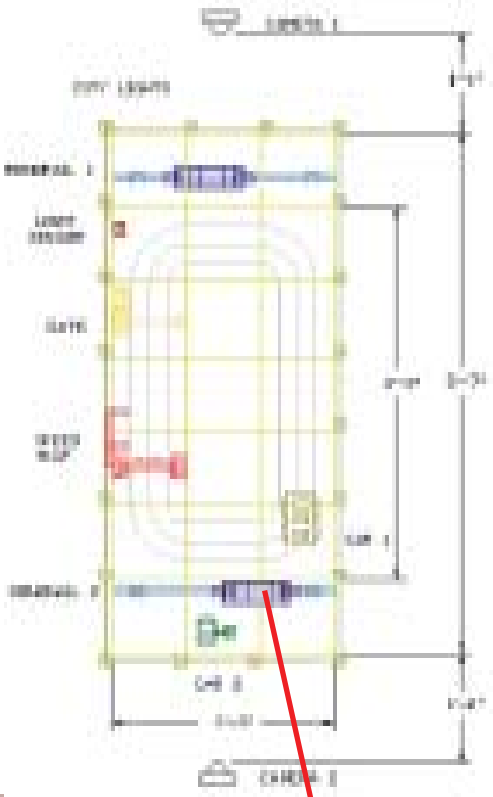
Transportation outreach on the WEB

Intelligent Transportation Systems - LEGO Robotics

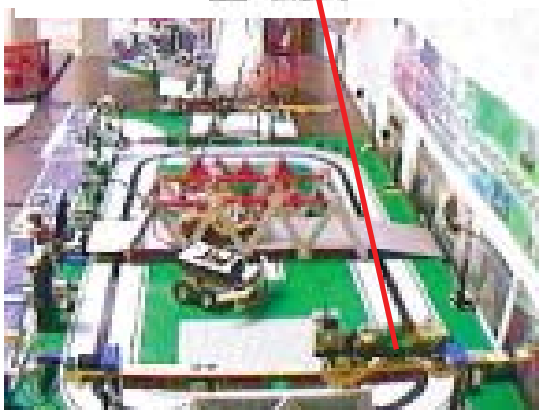
LEGO Robotics City is located in the information technology laboratory at RTI headquarters. This small, robotic city has two web cameras that provide live views of a simulated LEGO city with an oval track, two monorails, a traffic gate and an autonomous, line-following vehicle.

Middle school students learn the concept of tele-operation through this system, which is usually integrated into an Intelligent Transportation systems LEGO Robotics workshop at RTI headquarters or through site visits to elementary schools by RTI staff.

LEGO Robotics City can be operated through the web and viewed with a live web camera after viewers download Red Rover Operating System software from the RTI site.



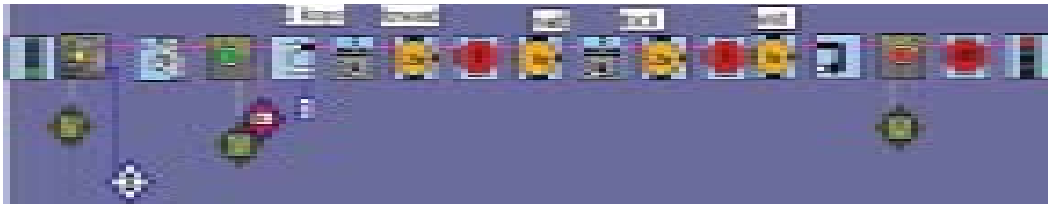
Top right: The red line shows an ITS monorail as seen from AppaLEGO City (viewed from web camera 2) and indicated on a schematic drawing.



Far above: The Red Rover Operating System control screen facilitates interactive e-mail exchanges from visitors with RTI operators. The system has control buttons that operate the monorail forward or backward. Programs may be written and sent to the system to perform more advanced operations such as opening the traffic gate or moving the monorail multiple times. Above: Students from Miller Elementary can be seen in the screen from a direct video link to the school.

