## Section A

Section A of this report encompasses NCTIP’s activities under its three primary categories of Education, Research and Technology Transfer for the period September 9, 1999 through June 30, 2000. Areas mandated by the USDOT guidelines for annual reports are indicated in the Table of Contents.

The reconstituted Advisory Board is introduced, as well as two critical programs, the new International Intermodal Transportation Center and the North Jersey Transportation Planning Authority/NJIT Brownfields Planning Program, both of which have strong potential for complementary interaction with NCTIP.

Sections B and C are reported in a separate document, as required.

### Key Words
- transportation education, research, productivity, multimodal

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INTRODUCTION
**DIRECTOR’S MESSAGE**

Transportation Activities at NJIT are multidisciplinary, cross-cutting and extensive both in the level of funding and number and profile of the faculty and students involved. There are four research centers with a combined annual funding level exceeding $3 million. Shown in Figure 1, they include:

1. **The National Center for Transportation and Industrial Productivity (NCTIP),** a member of USDOT’s University Transportation Centers Program which was established in ISTEA and re-authorized in the Transportation Equity Act for the 21st Century (TEA-21).

2. **The International Intermodal Transportation Center (IITC),** a project under the High Priority Projects Program of TEA-21.

3. **The Brownfields Redevelopment Project,** or fully titled "Preparing Modern Intermodal Freight Infrastructure to Support Brownfields Economic Development," one of 35 projects chosen for funding from over 500 proposals submitted to USDOT under the Transportation and Community and System Preservation Pilot Program. This is a joint project with the North Jersey Transportation Planning Authority (NJTPA).

4. **The New Jersey Transportation Information and Decision Engineering (TIDE) Center** funded by the New Jersey Commission on Science and Technology.

These Centers provide a critical mass of teaching and research faculty, staff and students unparalleled in the nation. This enables NJIT to respond effectively and dynamically to state and regional transportation issues including educational, research and technology transfer needs. The research centers support faculty from all five NJIT Schools and Colleges as well as other New Jersey regional colleges and universities. The centers not only provide support to students pursuing graduate degree programs in transportation, civil engineering, infrastructure, management and logistics, but also serve as places for undergraduate students to interact with their more senior colleagues in solving real-world problems.

Additionally, NJIT is the host agency to the North Jersey Transportation Planning Authority (NJTPA), the metropolitan planning organization that encompasses the 13 northern counties in New Jersey with an annual operating budget of $7M.

We are pleased with NCTIP’s many accomplishments during our first year of operation under TEA-21. We have successfully developed a new program in Logistics that has gone through a thorough approval process. We are adding faculty, exceptional young educators who will be the leaders in transportation education in the 21st Century. Dr. Janice Daniel joined NJIT as an assistant professor of civil and environmental engineering after a tenure at Georgia Tech. Barely a year with NJIT, Dr. Daniel has received two prestigious NSF awards and an NJDOT’s Governor’s Challenge Grant. Dr. Jian Yang, a recent graduate of the University of Texas at Austin, has joined NJIT as an assistant professor of logistics and industrial engineering. Although fresh out of graduate school, Dr. Jiang has a remarkable publication record in the field of vehicle routing and scheduling.

NCTIP continues its commitment to the Garrett A. Morgan Transportation Futures Program by once again...
sponsoring the Dr. Harold Deutschman's long-running Summer Transportation Institute for 10th and 11th graders from the greater Newark area. Also, through a connection made at the TransAction 2000 conference, Dr. Deutschman has been advising the Patterson, New Jersey School District as it initiates its Garrett A. Morgan Transportation Academy. And Dr. Sandy Moore has directed a successful elective course within NJIT's New Jersey School of Architecture, where undergraduate mentors have spent the past semester challenging 4th through 8th grade students from the Gifted and Talented Program of Newark's Abington Avenue school to an awareness of transportation, architecture and engineering as fields of study.

We continue to build a strong and successful relationship with the New Jersey Department of Transportation (NJDOT). We work closely with Ms. Pippa Woods, Assistant Commissioner for Planning, Research and Local Government Services, and Mr. William Hoffman, Director of the Division of Research and Technology. NJDOT provides $250,000 in direct matching funds to NCTIP in support of a number of projects that have gone through both its departmental and NCTIP peer review processes. In addition, the creation of the center secured additional funding for our colleagues in the Civil and Environmental Engineering (CEE) Department, and Infrastructure Program of the School of Architecture.
In November 1999 we participated in the very successful NJDOT 1st Annual Research Showcase. Dr. John Schuring, chair of NJIT's Department of Civil and Environmental Engineering, and I gave a joint presentation on state-of-the art NJDOT-supported research (which can be viewed at http://transportation.njit.edu/nctip/presentations.htm). NCTIP will host the NJDOT 2nd Annual Research Showcase on November 8, 2000 at the New Jersey Performing Arts Center in Newark. Details and registration are available on the NCTIP web site: http://transportation.njit.edu/nctip/.

NCTIP received enormous statewide media coverage for its research on Mobility and the Costs of Congestion in New Jersey. This project honors our mandate to provide the public and elected officials with sufficient facts and directions to help focus discussion on stable funding sources for transportation investments. This research was featured in the Spring 2000 issue of OnRoute and the full research report is highlighted on our web site.

NCTIP measures its success through students and alumni working in the transportation industry. As such, several students have made us especially proud. Lida Mazaheri, who received the University Transportation Centers' Student of the Year award, is currently with the Port of Authority of New York and New Jersey. Ms. Mazaheri returns to NJIT for her Ph.D. studies in transportation in fall 2000.

In the past two years, two NJIT students, M. Shoaib Chowdhury, in 1998, (OnRoute, Spring 1999) and Yuqing Ding, in 1999, have received the prestigious George Krambles Transportation Scholarship for their dissertations, indicating the quality of work produced by NJIT Ph.D. students in the public transit arena. Krambles was the former general manager of the Chicago Transit Authority, and this award, by the foundation that bears his name, encourages students to pursue careers in public transit. Both Chowdhury and Ding are currently employed by Parsons Brinckerhoff. In 1998, Ph.D. Candidate Alex Sideris received a $1,000 scholarship from the Council of Logistics Management's New Jersey Roundtable, and attended the CLM's Annual Conferences in Anaheim, California. In 1999, Ph.D. candidate Jakub Rowinski was awarded an all-expense-paid trip to attend and present at CLM's Annual Conference in Toronto, Canada.

During the Transportation Research Board's 79th annual meeting in January, Dr. Daniel and I were among a selected group of transportation educators and professionals who met with the Honorable Rodney E. Slater, U.S. Secretary of Transportation, to discuss major challenges in educating and training the next generation of transportation professionals for the 21st century; examples of innovative partnerships and how to build on their success; and ways in which the U.S. Department of Transportation can support the learning process that involves formal education, ongoing training, research and technology transfer.

The faculty of NJIT has, as usual, been very successful in securing sponsored research in transportation. I am particularly pleased that Dr. One-Jang Jeng, assistant professor of industrial and manufacturing engineering, has joined the NCTIP family of researchers. Dr. Jeng is researching Evaluation of Design Ideas for Prevention of Vehicle Entrapment on Railroad Tracks Due to Improper Left Turns. I am greatly satisfied when a junior faculty member has been motivated and mentored by colleagues in his department to apply his talent to solving transportation problems.

Finally, I am extremely pleased to announce the establishment of the International Intermodal Transportation Center (IITC) at NJIT. We are very excited that the IITC scope fully complements that of NCTIP, and we envision intensive and extensive cooperation between the two USDOT centers in supporting the goals of the University Transportation Centers Program.
**THEME**

The theme of the National Center for Transportation and Industrial Productivity (NCTIP) is "Increasing Productivity through Transportation Improvements." This theme was originally set forth in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and affirmed by New Jersey Institute of Technology (NJIT) in August 1998, after NCTIP was reauthorized in the Transportation Equity Act for the 21st Century (TEA-21).

The theme and mission of the Center support the United States Department of Transportation's (USDOT) strategic goals of *Mobility and Economic Growth* as well as the following outcomes of the National Transportation Science and Technology (NTST) strategy:

- Enhancing goods and freight movement at domestic and international gateways
- Increasing global competitiveness
- Optimizing intermodal passenger and freight transportation systems, and
- Modeling tools for transportation planning, design and operations.

**MISSION STATEMENT**

NCTIP’s mission is to scientifically determine means of increasing the efficiency and productivity of private or public sector entities and industries through transportation improvements by undertaking high quality, multidisciplinary, innovative education and research activities that can withstand rigorous peer review in the areas of freight and passenger movement efficiency, and facility, institutional, and regulatory transportation efficiency.

**CORE VALUES**

To fulfill its mission, NCTIP is strongly committed to the pursuit of knowledge and scientific truth through basic and applied research in the transportation field; a strong belief that the nurturing and mentoring of students who have chosen transportation careers secures the future of the industry by addressing the need for professionals highly trained in the planning, design and operation of increasingly complex transportation systems; the promotion of teamwork between faculty and students in the pursuit of higher societal goals; and the promotion of academic integrity in conducting educational and research functions.
1999 was a good year for the NCTIP Advisory Board. It was the beginning of a renewal of NCTIP and of the Advisory Board. The reconstituted Board was appointed and began the process of becoming thoroughly acquainted with NCTIP's mission and programmatic direction. The new Board is comprised of outstanding individuals representing a cross-section of industry knowledge and experience from academic and scholarly arenas to practitioners with many years of experience in industry and policy domains.

Three standing committees have been established by the Board to provide guidance and recommendations regarding future NCTIP endeavors and activities. The Research Committee is focused on considering alternative research paths for NCTIP that are consistent with its mission and at the same time responsive to the changing needs of the region and its constituent members. The Education Committee is addressing programmatic directions of transportation and logistics curricula at NJIT, as well as within the Center itself. Finally, the Nominating Committee is focused on identifying
additional outstanding candidates for Board membership who will complement existing Board strengths.

An important characteristic of this Board is that it is a "working" Board. Its members provide on-going advice and counsel to the NCTIP Director. As the Board grows, we anticipate significant strengths in NCTIP's position in the transportation community. These will occur not only within the region, but also across the nation, as NCTIP becomes a "go to" Center for meaningful, well-articulated recommendations and advice on how to address many serious transportation and industry productivity issues facing the region and nation.

John Betak
A member of the NJIT faculty since 1990, with a dual appointment to the School of Management and the Interdisciplinary Program in Transportation, Dr. Lazar N. Spasovic is an expert in the areas of freight transportation, business logistics and transportation systems analysis. He has been a leader in NJIT's transportation research and education programs with more than ten years of corporate and academic transportation experience. As director of the UTCP grant, Dr. Spasovic manages all aspects of the NCTIP operation, which includes overall technical and fiscal responsibility and supervision of all center activities. He represents NCTIP and/or the UTC program at external meetings and participates in annual meetings held by USDOT with other UTC directors. He is a member of the Transportation Research Board's Committee on Freight Transportation Planning and Logistics, and the Transportation Research Forum.

Sally O’Malley is responsible for design and implementation of the management processes necessary for collecting and distributing preliminary, ongoing and final information on NCTIP research projects; financial reports; supported student information; technical papers, publications and presentations, and all other areas of UTC-mandated reporting. She has co-written the semi-annual and annual reports. As Technology Transfer Specialist, she disseminates NCTIP research products to the widest possible audiences, via web creation and oversight, and writing,
design and production of publications, newsletters, brochures and presentation materials; manages the annual Student Paper Competition program; represents NCTIP at internal and external meetings and conferences; and collaborates with the Abington Avenue School GAM outreach program.

As a senior research associate employed full time by NCTIP, Dr. Chi Tang has, in addition to his serving as principal or co-principal investigator on several research projects, designed a detailed project database for use in tracking all pertinent details of NCTIP’s research projects, and interfacing them with USDOT web requirements. Still in its shake-down stage, this database, when fully operational, will give ongoing performance measurement information; allow all PIs to directly input timely data, track the submittal of all NJDOT quarterly and USDOT semi annual and annual reports; and monitor student information. The database also incorporates the Center's 5,000-name mailing list. Dr. Tang also monitors the Center's NT-based server system.
FACULTY/PRINCIPAL INVESTIGATORS

Michael Bieber
Associate Professor of Computer and Information Science
Areas of Specialization
Decision Support Systems, Hypertext, Hypermedia

Timothy N. Chang
Associate Professor of Electrical Engineering
Department of Electrical and Computer Engineering
Areas of Specialization:
Traffic Control, Vehicle Control, Fault Tolerant Systems, Sensor and Instrumentation

Sanchoy Das
Associate Professor of Industrial and Manufacturing Engineering
Department of Industrial and Manufacturing Engineering
Areas of Specialization:
Network Optimization, Optimal Resource Allocation, Routing and Scheduling

Janice R. Daniel
Assistant Professor of Civil & Environmental Engineering and Transportation
Department of Civil and Environmental Engineering
Areas of Specialization:
Traffic engineering and operations; adaptive traffic control systems; transportation safety

Steven I-Jy Chien
Assistant Professor of Civil & Environmental Engineering and Transportation
Department of Civil and Environmental Engineering
Areas of Specialization:
Transportation System Analysis, Urban Transportation Planning, Intelligent Transportation Systems, Traffic Simulation, and Intermodal Transportation Service Planning and Design

Harold Deutschman
Professor of Civil and Environmental Engineering
Department of Civil and Environmental Engineering
Areas of Specialization:
Urban Transportation Planning, Mass Transit Systems

All Principal Investigators and professional researchers associated with NCTIP activities are full-time faculty members of an NJIT academic Department or School, or are full-time faculty at another academic institution.
Eugene Golub
Professor of Civil Engineering
Department of Civil and Environmental Engineering
Areas of Specialization:
System Safety, Risk Assessment, Environmental Impact Analysis

Haim Grebel
Professor of Electrical Engineering
Department of Electrical and Computer Engineering
Areas of Specialization:
Smart Infrastructure, Optical Communication and Sensor Systems

Robert Dresnack
Professor of Civil Engineering
Department of Civil and Environmental Engineering
Areas of Specialization:
Environmental Impact Analysis; Surface and Air Traffic Induced Air and Noise Quality Impacts; Water Resources

Kenneth Farmer
Associate Professor of Physics
Director, Microelectronics Research Center
Areas of Specialization:
Physics in metal-insulator-semiconductor device structures and silicon microfabrication, micromachining and fusion bonding.

Joshua Greenfeld
Associate Professor of Civil Engineering
Program Coordinator for Surveying Engineering Technology
Department of Civil and Environmental Engineering
Areas of Specialization:
Geographic Information Systems (GIS), Surveying, Systems Integration, Man-Machine Interface

Edward Dauenheimer
Professor of Civil Engineering
Department of Civil and Environmental Engineering
Areas of Specialization:
Construction Engineering
One-Jang Jeng
Assistant Professor of Industrial and Manufacturing Engineering
Department of Industrial and Manufacturing Engineering
Areas of Specialization:
- Warning Display Designs,
- Usability Testing, Human Factors in Transportation Systems,
- Man-System Interface

Kenneth Lawrence
Professor of Management
School of Management
Areas of Specialization:
- Forecasting, Marketing, Data Analysis

Gary Kleinman
Associate Professor of Accounting
Fairleigh Dickenson University
Areas of Specialization:
- Forecasting, Costing Models

Sandy Moore
Associate Professor of Architecture
New Jersey School of Architecture
Areas of Specialization:
- Case Studies in Community and Urban Design; Introduction to People and their Environment; Environmental Education

Walter Konan
Professor of Civil Engineering
Department of Civil and Environmental Engineering
Areas of Specialization:
- Infrastructure, Remediation and Development; Groundwater Decontamination

Sandy Moor
Associate Professor of Architecture
New Jersey School of Architecture
Areas of Specialization:
- Case Studies in Community and Urban Design; Introduction to People and their Environment; Environmental Education

Jay Meegoda
Associate Professor of Civil and Environmental Engineering
Department of Civil and Environmental Engineering
Areas of Specialization:
- Material testing, microscopic modeling of material behavior; remediation and beneficial use of contaminated soils and sediments; ultrasound to decontaminate dredged sediments.

Kyriacos C. Mouskos
Assistant Professor of Civil and Environmental Engineering and Transportation
Department of Civil and Environmental Engineering
Areas of Specialization:
- Transportation systems analysis, transportation network design, traffic control systems, traffic flow theory, intelligent transportation systems, accident analysis, access management

National Center for Transportation and Industrial Productivity
... productivity improvements through transportation

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M. Ala. Saadeghvaziri
Associate Professor of Civil Engineering
Department of Civil and Environmental Engineering
Structural Engineering
Areas of Specialization:
Structural Engineering, finite element and computational methods, earthquake engineering, structural applications of composite materials

Edip Niver
Associate Professor of Electrical Engineering
Electrical & Computer Engineering
Areas of Specialization:
Antenna engineering: electronic toll collection, applications of microwave engineering to transportation, linear antennas for low frequency asymptotics and wavelet applications, indoor wave propagation, robotic applications

H. Joseph Wen
Associate Professor of Management
School of Management
Areas of Specialization:
Transportation Information System, Geographic Information System (GIS) and Database

Hindy L. Schachter
Professor of Management
School of Management
Areas of Specialization:
Public Administration, Communication, Management of Transportation Agencies

John Tavantzis
Professor of Mathematics
Department of Mathematics
Areas of Specialization:
Dynamical Systems, Numerical Methods, Control Theory, Equilibrium Network Assignment

Louis J. Pignataro
Distinguished Research Professor of Transportation,
Director, TIDE Center;
Program Director, TELUS
Areas of Specialization:
Traffic engineering, transportation planning, economic development, impact of transportation investments.

