

The First 20 Years of the Puerto Rico Transportation Technology Transfer Center in the Training of Engineers and Transportation Officials

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Abstract - The Puerto Rico Transportation Technology Transfer Center of the University of Puerto Rico at Mayagüez celebrated its 20th anniversary on April 2006. Since its origin, the Center has thrived in the training and development of engineers and transportation officials from the local municipalities and transportation agencies in Puerto Rico and the United States Virgin Islands, as well as in the education of the next generation of professionals, not only engineers and surveyors, but from other disciplines related to transportation issues. The main focus areas of the Center's activities are transportation safety, infrastructure management, workforce development, and value delivery. This paper describes the evolution of the Center, along with a description of the main activities and challenges and its impact in training and professional development at all levels of education. The new challenges that faced the transportation profession during these 20 years opened a window of opportunities to the Center to collaborate and actively participate, in a bilingual setting, in several innovative educational and professional development programs of local, national and international impact.

Index Terms – engineering education and training, professional development, technology transfer, transportation.

INTRODUCTION

The Puerto Rico Transportation Technology Transfer Center (referred herein as PR-T² Center) was created on April 1, 1986 in the Civil Engineering Department of the University of Puerto Rico at Mayagüez as part of the FHWA Rural Technical Assistance Program (RTAP) that emphasized technical assistance to local transportation officials in rural communities. The objectives of the PR-T² Center in its inception in 1986 were to:

- Transfer the significant findings of research studies that have been conducted in the United States and abroad to local municipalities in the Island in a concise format
- Train highway personnel in areas related to new construction and rehabilitation techniques, maintenance strategies, and pavement management
- Keep local highway and municipal officials current with the new technology already available in the areas of design, construction, programming, maintenance, evaluation and rehabilitation

With the enactment of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991, the program became known as the Local Technical Assistance Program (LTAP) and included technical assistance to urban areas with an expansion of the network to 57 Centers (one in each state of the United States of America, five in tribal communities and our Center).

The PR-T² Center has evolved significantly maximizing its strategic location within a university setting in the Caribbean, our access to students and faculty members from various disciplines and campuses, our bilingual capabilities, and the ever changing local and international transportation needs. Figure 1 shows the main activities, programs and services that have been conducted by the PR-T² Center during its first 20 years.

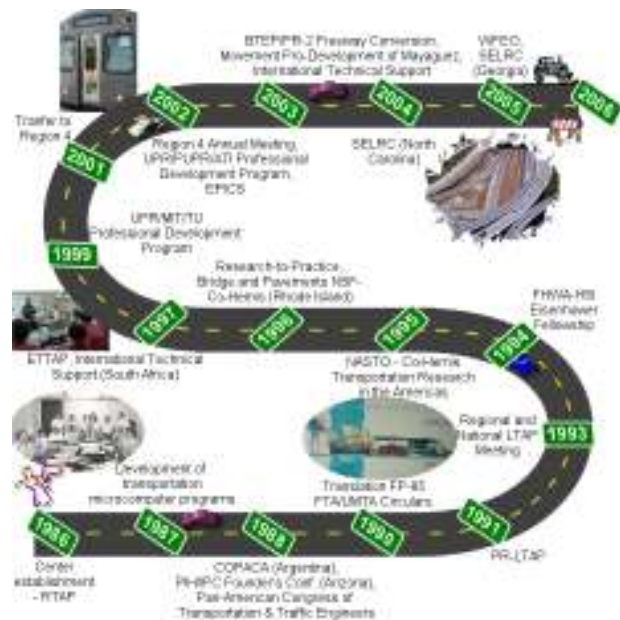


FIGURE 1
 EVOLUTION OF THE PUERTO RICO T² CENTER (1986-2006).

CENTER ACTIVITIES AND SPECIAL PROJECTS

The PR-T² Center has fully accomplished its initial goals and objectives and has evolved with other projects and activities, including special short-term projects, to complement the technology transfer activities and other related activities to the professional development of students,

the planning and coordination of local, national and international conferences, and the provision of international technical assistance.

I. Seminar Program

The principal activity of the PR-T² Center is the seminar program for local transportation officials from the 78 municipalities of the Commonwealth of Puerto Rico, the Puerto Rico Department of Transportation and Public Works (PR-DTPW) and the Virgin Islands Department of Public Works (VI-DPW). The annual training program has included at least 40 seminar-days in Puerto Rico and 10 seminar-days in the United States Virgin Islands (USVI).