Science and Engineering NASA Site of Remote Sensing (SENSORS City)

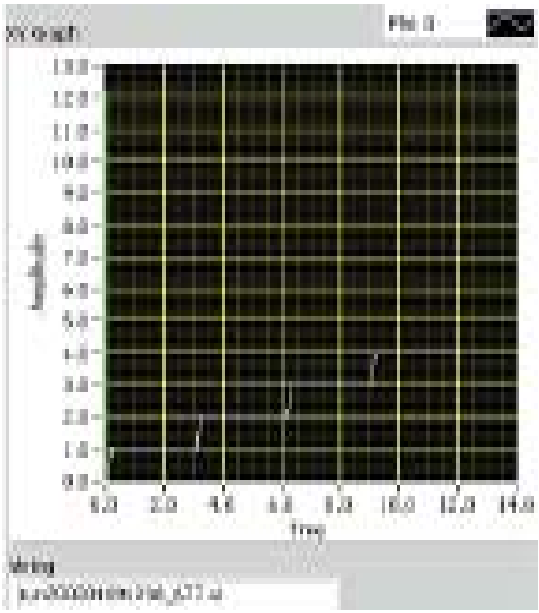
Transportation outreach on the WEB



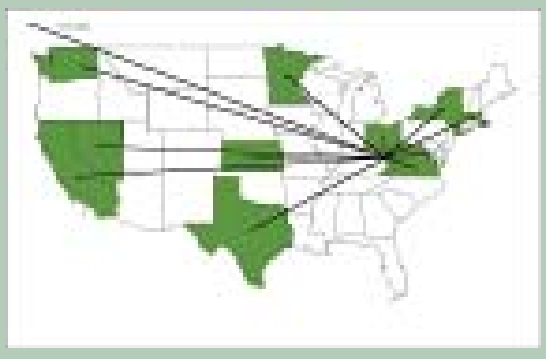
Left: This program can be downloaded and submitted to the SENSORS City web site to tell the monorail to move back and forth two times. Note: the computer programming process is identical to some high level professional programming software packages i.e. objects or icons representing computer commands are stringed together as opposed to written computer commands.

Through the Science and Engineering NASA Site of Remote Sensing (SENSORS) City, students use sensors to obtain feedback related to operation, control and "teleoperation" of intelligent vehicles and traffic control devices. Students use the SENSORS site to send computer programs to operate ITS components, which can be seen through a typical web connection and requires no special operating software.

After a program or "mission" is submitted, the system returns results, which include graphs that illustrate data collected by the sensors, such as changes in direction, temperature, light or elevation. Computer programming challenges and competitions for students who have ROBOLAB software are also posted on the SENSORS Site.



Above: Shows the resultant graph that is returned to the sender if the program executed properly. In this case, the graph shows four steps over time indicating that the monorail sensed it came into contact to the end of the monorail track four times.For example, if the monorail did travel back and forth two times it would have come into contact a total of four times with the end of the track.
Below: Shows the location of SENSORS City "mission submitters." The ages of the students range from middle school to high school.



Exploring Engineering Academy of Excellence

Right: Future engineers from local high schools who attended MU CITE's Exploring Engineering Academy visited the John Amos Power Plant. Below Right: EEA students construct a trebuchet from PVC pipe.

Thirty-two juniors from area high schools participated in a weeklong workshop after being chosen on the basis of written essays and academic achievement.

Sponsored by the Marshall University College of Information Technology and Engineering, RTI and local businesses, the academy encourages students to explore careers in engineering by allowing them to participate in hands-on engineering activities, tour engineering-related facilities and interact with professional engineers.

Attendees participate in team design and building competitions that highlight engineering concepts and careers in civil, mechanical, chemical, robotic, electrical and hydraulic engineering. Participants learn to incorporate concepts such as effectiveness, safety, cost and appearance into designs.