Naomi Rotter
Professor of Management
School of Management
Areas of Specialization:

National Center for Transportation and Industrial Productivity
... productivity improvements through transportation


**E**ducation

Within the Interdisciplinary Program in Transportation, two new areas have been added to the current three areas of specialization (Transportation Engineering, Transportation Planning and Advanced Transportation Systems and Technology). They are:

- Master's degree in Logistics Engineering and
- Master's degree in Management of Technology, with a transportation/logistics focus.

These options broaden the undergraduate disciplines from which students may be attracted into the transportation program and build in greater flexibility by providing a wider range of elective courses. They spring from an assessment of what a well educated transportation professional should know or be capable of doing. This is the basis from which NCTIP evaluates existing course material to keep pace with technology advances.

The growth of PC-based information technology in solving transportation problems, and the globalization of transportation functions, especially in the private sector, as well as the growing application of the fundamentals of electrical engineering and computer and information science in transportation are in the forefront of NCTIP research. Students participating in this research have the added benefit of designing or using this technology. Also, NJIT as a university supports advanced computer technology at all levels, and has been named the "most wired" public university in the United States by Yahoo! Internet Life magazine for the third consecutive year.

In its quest for the broadest student/faculty base possible, and with the specific intent of balancing the expertise of accomplished, experienced researchers with those new or relatively new to the field of transportation, NCTIP has developed interrelationships with all five educational entities comprising the New Jersey Institute of Technology:

**Industrial and Manufacturing Engineering (IME)**

Participating Faculty: 4, including department chair

**Logistics Engineering**

Within IME, a Master's degree in Logistics Engineering will be offered as of fall 2000. The process of introducing the new degree is quite complex. The program has been accepted by IME, and accepted by the faculty of the Newark College of Engineering in which the Department is housed. It has passed the NJIT Graduate Council and the Committee on Academic Affairs. The program description has been sent to all college and university presidents in New Jersey and their opinions have been sought. A consultant has been engaged to evaluate the program. Upon a positive recommendation, the program will be voted on by the whole faculty body of NJIT and approved.

"As organizations in this era of E-Commerce try to provide better customer service, become more efficient and coordinate the flow of goods produced in multiple facilities world-wide, logistics/supply chain management occupations have become very prominent and are growing in number. The new MS in Logistics program expects to enroll students in fall 2000. It

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National Center for Transportation and Industrial Productivity

*...productivity improvements through transportation*
aims to educate professionals to enter or advance in logistics positions in such industries as transportation carriers of all modes, manufacturers, distributors, and chain store retailers.

Individuals with undergraduate degrees in engineering, the sciences or business may apply. The busy water, air, rail, highway intermodal and distribution facilities in northern New Jersey provide an ideal laboratory for the program. This new program has an applied, quantitative and information technology-rich content and focuses not only on the technical aspects of operating the supply chain, but also on the managerial and coalition-building skills needed for partnerships, and the information systems that control the process. Qualified students may continue their studies for the Ph.D. in transportation or industrial development."

The degree approval process is lengthy and involves a large number of stages. During the 1999-2000 academic year, the approval process moved through the following stages.

- Approval by the Industrial and Manufacturing Engineering Department faculty.
- Approval by the Interdisciplinary Program in Transportation faculty.
- Approval by the Newark College of Engineering faculty.
- Approval by the University Graduate Council
- Preparation of a Program Announcement document (appended).
- Circulation of the Program Announcement to all New Jersey College and University Presidents for comment (no adverse comments received).
- Hiring of an external academic consultant to evaluate the program. The consultant visited NJIT for a day and wrote a complimentary report.

As soon as the fall semester begins, the program will be presented for approval to the entire NJIT faculty. If approved, as is expected, NJIT's Board of Trustees will endorse it in October, and a month later, New Jersey's Council on Higher Education should place the final seal of approval on it, thus allowing NJIT to grant the degree of "Master of Science - Logistics Engineering"

Promotion of the program has already started. It was included with a "pending approval" note in a new brochure describing all MS degrees of the Newark College of Engineering. BSIE graduates and graduating seniors were made aware of it, and discussions were initiated with the New Jersey Roundtable (local chapter) of the Council of Logistics Management to advertise it to their membership.

University resources are already committed for the program. A faculty member has been hired to support it, the library has strengthened its collection in the area, and additional computing resources will soon be in place.

**Faculty Highlights**
Professor Xuili Chao has received an initiation grant "Design and Evaluation of Toll Plaza Systems." This project is studying the evaluation of different designs of toll plazas and using it to search for the
optimal design, including the number of each type of tool booths, relative position of the toll booths, and how to dynamically change them during the day and the week. It is our expectation that this work will result in an NSF proposal.

**Civil and Environmental Engineering**

*Participating Faculty: 12*

NCTIP and CEE have a close collegial relationship, reflected in the numerous NCTIP-funded research projects in which CEE faculty are routinely involved. These projects are showcased or listed throughout this report.

Three core members of the Interdisciplinary Program in Transportation, Drs. Steven I. Chien, Janice Daniel, and Kyriacos C. Mouskos, are members of the Civil and environmental engineering faculty. An additional nine CEE faculty participate in NCTIP research projects.

**New Undergraduate Course Offerings**

Dr. Steven Chien developed and will teach an undergraduate course for senior students, "CE495: Civil Engineering Design II - Transportation." This course will be offered as of fall 2000.

Drs. Chien and Daniel are in the process of designing a second undergraduate course, "Introduction to Transportation Problems," which will expand the undergraduate offerings available within CEE.

Dr. Chien attended a workshop hosted by the Federal Highway Administration for the introduction of TSIS 5.0, which will be used extensively in his course "Public Transportation Operations and Technology."

**Faculty Highlights**

In addition to being PI on "Congestion Strategies for Adaptive Traffic Signal Systems," Dr. Janice Daniel has recently received two prestigious NSF awards, "Dynamic Flow Control for Urban Freight Movement," and "Optimization and Control of Freight Movement and Roadway Transport Systems," along with an NJDOT Governor's Challenge Grant.

Dr. Steven Chien has received notice of an award to research "South Jersey Real-Time Motorist Information System." This project will be initiated in September 2000.

Dr. Jay Meegoda has been appointed Principal Investigator for the NJDOT project, "Data Research - Materials Laboratory and Information System." This project is to design a computerized Laboratory Information System (LIMS), which will reduce paper-workloads significantly and provide the capability to organize relevant data rapidly.

The Summer Transportation Institute for high school students from the greater Newark area is mentored by Dr. Harold Deutschman. Dr. Deutschman has also contracted with the Patterson School District's Garrett A. Morgan Academy for program activities that will closely ally the new high school and NJIT.
Scholarship
A scholarship supporting undergraduate students in the Department of Civil and Environmental Engineering was announced in late spring 2000. Evaluation of the qualifications for applicants will be conducted in fall 2000.

School of Management
Participating Faculty: 5, including NCTIP Director

Master’s Degree in Management of Technology
Recognizing that individuals working in public and private sector organizations have very diverse responsibilities and educational backgrounds, ranging from human resources to operations research, and that as these professionals develop and move up within an organizational structure and begin to carry out more challenging management functions, they need to acquire new sets of skills, a Master's degree in Management of Technology, with a transportation/logistics focus, is being offered through the School of Management as of fall 2000. The School of Management at NJIT has been recognized as one of only four business schools in New Jersey accredited by AACS - The International Association for Management Education, the top national accreditation body for management education. Representative courses that relate to transportation are:

- MRKT 632 Marketing Strategy for Technology Based Organizations
- MGMT 710 Business Forecasting Methods
- TRAN 603 Introduction to Urban Transportation Planning
- TRAN 740 Management of Transportation Carriers
- TRAN 765 Multi-Level Freight Transportation System Analysis

Faculty Highlights
The faculty of the School of Management has played a significant role in NCTIP research. In addition to Dr. Spasovic, Drs. Kenneth D. Lawrence, Naomi Rotter, Hindy L. Schachter and H. Joseph Wen have significant histories as PIs for NCTIP projects. Dr. Rotter serves on the NCTIP Advisory Board and chairs the Research Subcommittee.

Dr. Joseph Wen is assisting the North Jersey Transportation Planning Authority, a local MPO, in the development of a MIS system for integrating planning functions with the capital management and the transportation improvement program.

Computer and Information Science
Participating Faculty: 1

Dr. Michael Bieber has been involved in two research projects with NCTIP and continues to use the technology gained in current research. Bieber is also Director of the Hypermedia Information Systems Research Lab and held the JOVE faculty fellowship for Automation Technology Section at NASA's Goddard Space Flight Center from 1994-1999.

Students from CIS have assisted with highly technical transportation research projects. In addition to the student mentioned under Honors College (above) another CIS major has recently been hired to serve as an assistant for the NCTIP webmaster.
ELECTRICAL AND COMPUTER ENGINEERING
Participating Faculty: 3

Faculty Involvement
Dr. Edip Niver has been involved in various transportation-related projects even predating NCTIP. Niver was recently awarded an NCTIP/NJDOT project for his proposed "Highway Advisory Radio (HAR) Systems."

Dr. Timothy Chang, whose expertise is in control systems, researched the recently completed "Fault Tolerant Traffic Control Systems."

Dr. Haim Grebel, who is also on the faculty of NJIT's physics department, is director of the Optoelectronics and Solid-State Circuits Research at the Electronic Imaging Center, and is associated with the NSI-funded Multi-Disciplinary Optical Science and Engineering Program. Dr. Grebel researched "Smart Sensors for Freight Movement."

MATHEMATICAL SCIENCES
Participating Faculty: 2

Faculty Highlights
Dr. John Tavantzis has been involved in advising/teaching Ph.D. students on the sophisticated mathematics required for several transportation research projects and for their dissertations. Dr. Tavantzis is Director of the Engineering and Life Sciences program, and is an advisor to Phi Eta Sigma.

Dr. David Bernstein, currently on the faculty of James Madison University co-advised, with Dr. Spasovic, Dr. Mei Chen, a 1999 graduate of the NCTIP flagship doctoral program in transportation. Dr. Bernstein was also co-PI of "Developing an Integrated Congestion Pricing and Traveler Information System," an NCTIP project.

PHYSICS
Participating Faculty: 1

Faculty Highlights
Dr. Kenneth R. Farmer, Director of the Microelectronics Research Center at NJIT, has worked with NCTIP as co-PI with Dr. Haim Grebel on a fiber optics transportation project "Smart Sensors for Freight Movement."

NEW JERSEY SCHOOL OF ARCHITECTURE
Participating Faculty: 2

Over the past year, NCTIP has collaborated with the New Jersey School of Architecture at NJIT on several exciting projects that focus on Newark, New Jersey. Two of these projects, an educational mentoring program and a technology transfer initiative will have direct and measurable input on our local community.

An elective class within the New Jersey School of Architecture, ARCH 312 - Architectural Education

National Center for Transportation and Industrial Productivity  
... productivity improvements through transportation
Faculty Highlights
Dr. Sandy Moore, who teaches the above course, has been working closely with the Abington Avenue School students for some years. Dr. Moore is designing a process to extend the mentoring program to other Newark and area schools.

Darius Solluhub, Associate Director of the Masters in Infrastructure Planning graduate program has just completed the "Riverside Transit Village" project. The project presented a plan to incorporate the proposed Trenton-Camden light rail service in South Jersey within the fabric of the town of Riverside on the Delaware River.

NJIT's Center for Environmental Engineering and Science (CEES)
CEES is nationally known for its Hazardous Substance Management Research Center, Emissions Reduction Research Center, the EPA Northeast Hazardous Substance Research Center, and the New Jersey Technical Assistance Program for Industrial Pollution. NCTIP frequently uses CEES expertise and resources in carrying out environmental research. For example, CEES is an excellent resource for modeling air pollution and estimating environmental impacts of transportation improvement projects. Potential collaborative research areas include particulate and vapor phase pollutants, and pollution source apportioning between mobile (transportation-related) and stationary sources pollution.

Other potential research areas include an industry-university collaborative research initiative in engineering management of hazardous waste, the impact of recycling on the demand for transportation service, and the environmental and economic revitalization of Brownfields.

This effort is directly connected to the NJIT/NJTPA Brownfields Study.

Albert Dorman Honors College
Student Support
NCTIP has initiated a mutual relationship with the Albert Dorman Honors College, which exists to help exceptional students achieve their full potential. To date, two students have been supported by NCTIP:

A computer information systems (CIS) major worked on NJDOT-sponsored research dealing with a multi-modal freight transportation database development and analysis and helped develop a web based database showing flows of 34 standard transportation commodity codes between 21 New Jersey counties and selected US regions by mode of transportation (truck, rail, air, water/other). The student developed a web site for the database on a Windows NT server, and maintained the site, http://freight.njit.edu, until his graduation with a perfect 4.0 average. He is currently employed by El Taller Collaborativo, a transportation consulting firm, and will continue his Masters studies part time.
An Honors College freshman and computer engineering major has been working with NCTIP assisting faculty with transportation simulation and highway capacity software. The student is participating in a transportation research project dealing with the material information system for NJDOT. The project, described in detail in the research section, will define performance evaluation measures; analyze relationships between testing data and field performances and generate summary reports form materials testing. In addition, he assists with NCTIP’s NT network system and web site.

The current profile of the College is 462 Honors scholars; average combined SAT score over 1300; 45% with a GPA over 3.5%; 26% women. 110 freshmen enrolled in the fall 1999 class -- 70% ranked in the top 10% of their high school class; over 65% live in residence halls; and 14% are enrolled in pre-med/pre-dental programs.

**Collaborative Doctoral Program**

NJT has expanded its unique Collaborative Doctorate to include public sector as well as private sector employees. Designed for mid-career engineers, executives, scientists, military personnel and educators who want to pursue a Ph.D. while continuing full-time employment, the requirements are the same high quality as for other NJIT doctoral programs, but a greater flexibility allows participants to draw on the combined expertise and resources of both NJIT and their current employers. Students must be recommended by employers who commit themselves to a proposed area of research in concert with the dissertation committee. In addition, the employer must suggest a researcher to serve on the student’s Ph.D. dissertation committee.

The Collaborative Doctorate Program has won praise from many students such as U.S. Army Major John Lacontora, a doctoral student in Industrial Engineering, who enrolled in the program a year ago. Lacontora, who is director of the Army National Guard’s Distributive Technologies Innovation Center at Fort Dix, asserts the NJIT Collaborative Doctorate Program has enabled him to "...achieve goals that otherwise would have been unachievable. The program is an excellent opportunity to excel personally and professionally. I would tell anyone who is interested in pursuing a doctoral degree to enroll."

In addition to transportation, the Collaborative Doctorate Program is available in biomedical informatics (joint degree with University of Medicine and Dentistry of New Jersey); chemical engineering; civil engineering; computer engineering; computer science; electrical engineering; environmental engineering; environmental science (joint degree with Rutgers-Newark); industrial engineering; information systems; materials science and engineering; mechanical engineering; and physics (joint degree with Rutgers-Newark).

**Internal Recruitment of Students and Faculty**

**NCTIP Seminar Series**

Held within the framework of the academic semester to enable student attendance, the NCTIP Seminar Series attracts students and faculty from multiple disciplines within the university. Seminars are advertised university-wide via brochures, flyers and e-mail bulletins. Faculty from various departments encourage their students to attend related seminars.

A detailed presentation of NCTIP and its resources was given to the School of Management Faculty by Dr. Lazar N. Spasovic in December 1999. As a direct result of this presentation, three faculty mem-
Two professors from the New Jersey School of Architecture have responded to overtures from NCTIP this year. Dr. Sandy Moore is working in conjunction with NCTIP faculty to bring her mentoring program fully within the Garrett A. Morgan guidelines. Darius Sollohub has submitted a proposal for a study called "E-Stations in Newark," an innovative concept for an enclosed bus shelter that will bring intelligent transportation systems, e-commerce, a portal to the internet, and other state-of-the-art services to neighborhoods often lacking accessibility to these goods and services. NCTIP will co-fund this project.

Other newly responsive faculty are listed above.

The NCTIP newsletter is distributed to all university faculty to keep them apprised of the resources of the Center.

"Research at NCTIP: Into the New Millenium" was also distributed to all university faculty as a demonstration of the scope of disciplines transportation research encompasses.

Transportation and transportation-related material are regularly submitted for inclusion in the numerous internal and external NJIT publications.

Faculty and students from the New Jersey School of Architecture are newly participating in NCTIP research.

General internal and external student body awareness of Transportation as a career is always an underlying theme in NCTIP planning, e.g., initiating a campus-wide search for a new NCTIP logo.

**NCTIP Logo Contest**

As part of a concerted program of internal publicity to bring transportation as a profession to the awareness of the undergraduate student body, a contest for a new center logo was held. The "NCTIP Logo Contest" was advertised widely throughout the campus and in the university newsletter, and brought dozens of responses. Entrants were referred to the NCTIP web site for background information, thereby requiring a study of the programs. An award of $500 was offered. A faculty and staff committee judged the submittals, and a design submitted by Y. Zhang, a transportation Masters student, was chosen.
GARRETT A. MORGAN PROGRAM

THE SUMMER TRANSPORTATION INSTITUTE

NCTIP has been supporting a remarkable effort on the part of Dr. Harold Deutschman to involve Greater Newark area students in the world of transportation. Five full days a week for three weeks during the summer, approximately 50 high school students have been commuting to NJIT. 10th and 11th graders, half boys and half girls from predominantly African-American and Hispanic backgrounds are introduced to the world of transportation, including highways and public transportation. Problems and potential solutions are emphasized. The potentials of new technology and the interrelationship of transportation with the environment, land use, the economy, jobs and safety are discussed.