The seminar program includes technical seminars and supporting tool-related seminars. Technical seminars correspond to topics of technical nature related to transportation, such as pavement design methodologies and construction procedures, pavement evaluation and maintenance techniques, management of transportation projects, material testing and selection procedures, safety evaluation and analysis of highway facilities, traffic engineering, and development of geographic information systems. Figure 2 presents one of our seminars offered to local transportation officials in the Laboratory of Structural Engineering in the Civil Engineering Department at the UPRM.



FIGURE 2
TECHNICAL SEMINAR OFFERED TO LOCAL TRANSPORTATION OFFICIALS.

Supporting tool-related seminars include topics that complement routine transportation-related activities such as introduction to microcomputers, introduction to spreadsheets and databases, basic management concepts, ethics for engineers, basic statistics, basic supervisory skills, tort liability, and guidelines in technical writing.

II. El Puente Newsletter

The PR-T² Center publishes "El Puente" (The Bridge); a bilingual newsletter (in English and Spanish) that serves as a bridge of information between the Center and the local transportation officials and as a vehicle for reader response. The current newsletter format keeps municipal and other transportation officials informed about the latest transportation-related technology, the latest technical publications and audio-visual materials available at our

library, and the topics and dates of the training opportunities sponsored by the PR-T² Center.

III. Technical Information Services

The PR-T² Center maintains a transportation-related library that provides technology transfer materials in the form of technical publications and videotapes to municipalities or transportation officials. The library includes over 1,500 research reports, technical magazines, transportation and highway engineering textbooks, proceedings of transportation-related conferences, and catalogues of information services that assist in the acquisition of technical information not available at the PR-T² Center. This library is complemented with newsletters from other LTAP Centers, and journals and other publications from the Transportation Research Board (TRB) and the Institute of Transportation Engineers (ITE), among other institutions.

The PR-T² Center has developed an audio-visual technical library that currently consists of over 500 videotapes in VHS, CD or DVD formats (about 80% of the materials are in English and 20% in Spanish). The topics include administration and management, asphalt, bridges and structures, design and construction, equipment and vehicles, geotechnology, drainage, maintenance and operation, pavements and traffic safety.

The PR-T² Center also provides technical information services to municipalities as requested through its web page (www.uprm.edu/prt2). The information provided is in terms of advice, guidance, or referral to published materials, new video releases associated to transportation issues and other relevant areas associated to the built transportation infrastructure in Puerto Rico and the USVI. The web page also includes links to other web pages, newsletter articles, upcoming events and tips/checklist of interest to our local stakeholders. Telephone, letter and electronic mail is also used to handle any request. In certain cases, the requests could be used to develop a seminar topic of interest to other officials from the municipalities.

IV. Special Projects

The PR-T² Center participates in short-term projects of interest to all the municipalities, the PR-DTPW, and the VI-DPW to complement its technology transfer activities. Some of these special projects are:

- Development of transportation-related microcomputer software tools
- Translation to Spanish of technical material of transportation-related topics
- Spanish translation of the Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects
- Development of guidelines for the municipalities on how to prepare Request for Proposals related to public transportation projects
- Development of technical videos regarding the proper use of asphalt, concrete, and soils in road and bridge construction
- Development of technical guidelines for traffic control in highway temporary work zones

- Participation in the USDOT-FHWA Strategic Highway Research Program (SHRP) Assessment Project regarding the documentation of successful stories associated to the implementation of safety products in highway construction zones, and the inventory of existing pavement distresses
- American with Disabilities Act (ADA) and its legal implications
- Identification of transportation needs of municipalities
- Surveys to determine the need of municipalities with a population of less than 50,000 people
- Evaluation of existent transportation facilities and evaluation of marketing methods to promote public transportation in municipalities with a population of less than 50,000 people

EFFECTIVENESS OF THE TRAINING PROGRAM

The effectiveness of the training program is evaluated on a continuing basis with the evaluation forms distributed in each seminar and with the comments received from members of the Advisory Committee and the participants of the PR-T² Center's activities. In addition, continuous feedback from customers not involved in our seminar program is received through the web page. Through this mechanism and following the guidelines of the Strategic Plan of the National LTAP Association, the evaluation of the effectiveness of the program is a continuous process. The LTAP Centers collect data of each calendar year and submit this information to FHWA in two quantitative tools known as Program Assessment Report (PAR) and Center Assessment Report (CAR). These reports provide both FHWA and program stakeholders with an up-to-date view of the quality of the LTAP/TTAP program and its impact on the surface transportation community.