Technology Transfer

Adopt-a-School Program

As part of RTI's Adopt a School program, RTI instructors use Robolab Cities and Transportation sets along with LEGO designed teacher curriculum to spark interests in math and science among local students twice a month during the academic year.

Barboursville Elementary

Davis Creek Elementary

tary

Miller Elementary

Spring Hill Elementary

Student Aspect Preparatory

Experiments conducted during Adopt a School sessions include:

- Building 3-D objects using 2-D drawings
- Speed measurements using light sensors
- Friction experiments using LEGO cars
- Rubber band powered cars
- Using LEGO CAD to design LEGO vehicles
- LEGO Robotics programmable one-turn vehicle
- Chain and pulley drive vehicles
- Robotic Arm
- Telecommunication experiments with LEGO RCX's
- Building a small transportation system using LEGO Robotics sets
- Gearing experiments using LEGO DUPLO
- Snail Car
- Cross Country Adventure
- Bumper Cars
- Exploring gear trains: teaching ratios and proportions
- Programmable car goes into and out of a tunnel
- How to build a snowplow
- The Little Blue Engine

Management Structure

RTI Nick J. Rahall, II Appalachian Transportation Institute
BSC Bluefield State College
MSU Mountain State University
WVUIT West Virginia University Institute of Technology

Management Structure

RTI Headquarters at Marshall University

Robert H. Plymale
Director
BA Geography
304-696-7098
plymaler@marshall.edu

Richard Begley
Associate Director
PhD Mining Engineering
304-696-6660
begley@marshall.edu

Barbara Roberts
Program Coordinator, Sr.
MA Political Science
304-696-7103
robertsb@marshall.edu

Pamela Hamilton
Tech Transfer Specialist
EdD Educational Leadership
304-696-6262
hamiltop@marshall.edu

Kim Baker, CPM
Contract Specialist -
BS Business Administration
304-696-7164
baker61@marshall.edu

Richard Hatcher
Grants and Contact Specialist
MBA
304-696-3331
hatcher2@marshall.edu

E. David Cartwright
Research Associate -
Webmaster, Pre-K-12 Consultant
MS Mechanical Engineering
304-696-3331
cartwrig@marshall.edu

John Ball, PE
Research Associate -
Senior Program Engineer
BS Engineering
304-696-2525
ballje@marshall.edu

Sean Litteral
Research Associate -
GIS Manager
MA Physical Science
304-696-2598
littera2@hotmail.com

Management Structure

RTI Headquarters at Marshall University

Mike Lewis, MCP
Network Technician
RBA
304-696-6047
mlewis@marshall.edu

D. Paul Young, Jr
Information Technology Consultant
304-696-7148
youngd@marshall.edu

Linda Delaney
Administrative Assistant
3 AS degrees in Business
304-696-2906
hammonds@marshall.edu

Sandra Jones
Administrative Secretary
304-696-7098
joness@marshall.edu

Partner School Contacts

Bluefield State College
nology
Bruce V Mutter
Director of Applied Research & Technical Center, Inc.
304-327-4420 x4121
bmutter@bluefield.

Mountain State University

Christal Masney
Instructor of Computers
304-253-7351 x1359
cmasney@mountainstate

WVU Institute of Tech-

Dr. Krishna Murthy, PE
Professor of Civil
304-442-3369
KMurthy@wvutech.edu

Management Structure

Advisory Council and Project Advisory Team Members

Federal Highway Administration

Burgess, Kevin, Research and Technology Engineer
Phone: 304-347-5266 Email: kevin.burgess@fhwa.dot.gov

Decker, Dennis, Assistant Division Administrator
Phone: 304-347-5929 Email: dennis.decker@fhwa.dot.gov

Smith, Thomas, Division Administrator
Phone: 304-347-5121 Email: thomas.smith@fhwa.dot.gov

Ventura, Jonathan, Statewide Planning Engineer
Phone: 304-347-5329 Email: jonathan.ventura@fhwa.dot.gov