During Summer 1999, students worked on and completed a ramp metering problem for a 10 mile highway, optimizing the flow without congestion, and computing the signal timing for each entrance ramp light. Their results were given in oral and written presentations. A timetable for a 10-station trolley system, similar to the Newark City Subway was designed. Given acceleration and deceleration rates, and distances between stations, the students optimized the number of trolleys needed for a two-hour morning peak period, and also produced a trolley time schedule with a minimum of one local trolley per hour and one express per hour, per station. For Design, they were given a number of plot plans with contours, and zoning requirements, and they designed, to scale, a development, including a residential complex, a fast food restaurant, and a shopping center, complete with internal road systems and parking. They also had sessions in communications and computer science.

The program is directed by Dr. Harold Deutschman, Professor of Civil and Environmental Engineering, who teaches the Transportation Planning section of the program. Mr. Joseph Staiger, Traffic and Transportation Consultant and Adjunct Professor of Civil Engineering, teaches the Design section of the program.

Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring

Dr. Deutschman was among the ten individuals (and five institutions) who received the 1999 Award, administered and funded through the National Science Foundation (NSF). The award cited: "......a distinguished record over the past 29 years initiating, directing and teaching pre-college programs, and mentoring students to enter college and pursue careers in science, mathematics and engineering. His summer engineering program for 9th and 10th graders, started in 1970, has run continuously for 29 years. He has mentored over 2,500 students, averaging 100 per year, who are predominately underrepresented minority students from the Greater Newark area. More than 95% of Deutschman's mentees have enrolled in college and 70% have majored in science, mathematics, or engineering." "No personal influence is as powerful, long-lasting, and positive as that of a superlative mentor. The mentors receiving this award...are a true national resource who play a key role in defining the quality of our nation's future human resources in science, mathematics, technology and engineering," said NSF director Rita Colwell.

On March 16, 2000 Dr. Deutschman also received the Educator of the Year award from the Consulting Engineering Council of New Jersey.
Approximately 50 10th and 11th graders from the greater Newark area spend five days a week for three full weeks during the summer commuting to NJIT.

Students are introduced to the world of transportation, including highways and public transportation. Problems and potential solutions are emphasized. The potentials of new technology and the interrelationship of transportation with the environment, land use, the economy, jobs and safety are discussed.
Patterson School District Garrett A. Morgan Academy

Since the initial contact was made during the TransAction 2000 conference in Atlantic City, NJ in November 1999, NJIT’s Professor Harold Deutschman been a resource to the Patterson School District in the planning of their Garrett A. Morgan transportation program.

The New Jersey Community Development Corp. (NJCDC), in conjunction with the School System of the City of Paterson, has set up a new high school with Transportation and Technology as the theme. This school, named the Garrett A. Morgan Academy, will enroll 30 Freshmen in September 2000, and then continue with 30 new students each year for a steady state enrollment of 120 students. Under a contract with NJIT, Dr. Deutschman will play the following role:

- Work with the Academy’s transportation specialists and other members of the staff to develop the Garrett A. Morgan “Freshman Studio” curriculum, which will be aligned to meet the core curriculum standards.

- Train Garrett A. Morgan Academy staff to utilize a series of transportation-related problem sets for student instruction, as well as working with staff to create a cross-curricular interdisciplinary program. As such, Dr. Deutschman will teach several Garrett A. Morgan studio classes, meet with Garrett A. Morgan staff on a regular basis, and work to bring outside resources into the classroom.

- Help to arrange and facilitate student field trips for the Garrett A. Morgan Academy to examine different aspects of the transportation field.

- Devise a syllabus and a budget for supplies in conjunction with the Garrett A. Morgan transportation specialist for the freshman class.

Abington Avenue School G&T Program

College student sponsors from an undergraduate elective course within the New Jersey School of Architecture spend the past semester challenging students from the NCTIP-sponsored Gifted and Talented Program of Newark’s Abington school to an awareness of transportation, architecture, engineering, technology, etc., as fields of study. Mentors served as role models, and participated in field trips and a glider contest, which required design and construction of a vehicle to carry and egg unbroken from the top of NCTIP’s Tiernan Hall.

The students have designed and prepared a video documenting their studies, from the initial glider project through model building, tours of the nearby Port of Newark/Elizabeth and Newark International Airport, and a transportation t-shirt contest. They wrote essays on their experience, which were made into a booklet, and are preparing a web site. The video will be sent to USDOT under separate cover, and will be available on request to other interested parties.

The initial Gifted and Talented program was established at NJIT in 1994 as part of the Pre-College consortium. Under the guidance of Dr. Sandy Moore of the NJ School of Architecture, students were exposed
to a variety of career options. The program has evolved to include a transportation valence, providing opportunities for the children from the transportation-intensive Newark area to become acquainted with the virtual laboratory in which they live.

Students worked in teams designing T-Shirts with transportation themes. Here, Kavita, Miguel and Allyson collaborate on their entry.

Above: Students and mentors about to learn the aerodynamic stability of their glider contest entries as they are dropped from the top of Tiernan Hall on the NJIT Campus.

Miguel, Francois, Allyson, and Kavita with their model just before “fly outs.”

Professor Moore addresses a gathering of Abington G&T students and their college student sponsors as they prepare for one of their several field trips to the Newark/Elizabeth port/airport area.
Janice Daniel, an assistant professor in the department of civil and environmental engineering, has joined NJIT's core transportation faculty, where she has, since her appointment in the fall of 1999, researched Mobility and the Costs of Congestion in New Jersey. Since arriving at NJIT she has been awarded two National Science Foundation (NSF) grants: Dynamic Flow Control For Urban Freight Movement which deals with the development of a control system for intermodal freight transportation; and Optimization and Control of Freight Movement and Roadway Transport Systems. Finally, she has also received an NJDOT Challenge Award for Congestion Strategies for Adaptive Traffic Control Systems.

Dr. Daniel's research interests are traffic engineering and operations, adaptive traffic control systems and transportation safety. She has researched work zone safety and congestion strategies and the development of a multimodal-planning tool that assesses the air quality impacts of ramp metering, and provided speed reduction strategies for highway work zones for the Georgia Department of Transportation.

Prior to joining NJIT, Daniel was on the faculty in the School of Civil and Environmental Engineering at Georgia Institute of Technology, where she taught graduate courses in traffic engineering, traffic flow theory, and highway capacity methods. She has worked in the Traffic Engineering Division of the Port Authority of New York and New Jersey and as a transportation engineer for Philip Habib and Associates, a New York City consulting firm. Daniel is a member of the Transportation Research Board's (TRB) Operational Effects of Geometrics Committee and serves on the arterial and interchange subcommittee for the Highway Capacity and Quality of Service Committee.

In 1995, Daniel received her Ph.D. in Civil Engineering from Texas A&M University, where her dissertation involved modeling delays for arterial signal systems. She received her M.S. in Transportation Planning and Engineering from Polytechnic University, in 1989, and a B.S.E. in Civil Engineering from Princeton University, in 1985.
Athanassios K. Bladikas, who has been a core transportation faculty member since NCTIP’s inception, has been confirmed both as chair of the industrial and manufacturing engineering department and as director of the interdisciplinary program in transportation. Dr. Bladikas has been the guiding force behind the new Masters program in logistics engineering. He received his Ph.D. from Polytechnic Institute of New York in 1983. His fields of expertise include transportation systems analysis and modeling, intermodal network analysis, geographic information systems, public transportation planning.

John Schuring, who as acting chair of the department of civil and environmental engineering (CEE) has partnered with NCTIP in NJDOT research projects and supported the 12 members of his department who have participated in NCTIP research, has been appointed chair of CEE.

Dr. Schuring received his Ph.D. from Stevens Institute of Technology in 1987. His research interests are in-situ remediation of contaminated soil and groundwater, including development of a new patented soil treatment process known as pneumatic fracturing which has advanced to full-scale commercialization; reconnaissance site evaluation using engineering geomorphology; and deep foundations. He is currently involved with integrating pneumatic fracturing with other in-situ technologies including bioremediation, reactive dechlorination, vitrification, and ultrasound.

Maria P. Boilé, who received the second Ph.D. in transportation granted by NJIT in 1995, returned to NJIT as a visiting assistant professor with the department of Industrial and Manufacturing Engineering and the National Center for Transportation and Industrial Productivity for the period January -August 2000. Professor Boilé is currently on junior faculty leave from Lafayette College, where she is an assistant professor of transportation engineering. Her major areas of interest are in network optimization, intermodal and multi-modal systems analysis for both passenger and freight transport, public transportation, intelligent transportation systems, geographic information systems applications in transportation, economic and environmental impacts of transportation policies. Her work has been published in leading academic journals and in conference proceedings. She is a member of the NCTIP Advisory Board.
One-Jang Jeng, an assistant professor of industrial and manufacturing engineering, is the newest addition to the NCTIP principal investigator family. Dr. Jeng, who received his Ph.D. from the University of Wisconsin-Madison in 1994 joined NJIT in September 1999. His current research project, Human Factors Evaluation of Design Ideas for Prevention of Vehicle Entrapment on Railroad Tracks Due to Improper Left Turns will examine the problem of vehicle entrapment at grade crossings due to attempts to make left turns onto roadways parallel to the railroad. Professor Jeng is conducting research on developing an evaluation system for operator performance and task design, setting up a microcomputer with data acquisition I/O interface, software, and hardware. The system could generate simulated work tasks and measure several operator performance parameters simultaneously, such as strength, speed and accuracy. System applications include work design measurement, consumer product design evaluation, and performance evaluation of devices and programs used for rehabilitation. Jeng's research interests are in the areas of occupational safety and health, industrial ergonomics, and human factors.

Chi Tang, a senior research associate with NCTIP who has numerous projects to his credit, including Project Monitoring and Research Performance Tracking System (ProMPTS) (see page 60) and CAPAS, is currently co-PI for an NJDOT project: Data Research - Materials Laboratory Information System, a computerized Laboratory Information System (LIMS), (see page 77) which will significantly reduce paper workloads and provide the capability of rapid data organization. Dr. Tang has successfully developed and implemented a web-based project tracking system for NCTIP, and is working with the university to develop a research productivity system based on ProMPTS. Dr. Tang received his Ph.D. from Rutgers University in 1995 in Operations Research.

Dr. Jian Yang, who receives his Ph.D. in Management Science from the Business School of the University of Texas at Austin in August 2000, will join the NJIT faculty as an assistant professor of logistics and industrial engineering. Dr. Yang's research will be in supply chain management with emphases on logistics and inventory control. He has had papers accepted by journals such as Computers and Operations Research, Combinatorial Optimization, and Transportation Research Record.
NEW DOCTORAL DEGREES GRANTED
Four Ph.D. degrees in Transportation have been granted to NCTIP-supported students during the 1999-2000 academic year:

Mei Chen, recipient of the 1999 Helene Overly Graduate Scholarship from the Greater New York Chapter of Women's Transportation Seminar, and a matching award from the Region II University Transportation Research Center (City College of NY), also received the Certificate of Achievement from the Graduate Student Association of NJIT in 1996.

Dr. Chen developed a sophisticated methodology of network toll design that provides valuable decision support to policymakers. Testing on an urban roadway network has shown that the implementation of her methodology can effectively reduce the total vehicle travel time by placing tolls on only a very small number of roadway links, which makes the tolling scheme politically viable. This is an important breakthrough in the design of congestion pricing policy, and has been recognized by her peers in the transportation research community as a development with a great potential for nationwide application.

Dr. Chen is currently employed as a research associate with NJIT's Transportation Information and Decision Engineering (TIDE) Center. Her dissertation is titled: A Methodology for Solving the Network Toll Design Problem.

M. Shoaib Chowdhury, recipient of the George Krambles Transit Scholarship in 1998, received his Ph.D. in May 2000. Dr. Chowdhury is currently employed by Parsons Brinckerhoff. His thesis is titled: Intermodal Transit System Coordination with Dynamic Vehicle Dispatching.

Yuqing Ding, recipient of George Krambles Transit Scholarship in 1999, received her degree in May 2000. Her thesis is titled: Development and Application of Dynamic Models for Predicting Transit Arrival Times. is currently employed by Parsons Brinckerhoff.
**Wu Sun**, currently employed as a research associate with NJIT's Transportation Information and Decision Engineering (TIDE) Center, has completed an additional Master's Degree in Computer Science since receiving his Ph.D. in 1999. Dr. Sun's thesis is titled *Optimization of Urban Traffic Control Strategies by a Network Design Model*.

**STUDENT HIGHLIGHTS**

Significant contributions to the transportation field have already been made by doctoral students:

**Alexios Sideris**, who received a $1,000 scholarship from the Council of Logistics Management's New Jersey Roundtable in 1998. Sideris is the person behind the research efforts in the area of seamless land and intermodal port interface, and is currently involved in planning container operations and land access at the terminal operator at the Port of Newark/Elizabeth. He was instrumental in the study on "Mobility and the Costs of Congestion in New Jersey." Alex will present a paper at the upcoming Transportation Research Forum meeting in Annapolis, Maryland titled “Operational Planning of Intermodal Marine Terminals.”

**Jakub Rowinski** was one of two New Jersey students selected by the New Jersey Roundtable of the Council of Logistics Management to attend the organization's annual meeting in 1999 in Toronto. During his studies at NJIT, he has done extensive research in the area of multi-modal freight transportation planning. Rowinski was also involved with the study on "Mobility and the Costs of Congestion in New Jersey," and will also present a paper at the Transportation Research Forum meeting in Annapolis, Maryland titled “"A Multi-Commodity, Multi-Class Generalized Cost User Equilibrium Assignment Model".”

**Cecilia Kelnhofer-Feeley**, a Ph.D. candidate in Transportation, and presidential fellow, was featured in the Winter 2000 issue of *InTransition* (see Appendix) in a well-received article on Women in
Transportation. Kelnhofer-Feeley’s undergraduate degree was in Science, Technology and Society (1995), and she has an MS in Transportation (1998). She envisions herself downroad teaching in the transportation field. She has submitted a paper entitled “A Methodology for Evaluating of School Bus Routing: A Case Study of Riverdale, New Jersey,” to the 80th Annual Meeting of the Transportation Research Board.

Kenrick C. Layne came to NJIT from a ten year career in the construction industry, during which time he received his undergraduate degree in Civil Engineering from the University of Guyana in 1994. As part of his bachelor’s degree requirements, he was involved in research on atmospheric pollution. Since his arrival in the United States, Mr. Layne has pursued studies in environmental engineering towards a career in transportation. He will complete his M.S. studies in Transportation Engineering in December 2000, and begin his Ph.D. studies in the fall of 2001, with a specific interest in transportation management. His current research involves the application of automatic control theory to freight transportation, especially in New Jersey. He has spent a semester working on an NSF-sponsored project to develop a control strategy for freight movement and used the simulation model CORSIM to simulate the roadways at Port Newark and Elizabeth. Having worked in almost every capacity within the construction industry, Layne looks forward to being able to apply that experience to the field of transportation.

**Student Clubs**

For more than a half-decade, the Transportation Students' Clubs at NJIT have been an integral complement to the academic graduate program in Transportation. From their inauguration, the three active clubs have been committed to providing new and continuing students alike with a highly praised, formal forum for professional development, vivid academic enhancement and social interaction.

The clubs are chartered under the Graduate Student Association at NJIT and budgeted on an annual basis from the graduate student community. Despite their prominent affiliation to the academic program in Transportation, activities are open to all interested members of the academic community. Membership is open to all students enrolled at NJIT academic programs. However, voting power on all issues is granted to graduate student members exclusively. The club officers are elected each September for an annual term and are responsible to observe the prevailing rules and regulations of GSA.

The Institute of Transportation Engineers (ITE) is the oldest student chapter, established in 1993. The student members can benefit from becoming part of the largest and most recognized professional national organization in the field. For a minimal fee the members are entitled to an annual subscription to the ITE Journal, a monthly publication with interesting links and articles for transportation professionals. In addition members get discounts to the numerous publications offered by ITE and are eligible for student registration to most meetings and seminars organized either at the national or the local NY/NJ chapter. In many occasions these events are essential in maintaining professional con-
tacts, rejoining with recent alumni, and detecting career opportunities.

The ITE chapter, under president Jakub Rowinski, organized several events during the 1999-2000 academic year. Among them were visits to Port Newark/Elizabeth and the Traffic Management Center in Queens, New York. Invited speakers included Dr. Steven Polzin, Director of the National Urban Transit Institute and Mr. William Adzimahe from Maryland State Highway Administration.

The Intelligent Transportation Society (ITS) of America student chapter was set forth on the same path of success just two years later. The student chapter is one of the first to be inducted at the national level by this prominent organization that seeks to inform professionals on how to address concurrent problems and to improve transportation operations by employing efficiently applied technological solutions. One important membership benefit is the unrestricted access to the biggest and most diverse online database of intelligent transportation systems solutions and ideas worldwide. In addition, members enjoy discount student registration fees to the organization annual meeting and other events.

In the past year, the ITS student chapter, under president Ghulam Ashar, organized several seminars and a field trip to TRANSCOM's headquarters in Jersey City. ITS early deployment plan for the City of Newark was presented by Dr. Bahman Izadmehr. Mr. Timothy Teen presented Tele-Parking, Inc., a wireless parking payment system aimed at replacing the traditional parking meters.