West Virginia Division of Highways

Carte, Neal, Systems Analyst
Phone: 304-558-2885
Email: ncarte@dot.state.wv.us

Clarke, Bernie, Highway Engineer IV
Phone: 304-558-3131 Email: bclark@dot.state.wv.us

Cramer, Cindy, Highway Engineer III
Phone: 304-558-2817 Email: ccramer@dot.state.wv.us

Cramer, David, Highway Engineer III
Phone: 304-558-2804 Email: dcramer@dot.state.wv.us

Ellis, Danny, Assitant Cabinet Secretary for Finance
Phone: 304-558-2811 Email: dellis@dot.state.wv.us

Ferguson, Ken, Transportation Service Manager III
Phone: 304-558-3165 Email: kmferguson@dot.state.wv.us

Hall, George, Highway Engineer IV
Phone: 304-558-0601 Email: ghall@dot.state.wv.us

Hartman, Bill, Highway Engineer V
Phone: 304-289-3521 Email: bhartman@dot.state.wv.us

Holtsclaw, Kathy, Administrative Services Manager II
Phone: 304-558-2804 Email: kholtsclaw@dot.state.wv.us

Kenney, Bruce, Highway Engineer III
Phone: 304-558-3180 Email: bkenney@dot.state.wv.us

Management Structure

Lancaster, John, Highway Engineer V
Phone: 304-558-3113 Email: jlancaster@dot.state.wv.us

Lewis, Cameron, Transportation Systems Director II
Phone: 304-558-2881 Email: cclewis@dot.state.wv.us

Lewis, Ray, Highway Engineer IV
Phone: 304-647-7465 Email: lewisr@dot.state.wv.us

O'Connell, Susan, Director Div. Public Transit
Phone: 304-558-0428
Email: soconnell@dot.state.wv.us

Pascoli, John, Highway Engineer IV
Phone: 304-558-2865 Email: jpascoli@dot.state.wv.us

Watson, Robert, Highway Engineer III
Phone: 304-558-3165 Email: rcwatson@dot.state.wv.us

West Virginia Development Office

Hardesty, Paul, Manager
Phone: 304-558-2234 Email: phardesty@wvdo.org

Satterfield, Dave, Executive Director
Phone: 304-558-2234 Email: satterfield@wvdo.org

Regional Economic Development Entities

Nevi, Dick, Greenbrier County Economic Development Commission, Executive Director
Phone: 304-645-7155 Email: gvedc@inetone.net

Ratcliff, Judy, 4C Economic Development Corporation, Director
Phone: 304-465-0585 Email: 4ceda@4ceda.org

Whitt, Mike, Mingo County Redevelopment Authority, Executive Director
Phone: 304-235-0042 Email: scb01005@wvnvmwvnet.edu

Management Structure

Augenstern, Bob, Southern Tier East Regional Planning Development Commission, Executive Director
Phone: 607-724-1327 Email:pk2000@cleda.com

Biery, Rick, Local Development District Association of Pennsylvania, Regional Planning Program Manager
Phone: 570-265-9103

Culver, Robert, Top of Alabama Regional Council of Governments, Exec. Director
Phone: 256-533-3330 Email: arcog@coa.state.al.us

Giltz, Linda, Land-of-Sky Regional Council, Regional Planner
Phone: 828-251-6622 Email: Linda_g@landofsky.org

Green, Ken, Eastern Panhandle Regional Planning and Development Council, Executive Director
Phone: 304-263-1743 Email: region9@intrepid.net

Hardy, John, Lowndes County Port Authority, Port Director
Phone: 662-329-5886 Email: port@cleda.com

Mainord, David, Upper Cumberland Development District, Planning Director
Phone: 931-432-4111 Email: mainord@ucdd.org

Ritchey, Dan, Ohio Mid-Eastern Governments Alliance, President, Business Advocate
Phone: 740-455-3266 Email: ritchey@usa.com