The Women Transportation Seminar (WTS) student chapter was organized in 1997. Within a year it was the first one to be officially inducted by the Greater NY/NJ Chapter cutting new ground at the national level. From its beginning the club has focused on maintaining contacts with successful professionals in the New York metropolitan area that can help the students in realizing the importance of leadership and professional skills as a prerequisite for an interesting career in the field. The members are invited regularly to the monthly meetings of the Greater NY/NJ Chapter. Cecilia Kelnhofer-Feeley, current president of the club, was honored with the graduate scholarship award in 1998 for her academic achievements and leadership efforts in establishing the club.

During the past academic year the WTS chapter held three seminars. The first seminar involved understanding the transportation planning process by Lucie Thiebold, Senior Planner at North Jersey Transportation Planning Association. The second was a resume writing seminar given by Andrea Nunez, the WTS Greater NY/NJ Student Affairs Chair. The final seminar was a demonstration of the autoscope using a new video imaging system held by Mark Hammer of Signal Services Inc.

Literature on the graduate studies programs available at NJIT is provided during student club meetings. Cecilia Kelnhofer-Feeley has also written articles for potential inclusion in the club newsletters.
In addition, the student organizations sponsored a trip to the 79 Annual Meeting of the TRB in Washington DC and hosted an open house.

**EXTERNAL ACADEMIC COLLABORATION**

Initial discussions have taken place with York College of the City University of New York to explore the potential for collaborative programs between York and NJIT. With the facilitation of Professor Sandy Moore, Dr. Charles Kidd, president of York College, has visited NCTIP to discuss the mutual benefits of such collaboration. York, with a high percentage of more mature students in a related inner city, transportation-rich environment, is a potential source of students for the interdisciplinary program in transportation.

And, reflecting her awareness that many greater Newark area minority students attend North Carolina AT&T for undergraduate studies, Dr. Moore has also initiated talks with that institution with the intention of attracting their graduates 'back home' for graduate studies at NJIT.

Dr. Moore also arranged for the School of Architecture to co-sponsor a nationally prominent architect, Carol R. Johnson, to speak on the topic of Landscape Value and Transportation at the NCTIPSeminar Series.

**Outreach to Community colleges**

NJT has scheduled a meeting with the Assistant Superintendent of Gloucester County Institute of Technology (GCIT). GCIT has two academic programs: a Transportation Academy and the Academy of Business and Computers. An educational partner with NJIT in the Bergen Tech-Prep, GCIT has its own SY01 Tech Prep application, which has monies to support the involvement of an engineering university. GCIT wishes to diversify its curriculum to include a pre-engineering track, and is seeking direction.

NCTIP involvement may be in the areas of providing faculty for analyses and to enhance GCTI’s Project Lead The Way material. The Center can also work with GCTI to identify course material and courses needed for articulation agreements from this program to a comparable 4 year program at NJIT; and work with GCTI students and teachers to coordinate industry-based activities. Students from the Transportation Academy (pre-engineering program) may potentially articulate into the Mechanical Engineering Program or into the Business school.

**NCTIP Advanced Institute for Transportation Education**

Qualified students employees of the state and regional public transportation agencies (e.g., NJDOT, NJ Transit, New York Metropolitan Transportation Authority, Port Authority of New York and New Jersey) are eligible for tuition grants from NCTIP to pursue graduate degrees in transportation. A student must matriculate into a graduate program and subscribe to the transportation curriculum in transportation-related fields of engineering and planning. These grants will cover the cost of study. To help students focus on their academic pursuits, participating employers would release their employees-students from work obligations one day a week. The employee salary will be considered as in-kind match for the NCTIP.
**SATELLITE CAMPUSES**

NJIT offers transportation courses on location at NJDOT’s main office in Trenton. Students can complete the entire program without coming to NJIT’s main campus in Newark. The Trenton location primarily serves students who are NJDOT employees; however, recently there has been an increase in students from the consulting community in Central and South Jersey.

The Interdisciplinary Program in Transportation is offering the following courses in Trenton:

- Fall 2000   Traffic Safety
- Spring 2001 Introduction to Urban Transportation Planning

In addition to the transportation courses, students can take courses in engineering management, environmental engineering and computer science, and may also take courses via distance learning and Internet.

**MENTORING**

The new International Intermodal Transportation Center at NJIT has been since its recent initiation an ideal setting for student mentoring. Multiple committees and subcommittees are involved in policy making, and interested students are part of this process. They have opportunities to see and hear the greater picture involving the three area ports: air, sea and rail, and their interconnectedness. Subcommittees to date have discussed issues of dredging, landside access/use, rail and highway capacity, drayage, global cargo flows, ‘green port’ concepts, land use in the vicinity of the ports, costs of doing business in the port area, labor issues, and the economic revitalization of brownfields. Dr. Spasovic is also chair of the Port Issues Subcommittee of the Advisory Council on Port Competitiveness.

Maher Terminals, a long-time supporter of NCTIP, continues to mentor students, allowing access to its facilities and programs. Roger Nortillo, Executive Vice President of Maher Terminals, is a member of the Advisory Board. Brian Maher, President, is a member of NJIT’s Board of Overseers, and has made significant donations to the university for use in inner city educational programs.

The Nominations subcommittee of the Advisory Board has taken up the issue of broader mentoring opportunities.

**UTC STUDENT AWARD PROGRAM**

NCTIP’s 1999 Student of the Year, Lida Mazaheri, who received her M.S. in Transportation in 1998, is returning to NJIT this fall as a Ph.D. student. For the past two years Ms. Mazahari has been employed as a traffic engineer with the Port Authority of New York and New Jersey. More recently she has been in charge of New York’s LaGuardia Airport, responsible for ensuring the safe and orderly flow of vehicular and non-vehicular traffic throughout the airport on a daily basis.
A presentation was made to the Morris County Leadership program in November 1999 by Dr. Lazar N. Spasovic. Entitled "Critical Transportation Issues and Vision - 2000 to 2020," its goal was to challenge new leaders in one of New Jersey's most populous county with a variety of modes and pressing public policy issues on the kind of trends and challenges that the program attendees will be facing in their professional careers. Congestion and its impacts; locational and travel choices of the baby and post-baby boomers; the impact of information technology on transportation; and stable sources of funding for state transportation improvements were the topics covered in the presentation, which can be found on the in its entirety at [http://transportation.njit.edu/NCTIP](http://transportation.njit.edu/NCTIP).

Newspaper headlines and wide TV and radio coverage of the NCTIP research project on the economic impacts of traffic congestion followed a press conference held by the New Jersey Alliance for Action at the State House in Trenton to formally release the project results. Dr. Spasovic was interviewed by local Channel 12, and all major area TV stations covered the conference. On radio, people from New Jersey, New York and Philadelphia were treated to a variety of morning commentary from the study. Eleven area newspapers with a combined circulation of 948,000 featured articles referencing the study, as did USA Today (2.3M) and both the New York Times' Sunday (1.1 M) and weekly (1.7M) sections.

Constructioneering magazine carried "Report Confirms the Obvious" in its June 2000 issue.
At the press conference, President Philip K. Beachem presented the report as part of the Alliance's primary goal of a long-term, stable transportation revenue source. The thirty-two page report has been widely distributed to municipal and state authorities throughout the state of New Jersey and is available on the NCTIP web site, Transportation.njit.edu/nctip. Almost two months later the "Hudson Report" section of the Jersey Journal gave prominent space to transportation issues in Hudson County following a nearby meeting of the Alliance for Action. The article was illustrated by a photo showing one of the members reading very distinctive-appearing Mobility Study.

**TRANSPORTATION RESEARCH BOARD ANNUAL MEETING**

All core transportation faculty members and staff, and several affiliated faculty from other departments who have participated in transportation research projects attended the January 2000 79th Annual Meeting of the Transportation Research Board (TRB) in Washington D.C.

During the conference, Drs. Spasovic and Daniel met with the Honorable Rodney E. Slater, U.S. Secretary of Transportation, to discuss innovations and ideas relating to the 21st century transportation workforce. Among topics covered were thoughts about the major challenges in educating and training the next generation of transportation professionals; examples of innovative partnerships and how to build on their success; and ways in which the USDOT can support the learning process that involves formal education, ongoing training, research and technology transfer.

Drs. Chen, Chien, Daniel, Mouksos and Sun presented papers and/or participated in workshops. Approximately 15 transportation graduate students attended, organizing their trip for the fourth consecutive year. Their participation was made possible by funds allocated from the three active GSA-sponsored Transportation clubs, in addition to NCTIP’s financial support and encouragement from the Director and the transportation faculty.

For the second year in a row, students organized and hosted a hospitality suite, designed to enhance the visibility of the academic and research programs available at NCTIP and the Interdisciplinary Program in Transportation. The hospitality suite provided a casual forum for students and their academic advisors to interact with faculty members and fellow students from academic institutions around the country. NJIT’s banner was prominently displayed as a PowerPoint presentation ran in the background featuring the
university transportation program and current research projects, and accenting student participation. Literature was available for casual reading or the taking. The numerous attendees talked transportation, shared their views, discussed career objectives and identified common goals in a friendly environment. Once again, the success of the evening virtually assures its repetition in 2001.

**TRANSACTION 2000 CONFERENCE**

Aiming at the an existing workforce of professionals seeking further studies or retraining, NCTIP’s presence at TransAction 2000, the New Jersey State Transportation Conference in Atlantic City produced tangible results. During the conference, a continuously cycling computer presentation featured NCTIP and the Interdisciplinary Program in Transportation. Brochures, pamphlets and posters describing the several related Master’s programs available at NJIT for part timers were displayed. Several inquiries about transportation master's studies were received, and as a result there has been a noticeable increase in applicants from county engineering and planning offices that matriculated into the Interdisciplinary Program in Transportation.

During the conference contact was made with a representative from the Patterson School District’s nascent Garrett A. Morgan program. As a result, Dr. Harold Deutschman has generously given of his time and knowledge to enable the creation of the Garrett A. Morgan Academy, which will open to thirty students in September 2000.

Dr. Janice Daniel served as a panelist with Collette Santasieri, chief engineer and environmental planner for the North Jersey Transportation Planning Authority (NJTPA), at a workshop titled “Women in Transportation.” The panel was an outgrowth of the lead article in the Winter 2000 issue of InTransition, the semi annual magazine jointly published by NCTIP and NJTPA. Sandra Lautenberg, a program manager at NJ TRANSIT, also participated in the panel, which was moderated by NJTPA’s Arlene Horowitz, editor of InTransition.

**NJDOT 1ST ANNUAL RESEARCH SHOWCASE**

In November 1999, the New Jersey Department of Transportation organized a research showcase for the purpose of familiarizing NJDOT’s customers with the broad scope of ongoing research, and explaining the research potential of the universities and their associated groups. The First Annual Research Showcase, hosted by Rutgers University, drew an estimated 200 statewide transportation researchers, engineers and planners, in addition to legislators, and Federal Highway
Administration and NJDOT administrators. Participating, in addition to Rutgers and NJIT, were the Region II universities. Rowan University and Stevens Institute of Technology were also represented.

NCTIP was strongly partnered in this Showcase by the Civil and Environmental Engineering (CEE) Department at NJIT whose faculty have participated in numerous NCTIP-funded projects. Profile presentations showcasing NCTIP-supported projects were given by NJIT research leaders. Dr. Lazar N. Spasovic gave an overview of NCTIP, its history, its place within the university, and its relationship with the interdisciplinary program in transportation. He emphasized the scope of NCTIP research projects, specifying the many that have been partially funded by NJDOT. Dr. John Schuring, Chair of CEE, highlighted those NJDOT/NCTIP projects which the CEE faculty has worked on, as well as those not within the NCTIP mandate. Numerous projects were displayed in poster presentations, and a PowerPoint presentation ran continuously. Afterwards, a booklet containing all display materials was prepared and distributed.

Intensive preparation is already underway for the 2nd Annual Research Showcase, which is being hosted by NCTIP at Newark's New Jersey Performing Arts Center.

**National Student Paper Competition**

The national student paper competition, held each year at the end of the spring semester, is open to students enrolled in a transportation- or transportation-related academic program, or those who are conducting associated research. The winning paper is chosen using a refereed process.

Michael Haynes, a 1999 graduate of Lafayette College, in Easton, Pa., was awarded $1,000 for his winning entry, "Integration of an Intermodal Transportation Planning Model with a Geographic Information System." Haynes, who graduated with honors with a B.S. in Civil Engineering, is currently attending the University of Texas at Austin, where he is pursuing a master's degree in transportation engineering.

The selection process for the 2000 competition winner is underway.

One of 1999's UTC Student of the Year award winners, Caroline Rodier of the University of California, won the NCTIP student paper competition in 1996.
Diversity

Outreach and Recruitment
The City of Newark is an urban area with a significant minority population, primarily African American and Latino. In addition to NJIT’s many pre-college programs, NCTIP has supported the Summer Transportation Institute for High School Students - Greater Newark Area and the Gifted and Talented Program - Abington Avenue School.

Dr. Athanassios K. Bladikas, director of the Interdisciplinary Program in Transportation and Chair of the Department of Industrial and Mechanical Engineering, has visited high schools in Glen Rock, Mahwah, Bayonne, Union Hill and Plainfield, New Jersey, areas with a wide ethnic mix, including a significant percentage of African-Americans and Hispanics, and differing income levels. Presentations were most usually in classrooms, and consisted of briefings about NJIT and engineering in general, with particular emphasis on transportation and industrial engineering. Three more high schools are scheduled to be visited in April and May of this year, and the program is expected to continue during the next academic year.

Dr. Janice Daniel joined Professor Bladikas in the presentation to students at Plainfield High School, which has a predominantly minority student population and is in an area from which students can easily travel to NJIT by train. Speaking to successive grouped science classes, they presented engineering as a career choice, discussing the field of transportation and other options.

Dr. Sandy Moore initiated exploration of a collegial relationship with York College in Jamaica, New York. Reflecting its location and economic milieu, the student body of York college is primarily minority and has a significant percentage of more mature students. Meetings have been held with York president, Dr. Charles C. Kidd, who visited NCTIP in June 2000.

Minority Rankings
The June 2000 issue of Black Issues in Higher Education includes rankings of schools (according to 1997/98 data) in the number of undergraduates degrees conferred to minorities. The rankings are based on quantity of graduates, making NJIT’s figures in comparison with larger schools even more significant. NJIT ranked:

- #16 with 51 Hispanic and 26 African-American Baccalaureates granted in Engineering.
- #47 with 4 Baccalaureates granted to Asian-Americans in Mathematics.
WOMEN AT NJIT

In addition to the women professionals highlighted throughout this report:

An article on women's choice of transportation careers was published in the Winter 2000 issue of the NCTIP/NJTPA InTransition magazine (see Appendix). The article gives a positive picture of the challenge and rewards of a transportation career through several life stories of well known and accomplished professionals as well as an up-and-coming NJIT Ph.D. student who is trying to keep motherhood and graduate school in a delicate balance. A separate article showcases careers of women professors and students at NJIT, and an ad provides instructions for students inquiring into the educational programs at NJIT.

Building on the above feature article, NJTPA hosted a panel at the April 2000 TRANSAction conference on Women in Transportation with Dr. Janice Daniel as a panelist.

Dr. Hindy Lauer Schachter has proposed researching "Gender and Professional Worklife at NJDOT," with the goal of learning how gender affects the NJDOT work place, including how professionals perceive gender in the workplace and how these perceptions influence workplace opportunities.

Doctoral candidate Cecilia Kelnhofer-Feely has been using her experience with transportation professional organizations, both from the student's and the professional's perspective, to reach out to women in transportation. She has discussed the Master's program with individuals and written articles for potential inclusion in organization newsletters.

Two more women graduates of the interdisciplinary program in transportation, Lisa Mazahari, and Cheryl Allen Munley are returning in fall 2000 to pursue Ph.D. degrees in transportation.

NCTIP also seeks to maximize its commitment to women in transportation by supporting the university's programs. The Constance A. Murray Women's Center on campus continuously organizes special events for women students, staff and faculty. In March the Murray Center hosted "Imagining the Future: Women's Day at NJIT," with 25-year old JPL/NASA Aerospace Engineer Kari Lewis presenting on the Mars Polar Lander Mission.

The university offers Women's Studies, a Computer Camp "for Girls Only," a FEMME program (females in Engineering Methods, Motivation and Experience), career support groups for women, a Big Sister/Little Sister mentoring program, etc., and works closely with various student organizations and clubs such as the Society of Women Engineers.
Dr. Naomi Rotter has taken the lead in the effort to design a Research Topic Selection Procedure for NCTIP. The first task in this process involved a survey of UTC Center directors via e-mail to investigate procedures that exist at other sister institutions/Centers. The process has now become part of the agenda for the Advisory Board Research Committee.

Lazar Spasovic and Michael Brimmer, Regional Vice President of CSX and an NCTIP Advisory Board member, have been exploring development of a closer relationship between CSX and NJIT, including corporate support for NJIT. In May 2000, John Orison, Vice President of Network Planning, met with Drs. Spasovic, Bladikas and Thomas to explore potential for sponsored research. It is expected that other CSX senior level management from various disciplines will also meet with NCTIP.

NCTIP and NJIT have worked closely with the New Jersey Alliance for Action (NJAF), a statewide coalition of government and labor organizations, on mobility and the costs of congestion issues as well as public policy issues dealing with securing stable state funding for statewide transportation projects. A significant research project, "Mobility and the Costs of Congestion in New Jersey," was undertaken for NJAF. The final report was issued to the public in a press conference held at the NJDOT offices in Trenton in April 2000, and received wide attention in the public media.