Rychnowski, Don, Southern Tier West, Executive Director
Phone: 716-945-5301 Email: stwrpdb @southerntierwest.org

Weston, Tim, Port Itawamba, Director
Phone: 662-862-4571 Email: icdc@nexband.com

Appalachian Regional Commission

Bischak, Greg, Chief Economist
Phone: 202-884-7790 Email: gbischak@arc.gov

Terry, Edward, Senior Transportation Advisor
Phone: 202-884-7706 Email: eterry@arc.gov

Scott Hercik, Intermodal Planning
Phone 202-884-7706 Email: Shercik@arc.gov

Management Structure

Appalachian States Coalition for Geological Hazards in Transportation

Tony Szwilski, Chair
Professor of Environmental Engineering
Chair, Division of Environmental Science and Safety Technology, CITE. Marshall University
Gullickson Hall 112, 18th St, 3rd Ave.,
Huntington, WV 25755
e-mail: szwilski@marshall.edu phone: 304-696-5457; fax: 304-696-5454

Kirk Beach, Co-Chair
Senior Geologist, Geotechnical Design Section
Ohio Department of Transportation
1600 West Broad Street, Room 2033
Columbus, Ohio 43223
e-mail: kirk.beach@dot.state.oh.us phone: 614-275-1342; fax: 614-275-1354

Jim Faircloth
Sr. Project Engineer,
CSX Transportation
4901 Befort Rd-J350,
Jacksonville, FL 322256
Tel: 904-245-1042

George Hall
West Virginia Department of Transportation
Division of Highways Engineering Division
Building 5, Room 650, 1900 Kanawha Blvd., E., Charleston, WV 25305-0430
e-mail: ghall@dot.state.wv.us phone: 304-558-0601

Tommy Hopkins
Chief Research Engineer, Head of Geotechnology
Kentucky Transportation Center
University of Kentucky, 282 CE/KTC
Lexington, KY 40506-0281
e-mail : thopkins@engr.uky.edu phone: 859-257-4513 Ext: 249; fax: 859-257-1815

Thomas Lefchik
Structural Engineer
FHWA
200 North High Street, Room 328

Management Structure

Columbus, Ohio 43215
e-mail: lefchik@fhwa.dot.gov phone: 614-280-6845

Thomas M. Berg
State Geologist & Chief, Division of Geological Survey
Ohio Department of Natural Resources
e-mail: thomas.berg@dnr.state.oh.us phone: 614-265-6988 fax: 614-268-3669

Larry D. Woodfork, State Geologist
West Virginia Geological Survey
Mont Chateau, P.O. Box 879
Morgantown, WV 26507-0879
e-mail: woodfork@geosrv.wvnet.edu phone: 304-594-2331; fax : 304-594-2338

Robert E. Yost
Chief, Geotechnical Branch
Engineering and Construction Division, Huntington District, USACE;
Attn:EC-G Address: 502 8th Street
Huntington, WV 25701
email: Roberty@lrh.usace.army.mil phone: 304-529-5276; fax: 304-529-5786

J.R. Zimmerman
Geotechnical EngineerNorfolk Southern Corporation
175 Spring Street, S.W., Atlanta, GA 30303e-mail: james.Zimmerman@nscorp.com phone: 404-658-2279

Gerald F. Wieczorek
U.S. Geological Survey
National Center, MS 926A, Reston, VA 20192
e-mail : gwieczor@usgs.gov phone: 703-648-6788; fax : 703-648-6953

James Cobb
State GeologistKentucky Geological Survey228 Mining & Mineral Resources BuildingUniversity of Kentucky, Lexington, KY 40506-0107e-mail: cobb@kgs.mm.uky.edu phone: 859-257-5500; fax : 859-257-1147

John Fulton
US Geological Survey
1000 Church Hill Road, Suite 200
Pittsburgh, PA 15205
e-mail: jwfulton@usgs.gov phone: 412-490-3828; fax: 412-490-3828