Five new research projects have been initiated between September 9, 1999 and June 30, 2000. These are the only projects included herein for reporting purposes.

Several other research projects have starting dates after June 30, 2000, and will be discussed in the December 2000 Semi Annual Report.

All continued projects are from the previous grant and will be included in the final report for that grant.
Mobility and the Costs of Congestion in New Jersey
Contact: Lazar N. Spasovic (spasovic@njit.edu; 973-596-6420)

In a study released in April 2000 by the New Jersey Alliance for Action, the National Center for Transportation and Industrial Productivity (NCTIP) at New Jersey Institute of Technology measured the quantifiable and qualitative impacts of congestion in the State of New Jersey. The study addressed the impacts both on the average traveler and on entire counties, combining not only the direct impact of travel delay and excess fuel costs, but also the added cost of providing goods and services.

Research Project
Congestion affects the movement of people and goods by increasing travel time and fuel consumption. Longer commutes produce higher levels of stress and lead to a decrease in labor productivity. Congestion translates into higher costs for truck freight operations through driver wages, and also has a negative impact on the manufacturing industry and service sector. Congestion decreases the productivity of just-in-time manufacturing processes by forcing businesses to keep larger inventory than necessary to accommodate unreliable delivery schedules.

Two recent studies dealt with urban mobility and the cost of transportation. One, by the Texas Transportation Institute (TTI), summarized a 15-year research effort that quantified urban mobility, finding that congestion cost U.S. travelers 4.3 billion hours of delay, 6.6 billion gallons of wasted fuel consumed, and $72 billion of time and fuel cost in 1997.

The second study, by The Road Information Program, indicated that New Jersey lags behind the national average in the quality of roadways and bridges. New Jersey motorists drive on substandard roads, resulting in additional operating costs. They also experience increased congestion, which reduces productivity and air quality and increases accidents. The road information program report found that substantial funds, beyond those currently programmed, were required for improving the transportation infrastructure. The study received wide coverage in news-papers throughout the state.

These studies provided critical information on congestion costs at the national level and the relationship between transportation infrastructure and cost. They did not address the significant impacts of congestion on a particular roadway and at a county level or the benefits of transportation improvements in reducing costs. Only by analyzing the cost on the state, county and roadway levels could the full benefits of congestion mitigation strategies be determined.
The NJIT research project, *Mobility and the Costs of Congestion in New Jersey*, was a five-month, $89,000 effort funded by NCTIP and the Foundation for the New Jersey Alliance for Action. The principal investigator for the study was Lazar N. Spasovic, NCTIP director, who was supported by research team of transportation faculty and doctoral students.

**Methodology**

NCTIP methodology built upon the TTI study, which used the Highway Performance Monitoring System (HPMS) database compiled by the Federal Highway Administration (FHWA). HPMS lacked the detail to determine the costs of congestion on specific roadway segments or to determine the potential benefits of implementing alternative highway improvement projects. To address deficiencies in HPMS, the New Jersey Congestion Management System (NJCMS) database was used.

NJCMS included traffic volume and roadway geometry information for 4,000 two-directional links. Given the improved dataset, a number of enhancements to the TTI study were instituted. Analysis of peaking characteristics was improved. Detailed data was used to determine the effects of trucks on congestion. Calculations of average vehicle occupancy (AVO) were updated.

The TTI study assumed the same lane capacity for all roadways of similar type. The NJCMS data included detailed geometry so that specific roadway capacity could be calculated.

The TTI study used a simple approach, where travel speed and congestion level were based on the average daily two-way traffic volume. To relate travel speed to congestion level, the NJIT methodology employed the concept of level of service (LOS). For each roadway link, the travel speed and LOS were computed based on the Highway Capacity Manual (HCM) (Transportation Research Board 1994 and 1998). According to the HCM, LOS = A, B, or C are considered satisfactory operating conditions. As speeds decrease to LOS = D, E or F, however, these changes are considered unacceptable to drivers. Therefore, links with LOS = D, E or F were included as part of the cost of congestion.

The TTI study developed a methodology to study congestion and related costs that is valid and useful on the national level. By enhancing the TTI methodology to make use of the detailed information available in the NJCMS, the NCTIP study was able to determine the cost of congestion on each link in the state. These costs were then summarized to provide costs on an area-wide or county basis, and on specific roadway corridors. In addition, NJCMS data was modified to reflect a proposed highway improvement. "Before" and "after" analyses determined the potential benefit in terms of reduced cost of congestion.
Congestion Measures

The NCTIP methodology uses a series of congestion measures to quantify the effects on economic productivity and quality of life in New Jersey.

Travel Delay. The total travel delay takes into account both recurring and non-recurring delays. Recurring delay is based on computed travel speeds. Non-recurring delay, such as incidents and accidents, is based on the TTI procedure that uses factors to relate non-recurring to recurring delay based on national averages for different roadways.

Congestion Cost. The cost of congestion is a function of delay and fuel costs. Delay cost was estimated using an average value of time based on wage data for each county. Fuel costs were estimated using an average cost per gallon of $1.28 (note the June 2000 average of $1.55 per gallon). The TTI study used $12 per hour as an average value of time. The average wage rate was found for each county (U.S. Department of Commerce, Bureau of Economic Analysis, May 6, 1999, prepared by N.J. Department of Labor, May 1999). These wage rates varied from $10.80 for Cumberland to $23.20 for Somerset counties. The wage information improved accuracy, but did not imply that a person earning a lower income should be more congestion-tolerant than a person earning more.

Congestion also causes delays to truck freight, increasing operator costs, such as driver wage, fuel, and inventory, which are passed onto consumers. Truck delay costs are expressed on a dollar-per-mile basis of $2.65 per mile, which was used in the TTI study and is likely to underestimate the cost of trucking in the New York/New Jersey metropolitan region.

Congestion Cost per Licensed Driver. This figure is the total congestion cost divided by the number of licensed drivers. According to FHWA's Annual Statistics Report, licensed drivers in New Jersey are 69.2 percent of the total number of residents or 5,546,657. The percent was assumed for all counties.

Results

Highlights of the results of the analyses are described below.

Congestion Measures

Travel Delay. The average annual delay per licensed driver in New Jersey is 34 hours, with Somerset County having the highest at 74.3 hours per year. Bergen, Morris and Monmouth counties also are very high. Several central and southern counties, including Camden and Mercer, also have a high delay per licensed driver.
Congestion Cost. The total annual cost of traffic congestion in New Jersey in lost time, operating cost and fuel consumption is approximately $4.9 billion. A county-by-county analysis shows that congestion costs impact all 21 counties. Of the total cost of congestion by county, Bergen, with the largest population, is the highest at $1.063 billion; Monmouth, $508 million; and Morris, $446 million. The total annual congestion costs by county are shown in Figure 1.

The congestion costs to auto and bus users are $3.7 billion. Auto and bus users incur approximately 190 million hours of person-delay and 400 million gallons of wasted fuel. The costs to truck operators are $1.2 billion annually in additional operating costs.

Congestion Cost per Licensed Driver. The average annual cost of congestion for New Jersey is $880 per licensed driver, with Somerset County the highest at $2,110; Bergen, $1,810; and Morris, $1,430. The annual congestion costs per licensed driver by county are shown in Figure 2.

Future Growth in Population and Congestion
Traffic volume in New Jersey will increase as population and employment continue to rise. Currently, many roadways in New Jersey operate at or near capacity conditions during peak periods. There is little excess capacity in the roadway network to accommodate additional growth. Consequently, even small increases in traffic volume result in significant delays and costs.

Traffic volumes are forecast to increase 7 percent by 2005 and 18 percent by 2015. If planned transportation improvements are not implemented, this growth will increase congestion cost by 34 percent in 2005 and 105 percent in 2015. The relative growth of population, traffic and cost of congestion is illustrated in Figure 3.

The impact on congestion levels is not distributed evenly across the state. Ocean, Sussex, Hunterdon and Warren counties will experience the highest traffic growth rates and, as a result, congestion costs will increase most rapidly in these counties.

Summary of Findings
Transportation investments frequently must compete with other government spending for scarce resources. Standard measures of effectiveness used by transportation agencies, such as traffic flow and air quality, are useful for comparing alternatives. These measures fail to account for the full marginal costs and benefits of transportation investments and are less than adequate for comparison with other public investments.
The true marginal costs and benefits of transportation improvements include the cost of congestion, as well as secondary economic benefits. Each of these areas should be quantified. Given that the costs of congestion are the largest areas of benefits in most highway improvement projects, the objective of this study was to measure quantifiable and qualitative impacts of congestion in New Jersey. The main findings of the study were:

- Financial and quality of life costs of congestion are real and impact virtually all residents in New Jersey. Accurately identifying the cost of congestion is critical and allows decision-makers to more precisely estimate benefits from the mitigation of congestion.

- Given the existing level of congestion throughout the state, coupled with the anticipated growth in population, employment and traffic, costs can be expected to grow dramatically.

- Available and easy-to-use computer modeling systems allow the integration of congestion cost-benefit analysis within budget planning at state, county and municipal levels.

Based on these results, a number of recommendations also were made:

- Transportation investment in heavily traveled corridors in the state can reduce congestion costs significantly.

- Specific highway improvement projects can reduce higher costs produced by traffic congestion.

- Estimation of congestion costs and benefits of mitigation should be routinely included in budgetary discussions on state, county, and local levels and made available to both the public and government officials. In addition, potential benefits of proposed and programmed projects should be estimated and made available.

- In a state that already has the highest population and economic activity density in the nation, and very high pollution costs, there must be a deliberate and informed effort to improve the efficiency of transportation facilities to allow growth to occur at the lowest cost to society.

- Efforts to mitigate congestion should include a balance between construction of new highway and transit facilities and the use of advanced technology, such as advanced traffic control, intelligent transportation systems and employer-based programs, including staggered work schedules and shorter workweeks.

*The full text of "Mobility and the Costs of Congestion in New Jersey" may be downloaded from the NCTIP web site: http://transportation.njit.edu/nctip.*
Riverside Transit Village Project
Contact: Darius Sollohub (sollohub@njit.edu; 973-596-5574)

Using Riverside, New Jersey as its specific focus, a modeling study has been completed by the New Jersey School of Architecture's Masters in Infrastructure Planning program as the first stage in a new approach to help towns maximize the benefits of transit access by planning the areas around stations. The study has modeled possible development scenarios for the area surrounding a planned station site along the Southern New Jersey Light Rail System, due to open in 2002. When complete, the $450 million system will serve a corridor that includes 17 towns and over 400,000 residents along the existing right-of-way of the former Camden and Amboy line. The findings of the study will be used to develop some general rules of thumb about the use of light rail in providing transportation support to communities.

Riverside, a town of 9,000 is located at a midway point between the light rail's terminus cities, Trenton and Camden. Approximately eight miles north of Camden, the town is a one and a half square mile suburban community located in the northwest portion of Burlington County at the confluence of the Delaware River and Rancocas Creek. To enable the Riverside community to take full advantage of this evolution, New Jersey Institute of Technology (NJIT) assisted in envisioning possibilities for future development. Using the resources of both state and local agencies, NJIT applied the Transit Village concept, a planning strategy recently revived with success in the United States and abroad. The transit village takes advantage of rail service to lessen automobile dependence and produce pedestrian-based residentially and commercially dense communities that offer a thriving sense of vitality.

Originally, prime geographical location — attractive flat land adjacent to a navigable river and roadways, yet close to developing urban areas — favored the area's growth. It was closely connected to the adjacent port for steamboats and where farm produce, raw material and manufactured goods were loaded. In the 1830s The Camden and Amboy Railroad extended its line from Bordentown to Camden, traversing what is now Riverside. Because of its river/rail infrastructure, Riverside emerged as a successful port and commercial center specializing in food processing, canning and glass production. The Industrial Revolution permitted Riverside to thrive as the Philadelphia-Camden region grew. It emerged as the world's largest manufacturer of high quality cases for pocket watches including those made in Switzerland. In 1896 the first of twenty-seven textile mills was built. Industry reached its golden age in Riverside in the 1920s and commercial activity thrived.
Regional road improvements in the 1920s, intending relief for Riverside and other communities from ever-increasing vehicular traffic, inadvertently began Riverside's slow and steady decline. The Benjamin Franklin Bridge opened in 1926 and U.S. Route 130 was improved in 1931 as a WPA project. After the Second World War, the Highway Act of 1957 created additional roads that further bypassed Riverside, and helped shift freight transportation from rail to truck. As industry no longer needed adjacency to railroads, it moved to inexpensive land in the countryside. Larger trucks needed more space to maneuver, further prejudicing denser, older areas like Riverside.

The residential vitality that once coexisted with industry also left Riverside following a pattern common to many older industrial areas in postwar America. As returning soldiers, bolstered by favorable government backed mortgages sought their own homes, expansion of highways and increased ownership of automobiles spread development into neighboring communities, sifting residential and commercial growth away from Riverside. Valuable farmland and attractive forested landscapes that once surrounded the town were soon erased by the sprawl of single-family detached homes. Riverside slipped into depression. Industry closed its doors, and passenger rail service, suffering from competition with automobiles and denied federal assistance, finally ceased in the 1960s.

Riverside is an iconic American small town. It has a real center, definitive edges and significant common ground. It has retained its identity, its celebration and its sense of place. The modeling project is a new approach to help maximize the benefits of transit access by planning the areas around stations. The state advocates the concept and launched a "Transit Village Program" in 1999 to restore stations to their historical role, enhance investment in urban areas and promote community leadership. Communities that create Transit Villages are given priority consideration for funding from the New Jersey Department of Transportation's Local Aid for Centers program, the Transportation Enhancements program, and the Bicycle and Pedestrian Projects program.

The initial segment of the transit village project involved two phases. In the first phase, local conditions were inventoried and the area around the rail line was modeled to demonstrate three different scenarios for creating a transit village. One scenario has a waterfront residential area, another builds around a craft industry with a fishing pier for recreation and essential services like a supermarket and day care center, and a third focuses on commercial development along the rail line. In the second phase, models were presented to representatives from the town at a meeting hosted by Burlington County, and reviewed by local government agencies. Taking their responses into account, concepts and features from each model were used to develop a comprehensive urban design proposal.

Key recommendations from the study will be incorporated into the town's redevelopment plan. It is also planned to leverage NJIT's work in conducting further development studies, applying for funding and attracting private sector investment. The town's leaders believe that with rezoning, new planning and restoration of its rail service, Riverside is poised to resume its former golden age.
Research Project Maintenance & Monitoring System (ProMPTS)

Contact: Joseph Wen (wen@njit.edu; 973-596-8569)

ProMPTS is a research project information management program which enables the staff of the Division of Research & Technology at the New Jersey Department of Transportation (NJDOT) to manage and track research projects throughout the development process, from entering problem statements to distributing the products and project close-out documentation. The goal of ProMPTS is to create a user-friendly data management environment that lets users quickly and easily access, search, and summarize relevant financial and business information for research projects so that detailed and summarized up-to-date reports can be efficiently generated.

ProMPTS was developed by the National Center for Transportation and Industrial Productivity at The New Jersey Institute of Technology, and NJDOT’s Bureau of Research, with an Access relational database and interactive graphical interfaces to fulfill a variety of functionalities in data entry, retrieval, updating, and summarizing. This project complies with NCTIP’s theme of facility, institutional and regulatory efficiency. The Major functionality groups of ProMPTS are:

u The Problem Statement Group which creates initial documents, starting the monitoring process;

u The Administration Group which includes functions carried out by the database manager and system administrator, such as generating new project and job numbers, entering personnel information, and downloading and up-loading financial and business data from other systems of NJDOT to ProMPTS;

u The Project Data Input Group which consists of customized data entry forms for document registration and tracking, job scheduling, work-hours assignments, etc.

u The Project Information Group which provides a variety of different query criteria that will lead user to relevant detailed and summarized information about research projects. This is the main display screen of the system. From it, the user can survey most of the database and review the information from multiple aspects.

u The Program Information Group which generates summary information based on program year, funding
source, and budget types, and also, provides interfaces for reviewing personnel and staffing information;
The Report Group. This is the report preview/print center that allows the user to pick up reports to review, print to machines, or send as an email directly to relevant parties.

Currently, ProMPTS is undergoing evaluation by the NJDOT staff which will be the system's users. Upon evaluation, should the need arise, ProMPTS further improvements will be made to meet users' expectations.

Potential benefits of the developed Information ProMPTS are:

- It will significantly reduce the searching time for finding relevant re-search project data from existing NJDOT databases and significantly lower paperwork costs.

- It is very user friendly. The operation of the system is simple and self-explanatory, and many data manipulation tasks have been streamlined.

- It is not only a data management system, but also a operational process monitoring system. It provides both detailed and summarized up-to-date reports on project current status, finance, and business situations (e.g., person's working hours assignment and salary costs; total budgets of certain funding source in a program year; and budget/cost comparison charts of a research project). These reports can be quickly generated daily, weekly, monthly, and annually. Therefore, management can watch the entire process of the projects under going and take responsive actions immediately.

ProMPTS provides a well-organized relational database that includes processed research project information. This information can be incorporated into NJDOT internet information system and be viewed by public. Thus, ProMPTS has the potential to help NJDOT research projects go on-line in the near future. It is envisioned that the system will be transferred to other state DOTs.
Greenfeld AVL Research selected for USDOT Research and Education Plan

(Contact: Joshua Greenfeld (Greenfel@njit.edu; 973-596-5808)

*Digital Map Requirements for Automatic Vehicle Location* (AVL), a recent research project that evaluated AVL performance under standard operating conditions for New Jersey Transit, has been selected as an example of academic efforts in support of Federal enabling research, and is slated for potential inclusion in the DOT University Transportation Research and Education Plan. The featured projects are those that have been supported by the UTC program. This research supports the NCTIP theme of Passenger Movement Efficiency.

The project was recently completed by Dr. Joshua Greenfeld, of the Department of Civil and Environmental Engineering, whose primary areas of expertise are in geographical information systems and global positioning systems. The final report for the project can be viewed on the web at [http://transportation.njit.edu/nctip/Research%20Reports/](http://transportation.njit.edu/nctip/Research%20Reports/).

New Jersey Transit (NJT) was investigating acquisition of an automated vehicle locator (AVL) system, the purpose of which would be to monitor the location of its buses. This knowledge would enable the agency to manage the bus fleet more efficiently and provide its customers with up-to-the-minute information on bus arrivals and departures.

To monitor bus location, positional information (as determined by the AVL) is displayed on a digital map such as a GIS. To ensure accurate information, the location (coordinates) of the bus must be consistent (or within a small tolerance) with those of the digital map. If this is not the case, the system may yield incorrect information. This problem may become especially critical in an urban area where the system would be most valuable.

In this project, a methodology was developed for testing and evaluating the accuracies of an AVL system and supporting digital maps. The AVL system analyzed in this project was the Continuous Positioning System (CPS) by Andrew Corporation. Digital mapping products evaluated were TIGER/LINE, NAVTECH and Digital Orthophotos. The above data sets were evaluated with an accurate network of control points measured by Global Positioning System (GPS). Following the analysis of this study, some recommendations on the appropriateness of the tested AVL system and NJT’s digital mapping data were made.

*Positional information for buses in densely built urban environments presents varied challenges for an AVL system.*
NJIT and Maher Terminals Team Up to Develop Advanced Freight Logistics System

Contact: Lazar N. Spasovic (spasovic@njit.edu; 973-596-6420)

An on-going research project conducted jointly by the New Jersey Institute of Technology (NJIT) and Maher Terminals, Inc. has produced a technological tool, currently under evaluation, that promises to increase productive use of port facilities to help meet the demands of the continued growth in maritime freight volumes. The National Center for Transportation and Industrial Productivity (NCTIP) at NJIT, working with the state-of-the-art logistics system currently in use at Maher Terminals, has identified advanced algorithms to further enhance the system for scheduling freight handling, transportation, and distribution services to add "virtual capacity" to terminal operations.

In the past decade, there has been a remarkable growth in the volume of containerized cargo, and the trend is expected to continue. This increase has been fueled by strong U.S. and, until recently, Asian economies, elimination of international trade barriers, and shifting patterns in global manufacturing and consumption. Growth has also been facilitated by the substantial technological developments in maritime intermodal transportation.

On average, the volume grew 6% annually in the United States, 1.5% in Canada, and 10% worldwide, a trend likely to continue through the next decade. Experts estimate that by the year 2010, 90% of the world’s liner freight will move in containers (USDOT 1998). Recognizing the critical role of port operations in the U.S. economy, on-going research conducted by the NCTIP and Maher Terminals is focusing on the interface between land and water modes at ports, to improve the productivity of the terminal container-handling operation and customer service quality.

Maher Terminals is the largest container terminal operator in the Port of New York and New Jersey, operating 14 container cranes in two terminals over a land area exceeding 500 acres. The Jersey City-based company operates two container terminals and an intermodal rail terminal in New Jersey. Approximately 600,000 of the containers that pass through the port each year are handled by Maher Terminals. A technology subsidiary, Maher Terminal Logistics Systems, provides computerized container systems in the Port of Miami, Mexico, and Poland.

"This type of research is absolutely necessary as the worldwide intermodal marketplace continues to grow
and demand heightened services," Dr. Roger E. Nortillo, Executive Vice President of Maher Terminals, Inc. and President of Maher Terminals Logistics Systems, Inc.

Efficient assignment of container-handling equipment requires port operators to predict the level of activity at the terminal on a daily basis. Ship arrivals change from day-to-day, resulting in changing demands for equipment and services. Using data from Maher Terminals, the NCTIP designed a logistics tool to assist terminal operators in planning for ship arrivals and departures by applying probability models based on past experience.

The NCTIP and Maher Terminals project, currently in the evaluation stage, is expected to produce a continuously updated database of logistics information to create a forecasting tool that incorporates real-time information. A management information system (MIS) will report the expected truck arrivals for a given set of scheduled voyages based on a unique arrival/departure pattern developed for any containership scheduled to call at the port.

According to NJIT President Saul K. Fenster, "sponsored research programs such as the NCTIP/Maher Terminals project complement the university's economic development mission." Fenster added, "NJIT remains committed to working with the business community, government, and local communities in other ways to support economic growth and improvement in the quality of life."
NCTIP Intermodal Freight Transport Research Impacts Business Decisions

Contact: Lazar N. Spasovic (spasovic@njit.edu; 973-596-6420)

From its initiation, the National Center for Transportation and Industrial Productivity (NCTIP) has been engaged in research topics that would yield improvements in the productivity of transportation operations. One of the indications that the UTC Program's Center is dealing with topics that are of a great importance to the motor carrier industry is an article by Lawrence H. Kauffman that appeared in January 21, 2000 issue of the Journal of Commerce. It deals with the planned consolidation of the drayage industry, with a national company, RoadLink, to unite 7 firms with $160 million in total revenue. Drayage is the highway portion of rail-truck intermodal transport wherein truck tractors move truck-trailers and containers on chassis between a rail head and local customers. The new company, RoadLink USA, is backed by General Electric Capital Co.

RoadLink founders believe the time is right for consolidation. As the NCTIP research indicated, this consolidation was long in coming in an intermodal marketplace that required a seamless intermodal chain. A truck executive said "consolidation will enable drayage companies to afford the cost of technology because they will achieve scale." Furthermore, "By consolidating, we could improve operating efficiency 10% to 25%, and improve operating margins by building scale strategically in key loading ports and rail points around the country." In his view, consolidation will improve vessel schedules, reduce the driver shortage, increase equipment turns and serve all of a steamship line's ports. RoadLink sees three futures for the company: an initial public offering in a few years; a strategic sale to another company, or a very broad merger.

NCTIP Rail Truck Intermodal Research

The research, initially supported by the Mid-Atlantic UTC and Consolidate Rail corporation via grant to University of Pennsylvania, identified approaches for improving service quality and cost of domestic intermodal service. In intermodal transport, a load is moved between the origin and the destination in the same container in a coordinated manner using two or more transportation modes. In rail-truck intermodal service in the United States, highway trailers or containers loaded on rail flat cars are hauled by train in line-haul service between the origin and the destination intermodal terminals, and locally picked up and delivered by truck between the terminals and shippers and terminals and receivers.

Economy of Intermodal Transport

Rail-truck intermodal was primarily designed to compete with over-the-road trucking. It combines the best of two modes; economies of rail line haul wherein a large number of containers is moved at a lower average cost compared to the parallel over-the-highway movement, with flexibility of truck in local drayage - this flexibility enabling pick-up or delivery at the customer's convenience rather then when a local freight train happens by, and enabling service to points not on rail lines, among other advantages. The cost characteristics of intermodal and trucking are quite different, as illustrated in Figure 1, which portrays the full (or long run) cost of the two modes on a pre shipment basis as a function of distance. For trucking, there is a small fixed or threshold cost that is independent of distance, representing the cost of transactions associated with the movement (documentation, billing) and of the loading and unloading activity (including truck time). The cost of operating a truck (including ownership, maintenance) is essentially proportional to distance. Typical values for the threshold cost are about $80 to $120 per load and the cost per unit dis-
unit distance is in the vicinity of $0.60 to $0.80 per mile. The net effect of the different cost structures results in a break-even distance below which trucking is less costly and above which intermodal is less costly, as indicated in Figure 1. Generally this is thought to be in the vicinity of 500 to 700 miles. Of course, local conditions, particularly the extent of adverse distance for drayage (i.e. drayage opposite to the direction of the destination), and the degree to which equipment is fully utilized in both directions, will influence the break-even distance. Using mid-range values for the above costs of over-the-road and intermodal movements results in a break-even distance of 546 miles. Adding 15% penalty to represent shipper costs associated with the movement (inventory while in transit, safety stock inventory, packaging costs) results in a break-even distance of 809 miles.

Potential of Intermodal
While intermodal was envisioned to be competitive with inter city trucking in the sense that it would offer a similar service at a lower cost, the actual cost structure and inferior service quality result in a high break-even distance. This precludes intermodal service from being a competitive alternative to truck in short haul markets for which it was originally intended. Given that over 75% of all cargo moves over distances of 500 miles or less, and 90% moves 900 miles and less, intermodal's competitive position is thus limited to a rather small segment of the inter city freight market.

Many analysts have concluded that intermodal has been characterized by low profit margins, describing it as "a great revenue business but poor net revenue business". It is argued that the low profit margins do not yield acceptable returns on investment and in turn do not justify the railroads' further investments in intermodal equipment. The lack of investment has resulted in a serious equipment shortage and terminal capacity problem, and is threatening to slow the intermodal growth. In addition, the intermodal was unsuccessful in making inroads into shorter haul markets of high value merchandise freight.

Since significant technological improvement were already made in the line haul (new articulated cars, efficient operating practice with unit trains, the attention naturally turned to drayage. It was commonly perceived that serious problems in both productivity and service quality of drayage effectively limits intermodal to longer distance hauls -- generally greater than 600 miles.

Proposed Centralized Drayage Operation
The research proposed that the drayage associated with an entire terminal must be viewed as a system, and the operation planned so as to meet the demands and service requirements at a minimum cost.

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*National Center for Transportation and Industrial Productivity*

*productivity improvements through transportation*
demands to be met in the form of loaded trailers/containers to be moved, either to the terminal from shippers or from the terminal to consignees, and of empty trailers to be spotted for loading or to be removed after unloading must be ascertained each day and tractors and drivers would be assigned to these tasks considering the totality of work to be done, so as to minimize total cost. Draymen would then follow this master plan in executing the movements. The savings, in terms of reduction of tractor-trailer deadheading miles would come from the repositioning of equipment, over the independent operation.

Research was undertaken to evaluate the use of centralized drayage operations planning to both reduce cost (and hence price) and improve service quality of drayage. The central part of the research was the development of a detailed mathematical model of drayage that was used to evaluate cost savings of an operation in which the movements of trailers and containers are centrally planned, compared to the current decentralized drayage operation. The research revealed that substantial cost savings in the range of 43-65% reduction of cost of centralized operation compared to the current operation.

To conclude, fragmented drayage prevents an efficient operation. Current prices are set assuming that each trailer delivery is undertaken independently of other deliveries. In practice, costs (prices) could deviate, as load density changes and economies and diseconomies appear. The natural question is: Why not take advantage of these economies of density? Figure 2 indicates that increasing load density could result in decreasing non-revenue truck mileage and thus costs. For example, with coordination and information sharing, cases of two round trip movements, each loaded in only one direction, could be replaced with one round trip movement with loads in both directions. The cost of a round trip would then be assigned over the two loads, thus decreasing the cost per load by almost half compared to the independent operation. It is this economy of density that finally yields the consolidation that was discussed in the Journal of Commerce Article.

Figure 2. Present and Proposed Drayage Operation
Present: Uncoordinated Drayage

Figure 2. Present and Proposed Drayage Operation
Proposed: Centralized Drayage Operations Planning
Research Sheds Light on Traffic Safety
Contact: Dr. Ala Saadeghvaziri (ala@njit.edu; 973-596-5813)

For many motorists, driving in the dark is a nightmare. So it isn’t surprising that there are more traffic fatalities at night than during the day.

Through a grant from the New Jersey Department of Transportation (NJDOT) and the Federal Highway Authority (FHWA), a team of researchers at NJIT has shed some light on this safety issue. The NJIT team developed a glare screen fence that can be mounted on existing highway median dividers. The fence serves a dual purpose in that it adds height to the median barrier to prevent highway crossings and reduces pedestrian deaths.

Dr. Ala Saadeghvaziri, associate professor of civil and environmental engineering, who conducted the project with Keith MacBain, a graduate student, and Allyn Luke, assistant to the chair for laboratories, expressed the hope that the fences would save lives.

Existing systems, roughly 30-33 inches in height, consist of metal posts and tension wires, which makes installation and maintenance expensive. The new Combination Glare Screen/Pedestrian Fence consists of two 1/2 inch thick panels that look like picket fences. They are made of recycled plastic and joined at the top of the concrete base, making the barrier about six feet tall. The tops of the panels are connected with fasteners or can be heat welded. The panel openings can be any shape. Circular openings are about 2-2/75 inches in diameter and spaced at 2/5-3/75 inches apart. Slotted panels are two inches wide and spaced every four inches. Both are positioned in a way that allows motorists to view objects on the opposite lanes and police to monitor traffic. Esthetics could determine the method of choice.

Saadeghvaziri believes that the use of recycled plastics makes the design more economical and is also a major step toward management of solid waste. Because the fences are plastic, they need less maintenance than metal or concrete.

NJDOT and FHWA have reviewed the designs and are looking into installing about 2,000 - 5,000 feet of the new fences on an as-yet undetermined highway. In addition to being less expensive and more durable, the fences are easy to install compared to existing systems and serve a dual purpose as a deterrent to pedestrian crossing and elimination of oncoming headlight glare.
The International Intermodal Transportation Corridor

Commissioner James Weinstein of the New Jersey Department of Transportation has designated New Jersey Institute of Technology as the International Intermodal Transportation Center (IITC), a university-based resource program that will work closely with public and private sector transportation stakeholders to facilitate economic development and quality of life improvement efforts linked to the intermodal transportation corridor.

One of IITC’s primary goals is to identify common and complementary needs within the region, ensuring that a cooperative agenda can be created to further economic growth from the powerful global trade assets shared by the region. Consequently, one of the early projects will be the establishment of a Forum to facilitate expanded communication and collaboration among all the transportation stakeholders in the Corridor.

High on the list of priorities will be support for Portway - a critical State program to strengthen and improve the immediate access corridor between the Newark-Elizabeth Seaport/Airport complex, nearby rail and trucking warehousing terminals, and the interstate and international surface distribution network. IITC also will address broader issues such as freight transportation, brownfields and passenger transportation. In addition, the Center will identify public and private sector investments made in the corridor communities to support mobility and advance intermodal related economic development.

The Center is funded by a $2 million grant from the U.S. Department of Transportation Federal Highway Administration (FHWA) under the High Priority Projects Program of the Transportation Equity Act for the 21st Century (TEA-21). IITC’s steering Committee will include expert staff from such agencies and groups as the New Jersey Department of Transportation, New Jersey Turnpike, Port Authority
of New York and New Jersey, North Jersey Transportation Planning Authority, freight carriers, logistic companies, terminal operators, transportation consumers and academia.

Many common areas for rich interchange exist between the functions of NCTIP and IITC. Lazar N. Spasovic, director NCTIP, is also director of IITC.
NJTPA/NJIT Brownfields Planning

Contact: Lazar N. Spasovic (spasovic@njit.edu; 973-596-6420)

The North Jersey Transportation Planning Organization, in partnership with its host agency, the New Jersey Institute of Technology (NJIT), was awarded a $700,000 grant by the U.S. Department of Transportation in May 1999 and received an additional appropriation by Congress of $800,000 in Fall of 1999 to explore ways to channel new or expanded freight-related businesses into the region's numerous abandoned or idled industrial properties, known as brownfield sites.

Pursuing this strategy is vital given the staggering increase in freight movement that will take place in northern New Jersey. Containers moving through the region's marine port are projected to double in ten years and increase six-fold by 2040. Within just the next few years, Newark International Airport will become the northeast's largest air cargo center. At the same time, rail-borne freight will increase steadily as CSX and Norfolk-Southern take over and revitalize Conrail's extensive rail lines and facilities in the region. It all adds up to a coming juggernaut of ships, airplanes, trucks and trains moving many millions of tons of freight to, from and through the northern New Jersey region.

The increase in freight activity will be a welcome development, creating thousands of new jobs not only in freight businesses themselves but in new "spin-off" businesses engaged in warehousing, packaging, assembly and other support services.

But the increase also presents a potential threat. If not prepared for and managed effectively, the coming freight onslaught could compound roadway congestion, consume precious open space in rural and suburban areas, worsen the region's air quality and disrupt life in the region's communities. Ultimately, these problems could dampen future economic growth.

For northern New Jersey, the successful reclamation of brownfields by freight businesses would not only make most efficient use of its land and transportation resources but help reverse the loss of jobs and economic activity in the region's blighted urban areas. The NJTPA-NJIT project was one of 35 chosen for funding out of over 500 proposals submitted under the Transportation and Community and System Preservation Pilot Program.