Thomas Smith
Division Administrator

Project Listing

Number	Title	Principal Investigator
NEW		
00-01	Phase II: Integrated Railroad Track Stability Assessment and Monitoring System	Dr. Tony Szwilski
00-02	Land Use Planning Adjacent to Transportation Corridors in W.Va.: A Regional Approach for Six Counties in Southern W.Va.	Mr. Bob Plymale
ONGOING		
99-01	Automated Road Extraction Using Satellite Imagery	Dr. Herbert Tesser
99-02	Preserving Branch Line Railroads	Dr. Mark Burton
99-06	Potential Uses of Fly Ash and Other Recoverable Materials in New Transportation Infrastructure Components	Dr. Anthony Szwilski
99-09	Pre-Construction Assessment of Wetlands to be Built along the Tolsia Highway	Dr. Mike Robinson
99-10	Endangered Species Identification along Corridors Using GIS	Dr. Mike Little
99-13	Commodity Flows in Northern W.Va.	Dr. Mark Burton
99-15	Impacts of the Appalachian Corridors on Small Businesses	Dr. Michael Hicks
99-16	McDowell County Transportation Study	Ms. Jennifer Plymale
99-18	ITS Research Initiation Project	Dr. Ashok Vaseashta
99-19	Public/Private Port Case Study	Dr. Mark Burton
99-23	Survey of Truck Parking Places (Private) in W.Va.	Ms. Jennifer Plymale
99-26	Beckley Exhibition Mine Expansion: Project Management and Evaluation for a Transportation Enhancement Project to be Built along a National Scenic By-way in W.Va.	Dr. Richard Begley
99-27	Using FLI-MAP Technology for Transportation Applications: Research Initiation Project	Mr. Bruce Mutter
99-32	GIS Implementation Strategy for	Dr. Herbert Tes-

Project Listing

99-33	Highway Program Finance Options and Strategy	Dr. Michael Hicks
99-05-2	Use of Electroluminescence Technology for Highway Signage - Phase II Demonstration Highway Sign	Dr. Richard Begley
99-06-02	Potential Uses of Fly Ash and Other Recoverable Materials in New Transportation Infrastructure Components (Phase 2)	Dr. Tony Szwilski
99-10-2	Endangered Species Identification along Corridors in W.Va. Using GIS (Phase 2)	Dr. Mike Little
99-24-2	Improving the Efficiency of Truck/Rail Intermodal Transportation -- The Case of W.Va. (Phase 2)	Dr. Mark Burton

COMPLETED

99-00	Commodity Flows and Transportation Inventory	Dr. Mark Burton
99-03	Lincoln County Transportation Study	Dr. Mark Burton
99-04	Integrated Track Stability Assessment and Monitoring	Dr. Richard Begley
99-05	Use of Electroluminescne Technology for Highway Signage	Dr. Richard Begley
99-07	A Rockfall Rating System for Slopes along Highways in W.Va. and Ky.	Dr. Anthony Szwilski
99-08	Abandoned Tire Health Risk Survey/Analysis	Dr. James Joy
99-11	Maxamizing Economic Benefits from a Rails to Trails Project in Southern W.Va.: A Case Study of the Greenbrier River Trail	Dr. Raymond Busbee
99-14	Drowsy Driving Problems in W.Va.	Dr. Robert Walker
99-17	Magnetic Levitation Planning for W.Va.	Dr. Richard Begley
99-24	Railroad Tunnel Size Restrictions	Dr. Mark Burton
99-25	Improving Safety and Operational Conditions at Railroad Crossings: An Analysis of Bolt Installations, Designs and Torque Procedures	Dr. Richard Begley
99-29	Development of a Plan for a Non-Motorized Transportation Corridor in Southern W.Va.: Case Study for Alternate Sources of Transportation between Huntington and Charleston	Dr. Raymond Busbee