Freight related businesses are a potentially "good fit" for the region's brownfields. By nature, these businesses require good transportation access. A large number of brownfields lie within several miles of the Newark/Elizabeth transportation hub that includes the marine port, airport and major rail terminals. Even brownfields located at greater distances from this hub tend to have good highway or rail connections -- though these often must be rehabilitated and upgraded. Attracting freight businesses to brownfields sites would help reduce the need for long distance trucking of goods, increase rail usage and create new unskilled and semiskilled jobs in proximity to urban populations with significant unemployment.
The NJTPA-NJIT project will explore the specific prospects for freight related brownfields redevelopment in the region. Key tasks will include:

- Analyzing the nature and extent of expected growth in regional freight business
- Exploring successful freight related brownfields reuse around the country
- Surveying freight businesses on their expansion plans and locational needs
- Gathering information on all brownfield sites throughout the region from state and local sources
- Developing criteria to cull out those sites with the greatest promise for freight redevelopment
- Gathering information on the condition of the promising sites including their histories, contamination, transportation access, etc;
- Conducting outreach to assess community concerns about the promising sites;
- Developing materials documenting where and how freight related brownfields redevelopment can be encouraged in the region.

Assisting the NJTPA and NJIT in carrying out these tasks will be a steering committee composed of the NJ Department of Environmental Protection, the NJ Department of Transportation, the NJ Office of State Planning, the Port Authority of New York & New Jersey and the NJ Commerce & Economic Growth Commission. In addition, a project advisory committee will be formed including a variety of agencies, regional stakeholders and organizations.

The second phase of the project that will include detailed case studies of selected sites and development of a methodology that can be applied to sites across the country. An important final product will be a Transportation and Community Action Plan containing potential projects and strategies that can be considered by the NJTPA, state and local agencies, private sector organizations and other entities for facilitating brownfields redevelopment.

Transportation measures contained in such an Action Plan could be crucial to facilitating freight related brownfields development. For instance, the NJTPA is currently working with the City of Newark to improve truck access to a large underutilized industrial area. The main obstacle is a single bridge whose low clearance impedes truck movement.

The NJTPA-NJIT project will seek to identify similar transportation projects that can spur redevelopment at brownfield sites around the region. It will also explore new transportation technologies and options for reducing negative air quality impacts from freight related operations in brownfield sites.

According to the grant proposal, the "project's main purpose is to reclaim and put to productive economic use the transportation and land assets that underpinned the earlier vibrant industrial economy of northern New Jersey, thus re-enlivening economic opportunities for the urban centers that have historically grown around these old industrial sites."

John V. Hummer of NJTPA and Gary L. Thomas of NJIT are co-PIs on for this partnership.
TECHNOLOGY TRANSFER

SUPPORT PROCEDURES FOR TECHNOLOGY TRANSFER ACTIVITIES

Equipment: To provide state-of-the-art tools for the many publications produced by NCTIP, a Micron Millenia computer and monitor with capacity for advanced graphics/photo production, and the ability to transfer material by means of CD, Zip, etc. was purchased. A new server has been purchased and is on line particularly to service web needs. Software packages have been updated for web interface and for adaptability to the Windows NT.

Mailing Lists: A web-based Access database has been designed and created to allow continuous updates of the Center's mailing lists by staff and affiliated faculty. This database, which will be in use as of September 2000, will be compatible with NJIT mailroom equipment for more efficient distribution of Center material.

A Project Database has been designed and is in place for all research projects. Testing for maximum efficiency still takes place. This program will interface with the web research projects listings. Segments of the database are currently being designed so that PIs can input timely data for report requirements.

Web-based forms: Forms for accurate report production are now available to PIs on line. A registration form is also available on line for the upcoming NIDOT 2nd Annual Research Day.

SEMINARS

The NCTIP Seminar Series received wide coverage in mailings, on the web, and through various in-house media, including university-wide e-mail bulletins on the day of the seminar. In the recent academic year invited speakers addressed the following topics:


Quantifying The Bullwhip Effect in Simple Supply Chain: The Impact of Forecasting Lead Times and Information by Dr. David Simchi-Levi, Department of Industrial Engineering and Management Sciences, Northwestern University, December 9, 1999.


Reliability Estimation of Structural Components Subject to Degradation by Dr. E.A. Elsayed, Department of Industrial Engineering, Rutgers University, April 19, 2000.

Landscape Value and Transportation by Carol R. Johnson, Chairman of the Board, Carol R. Johnson Associates Inc. (Massachusetts), April 26, 2000.

Abstracts of the above seminars may be found on the NCTIP website: transportation.njit.edu/nctip/seminars.htm.
In addition to the formal NCTIP Seminar Series, numerous other seminars were sponsored by NCTIP in cooperation with other university departments:

Assessing the Changes: U.S. Engineering Programs at the Start of the Millennium by Way Kuo, Professor and Head of the Department of Industrial Engineering, Texas A&M University, March 29, 2000.

Engineering Employment Opportunities at a State Highway Agency by William Adzimahe, Maryland State Highway Administration, October 12, 1999.


Fault Tolerant and Re-Configurable Discrete Event Systems by Houshang Darabi, a Ph.D. candidate at the Department of Industrial and Systems Engineering at Rutgers University, March 10, 2000.


Integration of IDEF3 with Quantitative Modeling Methods by Ki-Young Jeong, Knowledge Based Systems, Inc., March 21, 2000

Solving the Urban Transportation Problem: Step One - Understanding Travel Behavior by Dr. Steven E. Polzin, Deputy Director, Center for Urban Transportation Research, University of South Florida, October 18, 1999

Study of a Real-time Multi-vehicle Truckload Pickup-and-Delivery Problem by Jian Yang, a Ph.D. candidate at the University of Texas at Austin, March 3, 2000.

Tele-Parking Systems - Increasing Net Parking Revenue Instantly by Timothy Teen of Baran/Tec, Inc., presented for the Alpha Student Chapter of ITS America and the Transportation Information and Decision Engineering Center at NJIT, October 14, 1999.

The Women’s Transportation Seminar student organization hels a series of seminars as well. The first seminar involved Understanding the Transportation Planning Process by Lucie Thiebold, Senior Planner at North Jersey Transportation Planning Association (a Master’s graduate of NJIT’s Transportation program, and NCTIP’s 1998 Student of the Year). The second was a resume writing seminar given by Andrea Nunez, the WTS Greater NY/NJ Student Affairs Chair. The final seminar was a demonstration of the auto-scope using a new video imaging system held by Mark Hammer of Signal Services Inc.

**Publications**

**OnRoute**

The feature research article of the Spring 2000 issue of *OnRoute* is on the Mobility and Congestion Study. The newsletter also includes a Director’s column, a list of awarded grants, introduction to new faculty, announcement of NJIT as the International Intermodal Transportation Center, information on our seminar series, the winner of our student paper competition, Dr. Deutschman’s Presidential Award, our UTC Student of the Year, and an ‘heads up’ for the NJDOT 2nd Annual Research Day. External Distribution of this newsletter is 4200 nationwide.

Plans for the Fall 2000 issue include showcasing the NJDOT Research Showcase Day - to be held on November 8, 2000. The newsletter, which is already in layout, will be issued shortly thereafter.
Research at NCTIP
NCTIP published a 40-page brochure, "Research at NCTIP," highlighting current and completed projects funded by NCTIP since its inception. The brochure also gives representative publications and presentations relating to the research, and lists all participating faculty/principal investigators with title, terminal degree, and areas of interest.

Research at NCTIP has been widely distributed since its November 1999 publication, timed to coincide with the 1999 NJDOT Research Showcase (see page 43). It has also been sent to university contacts nationwide, particularly those with historically minority student bodies.

A second publication is being prepared in time for the 2nd Annual NJDOT Research Showcas which is being hosted by NJIT in November 2000. This more extensive publication will focus on NCTIP/NJDOT research projects.

Mobility and the Costs of Congestion in New Jersey
The final report for this study, mentioned in several places, was designed as an attractive, eye-catching publication and has been widely distributed to all New Jersey municipal, county and state leaders, and to others who responded to media coverage. The New Jersey Department of Transportation as well as the New Jersey Alliance for Action continue to distribute copies to their customers.

InTransition Magazine
The Winter 2000 issue included:

- Women in Transportation Aren't So Lonely Anymore (See Appendix).
- Spreading TELUS Across America (see page 69).
- Urban Sprawl Comes to Iowa
- Value for Money in European Traffic Control Practices
- Project ACTION Making Transit Accessible
Graduate Degree Programs Brochure
An updated brochure has been published describing the graduate degree programs available through the Interdisciplinary Program in Transportation. Particular focus has been given to the new Masters Degree in Logistics Engineering. Production of the brochure was timed to coincide with the TransAction 2000 conference, where it was widely distributed. After this conference, several inquiries were received from potential part-timer students from state and municipal organizations; as a result some part time students are expected to enroll as of September 2000.

NCTIP Fact Sheet
A two-page fact sheet giving highlights of the NCTIP program was produced for use in meeting with contacts from the corporate world.

National Student Paper Competition Flyer
For the annual Student Paper Competition flyers are sent to transportation programs and deans of engineering across the country nationwide.
WEB
The NCTIP web page has grown progressively more complex. As of this writing, a counter summary shows over 3400 hits since January '99, 91 of them in the past week alone. A computer science undergraduate student with expertise in web pages has been hired to work alongside Sally O’Malley updating and expanding the site and providing more externally interactive programs. Final reports of NCTIP research projects are being published on the web, with more and more of these available in the near future.

Registration for and responses to the upcoming NJDOT 2nd Annual Research Showcase will take place online, drawing all interested parties to the NCTIP site.

SYMPOSIUM ON PRODUCTIVITY AND TRANSPORTATION SYSTEMS
Since the designation of NJIT as the International Intermodal Transportation Center, and of Lazar N. Spasovic as its Director, the issues to be explored in a major symposium involving productivity of transportation systems and facilities, e.g., airport and ports as economic engines of the 21st Century have become intrinsically interconnected. IITC has a definite sequence to its agenda, which includes a major conference/symposium, and it is deemed in the best interests of NCTIP at this point to position itself vis-à-vis IITC because of the vast audience expected to be drawn.

INCREASED VISIBILITY
Multiple electronic presentations have been developed by NCTIP and are used for showcasing the various components of the program to internal and external audiences. NCTIP has backed up its participation in TRB and TransAction 2000, for example, with a wide range of printed materials as well as electronic productions. Presentations have been given to the Morris County Leadership Forum, various student organizations, and Maher Terminals, as well as to high schools in a wide area of New Jersey.

Several research projects resulted specifically from a presentation to faculty from the School of Management.

REGIONAL BUSINESS PARTNERSHIP
As it has over the past several years, NCTIP reserved a table for 10 at the annual transportation awards breakfast of the Regional Business Partnership, the local equivalent of the Newark Area Chamber of Commerce.

A WORKSHOP ON BUS RAPID TRANSIT: INTERNATIONAL EXPERIENCE
Coordinated by Dr. Steven Chien, "Bus Rapid Transit: International Experience," a panel discussion question and answer session, was held at NJIT on May 15, 2000. The event was sponsored by NCTIP, The National Transit Institute at Rutgers University and the American Public Transit Association. The panelists included speakers from the United States, Canada, Germany and Sweden, who provided highly useful information to transit agencies looking for ways to improve their bus services. A moderated discussion with the audience followed.

National Center for Transportation and Industrial Productivity
...productivity improvements through transportation
**NCTIP Featured in New Jersey Business Transportation Issue**

Following lengthy interviews with NCTIP Director Lazar N. Spasovic, New Jersey Business magazine, in two separate articles, featured research activities of the National Center for Transportation and Industrial Productivity.

The first article highlighted the significant study on ‘Mobility and the Costs of Congestion in New Jersey,’ which is to be released to the public the week of March 22, 2000. The second article discussed the many crucial transportation efforts currently taking place in New Jersey in which NCTIP and NJIT feature prominently.

In the same issue, NCTIP ran a quarter page ad for the Masters Program in Transportation.

### Congestion: What is the Cost?

The Alliance for Action commissions a study on the impact of traffic jams on businesses.

For most New Jersey residents, getting stuck in a morning traffic jam has become as routine as grabbing a bagel and coffee for breakfast. As the traffic situation worsens in the Garden State, which has the country’s highest population density, consumers have simply reconciled to leaving home a little earlier.

Apart from increasing road rage and stress levels, congestion leads to a significant financial loss to the economy. What is that cost? Many of the components that determine that number are loss of productivity due to stress and late arrivals at work. Leaders in the transportation industry believe that unless the cost of congestion is studied and quantified the decision-makers won’t recognize the urgency for remediation of the state’s highways and roads - many of which are in state of disrepair.

With these goals in mind, the Foundation of the New Jersey Alliance for Action has commissioned the New Jersey Institute of Technology (NJIT) in Newark to conduct a study on congestion and its costs to the state. The foundation is the research and public education arm of Edison-based Alliance for Action, a coalition of 600 odd business, labor, and government organizations. The study is expected to be completed by November.

According to Phil Beechem, president of the Alliance, business polls found that traffic congestion was affecting employers as well as motorists. "Increasingly businesses find that employment decisions are based on how easy it is for the employee to commute to and from work," he says. "That is why we decided to look at the issue of congestion, and what it means in terms of business and opportunities."

Lazar N. Spasovic, who as director of the National Center for Transportation and Industrial Productivity at NJIT is in charge of the study, cites the results of a Texas University study. It found that nationwide traffic congestion costs nearly 4.6 billion hours, 6.7 billion gallons of fuel, and $74 billion in lost time and fuel expenses a year. While traffic congestion has become a nationwide problem, New Jersey's situation is worse than most because of its location and population density. According to a 1998 report by the Road Information Program, a nonprofit national transportation research organization, New Jersey motorists spend $732 million annually - an average of $133 per driver - in additional vehicle operating costs caused by driving on substandard roads. New Jersey ranks 42nd nationally among states in the condition of the pavement on most major roadways, and its roads are the most heavily traveled in the nation, with a single-lane mile carrying 2.6 million vehicles annually.

Highway travel in the state is expected to increase 19% by 2010. Spasovic says the number of trips a vehicle takes in the state is increasing twice as much as the number of employees, which is among the highest in the nation. This, he adds, is indicative of the magnitude of the problem in the state. "Once we find out how much congestion costs the state, we can find ways to alleviate the problem."

Spasovic plans to look at the problem very closely, studying county-by-county, road-by-road, pothole-by-pothole.
Making Room for Even More Precious Cargo
Geeta Sundaramoorthy

An efficient integrated system is crucial if the region is to grab a big share of global trade.

For those involved with the freight industry - the business of moving cargo from one destination to another - New Jersey presents opportunities like no other. Within a day of affluent metropolitan markets such as NYC in the north and Philadelphia in the south, and with one of the largest seaports in the country, the Garden State is a distribution center. But with opportunities come challenges that must be tackled before they become impediments to growth. New Jersey's port region is facing these challenges in the face.

Transportation experts agree that if immediate steps are not taken to provide for efficient movement of cargo in and out of the port region, the state's infrastructure will be unable to support a cargo increase. That is a daunting task, as Ports Newark and Elizabeth alone expect the cargo throughput to double from 2.5 million TEUs (20 foot equivalent units, a standard measure for marine containers) to 5 million TEUs by 2010 and increase six-fold by 2040. Also, the new rail system with the takeover of Conrail by CSX and Norfolk Southern is expected to bring in more cargo. The two railroads expect Northern New Jersey's intermodal volumes to grow by 18% in 2000, 10% in 2001, and 3.5% through 2020.

According to the Newark-based North Jersey Transportation Planning Authority (NJTPA) some 350 million tons of freight move through New Jersey each year, and as much as 90% of it moves by truck for all or part of the journey. As a result of congestion and other factors, it now costs twice as much to move an intermodal container within the New York-Northern New Jersey region as it does, on average, elsewhere in the country, says a NJTPA report published on its Web site (http://njtpa.njit.edu). The problem is worsened by lack of ware-housing and distribution centers around the port area, forcing trucks to haul the goods to warehouses as far away as Bethlehem, Pa. They must then bring them back packaged and ready for distribution in the New York metropolitan area. This not only causes congestion on the roads and leads to deterioration of the state's infrastructure, it also increases shippers' costs.

John V. Hummer, special project manager for freight services and new initiatives at NJTPA, says to alleviate the problem they must figure out how to maximize the usage of land around the port. He believes the state's brownfields in Northern New Jersey, properties that are often polluted, can be cleaned up to provide much needed space for freight-related activities. Along with New Jersey Institute of Technology, NJTPA received a federal grant of $700,000 to conduct a study of brownfields and other redevelopable sites. The proposal involves a market analysis to establish the necessary criteria for locating freight businesses, an inventory of brownfield and other redevelopable sites in and around the port district as well as along freight routes, and identification of candidate properties for freight operators.

Proponents of the brownfield project hope to not only ease congestion and increase efficient movement of cargo, but also to create an entire economic system around the port. In addition to ware-houses and distribution centers, the system would include light manufacturing and value-added services to spur the region's economy. Hum-mer says the result will be an interdependent economy with lower costs and lots of synergies. Says he: "We are working on an incentive program to attract entreprenuers to the area by offering aid to clean up the brownfields sites, and we are keeping the land cost competitive."

But revitalizing brownfields is only one way to maximize the economic development from increased trade. The region also needs to integrate the port facilities with the truck and rail systems to create seamless transportation, says Lazar N. Spasovic, director of the National Center for Transportation and Industrial Productivity at NJIT. The state government seems to be heading in that direction. James Weinstein, New Jersey's Transportation Commissioner, says the state Department of Transportation and other agencies have identified $4 billion worth of projects over the next 10 years.

A project high on the department's agenda and a key element in Governor Whitman's New Jersey First Program is the Portway Project under the "Transportation Vision for the 21st Century..." Estimated at around $700 million, the project includes a dedicated freight corridor extending northward from the Newark/Elizabeth seaport to rail facilities in Essex, Hudson and Bergen counties and eastward to port facilities on the Bayonne Peninsula.

Another crucial part of the freight transportation system is the development of rail terminals and expanded facilities for Norfolk Southern and CSX, which split Con-rails' business earlier this year. The two railroads hope to divert an additional 1 million domestic containers now being trucked into the Northeast on main road networks. Much of this traffic heads for the New York metropolitan area, where it will be transferred from rail terminals to other distribution centers for final truck delivery.

Hummer expects a significant capacity crunch to develop as the Hudson-Bergen Light Rail Transit, a passenger line between Bayonne and Ridgefield, via Jersey City, Hoboken, Weehawken and North Bergen, goes into its second phase of construction. This would occupy two tracks used by the railroads to serve the Northern freight and marine terminals. Railroads expect the task of finding an alternative to cost about $20 million. This is just one of more than a dozen projects, which are estimated to cost $250 million, that the railroads say are essential to secure adequate service over the next decade.

Ultimately, says Spasovic, it is all a question of public policy. "In Europe, they have taken trucks off the road. But the railroads there are public entities. Here, the railroads are private companies that need to make money, like the trucking companies. What we need is a multidisciplinary, multimodal approach to solving these issues. Clearly, the only way is to come up with a win-win strategy for all involved." Easier said than done.
InTransition Article
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Women in Transportation

Aren’t So Lonely Anymore

Progress has been slow; too slow for some, but opportunities for women in the field of transportation seem to be sprouting everywhere. It’s about time believe Eva Lerner-Lam, Elizabeth Levin, Shirley DeLibero and Janet Oakley. When each of them began her professional transportation career during the 1970s, there were only a handful of women working in a limited number of transportation jobs. By the time Elizabeth O’Donoghue and Anne Mackenzie entered the profession during the 1990s, scores of women were involved in virtually all transportation disciplines. The next generation of women in transportation, represented by Ph.D. student Cecilia Kelinhofer-Feeley, confidently expects unlimited opportunity.

(Top) Eva Lerner-Lam (center)
Elizabeth O’Donoghue (bottom)
Shirley DeLibero
**Altruism and Confidence**

After eight successful years as executive director of New Jersey Transit, altruism lured Shirley DeLibero to Texas. "The first black mayor of Houston asked me to build a light rail system. I thought it was an opportunity for me to give something back to my race. If it can be built where everything is so spread out, light rail can be built everywhere. It's the wave of the future. It can't be built fast enough."

DeLibero was selling mainframe computers "the size of small buildings" when in 1976 she applied for a job at the Boston transit agency and was hired as a project manager responsible for refurbishing old streetcars. "I was the only woman in operations," recalls DeLibero. "I really enjoyed transit. I did a good job. It was very satisfying. It was also quantifiable. I liked that. When I do something, I want to be the best. I loved the business and wanted to become a general manager, but I knew I needed to learn more. I didn't necessarily know where I would be acquiring the knowledge, but I absolutely knew that I would.

"It was tough because transit is a man's world and always will be. You're going where people don't want you. You have to have self-confidence. You've got to be pretty damn obnoxious. You can't be thin-skinned. You can't worry what people think about you. I do not have a problem telling people how good I am."

Add DeLibero, "It's getting better for women. For one thing, there are now other women who can be mentors. It's changing. There may only be 50 women general managers, but that's 50 more than when I started in the business."

Despite the sacrifices she has made to acquire the knowledge she needed to become a general manager, she has few regrets. "My philosophy has always been, after five years on a job, either up or out. I never allow myself complacency. I wanted to be a president and CEO of a transit agency, and I am. I knew it would cost me; it cost me my marriage. But when I look back, I got the best of the bargain."

**Changing Attitudes Is Tough**

Elizabeth Levin credits both the National Environmental Policy Act (NEPA) of 1970 and the momentum of the women's movement for the career she began as a planner. Levin, current national president, Women’s Transportation Seminar (WTS) was hired in 1972 by "an old-line engineering firm" as one of only three professional women among 500 employees. "We were the lowest on the totem pole. It was not an easy environment."

The firm was involved in major wastewater infrastructure projects and the senior staff was having a hard time coping with NEPA requirements, recalls Levin. "Because no one else wanted to do it, those were the aspects of the jobs that I got to do."

"Most women were overlooked. The firm thought women could do only certain things. I got all the 'dog' jobs, the ones that lost money or were badly managed, but I completed all of them. It gave me a lot of experience which eventually helped carve out a niche for me in projects I truly enjoyed doing. I think they admired me for it, but I never fit into their mainstream," Levin said.

She remained at this firm for 13 years until 1985, when she accepted another job offer. Presently senior vice president and principal in a firm of 200 employees, "I play a significant leadership role and have had an opportunity to create the culture, but there's good news and bad news here. We do much better more than most engineering firms. About 30 percent of our professionals are women, but I can't get over some obstacles. Managers tend to give opportunities to people who are like themselves. Most managers are men," observes Levin.
Looking Back

In a June 22, 1965, Wall Street Journal article about the opening of the Equal Employment Opportunity Commission (EEOC), one personnel executive for an airline wondered, “What are we going to do now when a gal walks into our office, demands a job as an airline pilot and has the credentials to qualify?”

“IT never occurred to me that I could apply for the job. I was waiting to hear who would be hired, like everybody else.”

A Delicate Balance

“Transportation is so meaningful to people. It’s much more fascinating and dynamic than I ever thought,” says Elizabeth O’Donoghue, director of communications and government relations for Amtrak West in Oakland, California. “I have to believe in what I do or I can’t do my job well. I had no plan for a career. I knew I wanted to work in the public realm. I knew the government and the legislative process interested me, but I sort of fell into these opportunities. I’ve taken opportunities where I find them, but I don’t jockey for them. Ultimately, that’s not good for me,” she says.

After finishing college in Ohio, O’Donoghue worked on a variety of environmental and social welfare jobs in her home state of New Jersey before moving to Washington, D.C., in 1993. She got a job with Senator Frank Lautenberg to work on projects ranging from the environment to international disputes and federal grant awards.

In 1996, the legislative assistant for transportation post on the senator’s staff became vacant. Lautenberg is ranking minority member of the transportation appropriations subcommittee, senior member of the Senate Environment and Public Works Committee, an original author of ISTEA, and ranking minority member of the Senate Budget Committee. Given Lautenberg’s national prominence, whoever got the job would surely become one of the most sought after congressional staffers in Washington.

Because O’Donoghue already liked what she was doing, she first decided not to tempt fate by applying for the promotion to transportation legislative assistant. But after considering it some more, she took a chance and applied for the job. She’s now glad she did. “Transportation is the single issue in which Lautenberg’s influence is most felt. I knew that there were not a lot of women in the industry. I’d be one of few rather than one of many. You see the same faces in the transportation community and usually they are male.”

Janet Oakley was one of the Women recruited for Elizabeth Dole’s management training program.
“You see the same faces in the Transportation community and usually they are male.”

Similarly, when Eva Lerner-Lam was a planner for the San Diego Metropolitan Transit Development Board (MTDB) in 1982, the planning and operations director quit. “It never occurred to me that I could apply for the job. I was waiting to hear who would be hired, like everybody else.” Then a male superior asked her why she hadn’t submitted an application. If he hadn’t, Lerner-Lam would never have become director of planning and operations for the San Diego MTDB. Lerner-Lam, a former New Jersey Transit board member, is currently owner of the Palisades Consulting group in Teaneck, New Jersey.

When Lerner-Lam’s father, CEO of a Hong Kong-based company, became seriously ill in 1984, he asked her to leave San Diego to return to New York to be with him and to help run his business. “All these people in the transportation profession had bent over backwards to give me a chance. I felt like a traitor.”

Embarrassed by the truth, she fabricated a story on why she was leaving. “I felt it would be a black mark on my record to leave my career to help my father. How would I tell my boss? I came up with a cockamamie story. It was a cover-up and my male boss listened to me and said ‘My g-d, Eva, your dad’s sick and you have to go back.’ What a relief.”

Things were different for Levin when she approached her employer about an even more common family responsibility. “When I had my first child,” she recalls, “I took unpaid sick leave because there was no company policy on maternity leave. By the time I had my second child, there was family leave legislation on the books. I asked what the firm intended to do about this maternity leave. There was no response.

“I waited a year for an answer. About three weeks before my baby was one year old, I wrote a letter and asked if they had decided if I could be eligible to receive payment for my maternity leave. There was no answer. One day I received a check in the mail; no letter, just a check. The first time, I asked. The second time I asked and waited for an answer. I never pressed beyond what they were willing to accept,” admits Levin.

Women Need Mentors and Role Models

After her marriage, Janet Oakley, current director of government relations for the American Association of State Highway Transportation Officials (AASHTO), moved to Frankfort, Kentucky, where she and her husband both had jobs with the state DOT. Oakley, the daughter of a bridge engineer who took her to construction sites as often as to amusement parks, worked on the state’s aviation and rail plans, and became liaison to the river ports commission.

“Being a planner there was very interesting. The DOT was pretty exciting and forward thinking in regard to planning and transportation. The state was talking multi-modal, freight and environment even back in the 1970s,” remembers Oakley.

Her job ended when Oakley’s husband was asked to move to Washington, D.C. to open an office for the state of Kentucky. He had a job waiting for him in D.C., but she did not. “The thing that saved my life was the Women’s Transportation Seminar.

“The WTS network was key to my finding work in the transportation field. They kept up my confidence. Because they showed me that someone else had been there before, everything was not nearly so scary.”

After a short stint at a local transportation agency, Oakley became an FHWA planner during the Reagan Administration. Elizabeth Dole was the Secretary of Transportation. “She instituted a special program to identify promising women at USDOT, women who could be trained as top-level managers.”

Oakley was selected for the program and was enrolled in a special management course. “I met women from all over the country. Each of us was assigned a high-ranking DOT official as a mentor. After the course we were given opportunities to broaden our professional experience with short-term assignments inside and outside the government. I got a call from the House Appropriations Committee. When I asked my FHWA bosses if I could take the assignment, they refused to release me.”

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It took a subsequent call to Secretary Dole's office by Oakley to release her to the House Appropriations Committee for one year. Scores of state DOT and MPO officials have been indebted to Elizabeth Dole ever since. Before joining AASHTO, Oakley was transportation director for the Association of Metropolitan Planning Organizations (AMPO).

A woman role model was important to Lerner-Lam too. As a Princeton University undergraduate, Lerner-Lam was the first woman elected to head an eating club and was president of a class that was only one-third female. "I recall how important it was for me as a student to observe Adele Simpson, the only female dean at Princeton," says Lerner-Lam. "It meant so much. I met few other women who were studying transportation.

"It was important to be invited to her house. That gave me a glimpse of her home, her husband. I saw the whole person behind the legend. She gave me so much confidence to be myself and not to worry what others think of me. She was a stable role model who seemed to be so comfortable. It was very valuable. It wasn't an ego trip for her. She was sharing. That's why I now mentor Princeton students at least an hour or two a month," reports Lerner-Lam.

A grateful O'Donoghue also acknowledges, "I benefited from the women like Jane Garvey, Lillian Borrone, Ann Canby and Grace Crunican, and other women on Capitol Hill. Transportation is a growing and exciting field for women. It's still a man's world, but there's an active group of women who are rising.

"Women mentors are really important," believes O'Donoghue. "Women have to support other women to get through. It's a natural need in a new field for women. Women need a supportive atmosphere to take the risks needed for success."

DeLibero agrees. "I'm mentoring women and men too. I give the best advice I can and I am honest. A lot of women think they're going to get these jobs because they're women. But women have to work harder. If you do a good job, you'll get noticed. There is plenty of opportunity for women, especially on the second tier right now, but women have to take the initiative. Don't expect it to be handed to you."

"Few women have cracked the top," says O'Donoghue. "We still have to change the mindset, but there are big cracks in that armor already. We need more women in all segments of the field: women engineers, women crew, women forepersons, women executives and women lobbyists. Then people won't be surprised when they see women on construction crews or in the boardroom."

Adds Levin, "When a man fails, it is a learning experience before going on to the next career challenge. If a woman fails, it's her last chance. Men are taken by the hand. There's a willingness to give them leadership roles before they're ready for promotion. Women are usually over-qualified by the time they get the same opportunities."

"It's absolutely true," observes O'Donoghue. "There is a double standard in the transportation industry. For the same behavior, a woman is considered a bitch, and a man is considered ambitious. Salary rarely has to do with qualifications. Women don't get paid because they rarely ask for it. Women don't advocate for themselves as well as men. As a result women get the shorter end of the salary and project stick."

"Diversity is something business has to support if it is to serve its customers. I am asking for the playing field to be equalized," adds Levin.

Women's Work

As important as mentors and role models are, many women learn too late that not every woman is her friend, nor is every man her enemy.
Some women prefer an unequal playing field. During the 1970s, feminists called these women "Queen Bees." Queen Bees compete with men willingly, but cut out other women deliberately.

"I'm sort of a Pollyanna. I never assume people are out to do me wrong," admits Lerner-Lam. "I've often found when I was a student and later with women professional colleagues an element of competition crops up I never expected. There have been times I have made overtures to women to do challenging work, and instead of sharing the credit, they invariably insist it was their idea in the first place.

"I find this disturbing about working with other women. I can't think of a single woman who's given me a break. I'd like to think it's because there aren't enough women in power positions to help," she believes.

Despite this, she made a surprising discovery recently. Most of the people she hires to work on the projects in her consulting firm are women.

"I've found that one of our better strengths as women is that we seem to be able to process and analyze a lot of seemingly extraneous information at the same time.

"The more we process and analyze, the closer we get to the truth of the matter. Solving transportation problems is merely processing multiple parameters. Men tend to think of tasks in a serial way, which is also important for problem solving, but they have much more difficulty with multi-task functioning," believes Lerner-Lam.

Janet Oakley is convinced the field will accommodate women eventually. "Transportation must respond to changing demographics, electronic commerce, and changes we haven't imagined yet. It's all happening so fast. Transportation organizations have to adapt just as fast. We need to encourage more women to coach and mentor the next generation to get them interested in science, engineering and transportation fields."

"Women are a good fit to this profession," remarks Ann Mackenzie. Married to an American, this Canadian worked as a planner in the U.S. until recently. "Women like to take care of things and they are good at multi-tasking. There's a lot of juggling in planning."

Though still barely out of her twenties, Mackenzie has already seen a dramatic shift in attitude. At her first job, just a decade ago, "Women were managed differently than men. Women were coddled. We weren't expected to have any answers. Nothing was expected of us, but at the meetings, we got the coffee.

"It's not that way anymore. In the last firm I worked, planners were fifty-fifty men and women. Many of the old-timers at the firm struggled with this because a lot of their views are no longer politically correct, but I think they're coming around. They're seeing women in the firm earn their keep and respect, but they still refer to the clerical workers as, 'the girls,'" says Mackenzie.

Cecilia Kehlhofer-Feely represents the next generation of women entering the field of transportation. A new mother and one of four women in a class of 15 transportation Ph.D students at New Jersey Institute of Technology (NJIT), she says, "Being a female at NJIT is an advantage. Whatever we say is noticed. We are treated with respect by professors. I have ever heard only one sexist remark from one of the male students. That was the most uncomfortable I ever was."

She originally planned on an environmental career but while still a graduate student, a summer job with Lazar Spasovic, a professor in NJIT's transportation program changed her direction.

"I was nervous because the students in my environmental program were having trouble finding jobs, but I noticed that the transportation graduate students were getting multiple jobs."

**Transportation Women at NJIT**

Janice Daniel, an assistant professor of civil and environmental engineering, was appointed to the NJIT core transportation program faculty in September 1999. Daniel's work is in the area of traffic engineering and operations, and congestion management. She holds degrees from Texas A&M, Polytechnic, and Princeton. In 1995, Maria P. Boilé received the second Ph.D. in transportation awarded by NJIT. She is currently an assistant professor of transportation engineering at the faculty of Lafayette College in Easton, PA. Boilé is a recognized expert in intermodal freight movement and still participates in research projects with the National Center for Transportation and Industrial Productivity (NCTIP) at NJIT. School of Management Professors, Naomi Rotter and Hindy L. Schachter, have been involved in numerous transportation research projects supported by NCTIP and NJDOT. Mei Chen, a 1999 Ph.D. recipient, is currently a transportation research associate in NJIT's Institute for Transportation.

For more information about transportation studies at NJIT contact: Athanassios K. Bladikas, Director Interdisciplinary Program in Transportation New Jersey Institute of Technology University Heights Newark, New Jersey 07102 http://transportation.njit.edu

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"Transportation never occurred to me before. When I started as an undergraduate, environmentalism was glamorized but transportation was overlooked."

Kelnhofer-Feely wants to teach eventually. "I like the career opportunities. I see a place for me. Unlike the environmental field, in which there are sometimes jobs, and sometimes none, there's pretty steady growth and not much fluctuation in the field."

Because the encouragement she has received from other women has been so important to her, she is devoting a portion of her time to WTS and the Society for Women in Engineering at NJIT. "I'll be encouraging and mentoring other women to think of transportation."

"There are jobs everywhere," advises Mackenzie. "When I started, it wasn't like that. I don't know why, but it's true. You can make a decent living because there are so many opportunities. The more hats you wear successfully, the better you'll be. Planning requires knowledge, not just of transportation, but a balance of a lot of aspects from a variety of disciplines, economics, environmental protection, geography, demographics, engineering, etc.

"I absolutely recommend this profession to women. You actually feel you're doing something positive. You're working with people who have big hearts and who want positive change," she says.