The CAR addresses specific success and challenges, general program and center management and overall program and center management. The PAR includes data of the major activities conducted by the PR-T² Center that are associated with the performance measures incorporated in the PR-T² Center's Strategic Plan. The four (4) focus areas are listed below:

- Safety
- Infrastructure Management
- Workforce Development
- Value Delivery

During calendar year 2005, an excess of 1,000 participant-hours have been devoted to highway safety, 475 participant-hours to worker/workplace safety training, 4,825 participant-hours to infrastructure management training and 1,270 participant-hours to workforce development, management/leadership and soft skills. During the 20 years of the PR-T² Center, over 20,000 transportation officials of Puerto Rico and the USVI have participated in the training program.

NEW EDUCATION INITIATIVES TO INCREASE THE TRANSPORTATION WORKFORCE

In addition to the PR-LTAP program, the PR-T² Center has participated in pioneering initiatives to increase the transportation workforce at the local and international level. Seven (7) programs associated with professional development and community service administered through the PR-T² Center are described below.

I. UPR / MIT / Tren Urbano Professional Development Program

The University of Puerto Rico (UPR), Massachusetts Institute of Technology (MIT), Tren Urbano (TU) Professional Development Program was in operation since the summer of 1994 and was transferred to the PR-T² Center in 1999. During the ten years of the program its main focus was the development of future transportation workforce and research mainly devoted to the planning and construction activities of the TU, the heavy rail mass transit system and largest transportation infrastructure project constructed in the San Juan Metropolitan Area (SJMA).

Undergraduate and graduate students from different disciplines learned the importance of analyzing and evaluating all aspects of a transportation project, such as engineering, transportation systems, architecture, social factors, urban planning, safety, and public participation. Students were exposed to a multidisciplinary setting that promoted the interaction among professionals, exposition to the latest technologies, global impacts, ethics and professionalism, contemporary issues, and communication skills, and allowed them to apply their knowledge in mathematics, science, and engineering to conduct experiments, and to identify, formulate and solve engineering, architectural and planning problems. [2-3]

The success of the Tren Urbano / UPR / MIT Professional Development Program rely on the employment of a team approach toward problem-solving between members of the academia, researchers, and the private and public sectors that make it a true technology-sharing component of the TU. The program consisted of five elements: university courses on public transportation specifically design for this innovative project, research projects developed by the students, summer hands-on work internships, site visits to TU construction sites and to an operating urban rail transit system, and potential post-graduation employment with TU consultants and contractors. Figure 3 shows one of the program elements; students visiting the construction site of one of the TU stations.



FIGURE 3
UPR / MIT / TU GROUP 10 STUDENTS VISITING A TREN URBANO STATION
CONSTRUCTION SITE.

Over 300 research projects were developed in this successful initiative in partnership with MIT and other supporting universities. Many students that participated in this program have been employed by Alternate Concepts Inc. (the firm operating the TU), “Alternativa de Transporte Integrado (ATI)” Office (the government office in charge of supervising the TU operation and its integration to other transportation modes), local government transportation offices, and private consultant firms.

II. UPR / PUPR / ATI Professional Development Program

The UPR / PUPR / ATI Professional Development Program have been in operation since the summer of 2004. This program involves the UPR Mayagüez and Río Piedras Campuses, the Polytechnic University of Puerto Rico (PUPR) and ATI through the Puerto Rico Highway and Transportation Authority (PR-HTA). The UPRM is continuing this successful venture as the lead university through the PR-T² Center. The three main objectives of this program are:

During the first two years of the program, undergraduate and graduate students, with faculty mentorship from the three campuses, learned about the interaction among professionals and focused on the integrated operation of the TU. This program is similar to the earlier UPR / MIT / TU Program with a new emphasis on analyzing the effectiveness of the SJMA public transportation system since the TU started operations, and the many impacts the TU is having on the SJMA and on its integration to other public transportation modes. Figure 4 presents one of the program elements with a group of our students visiting the Portland TRI-MET system to learn about its history and operation to transfer those experiences to the ATI and TU in Puerto Rico. Over 30 research projects have been completed as result of this initiative.



FIGURE 4
UPR / PUPR / ATI GROUP 3 EXPLORING THE PORTLAND TRI-MET TRANSIT
SYSTEM.

III. Dwight David Eisenhower Transportation Fellowship Program

The Dwight David Eisenhower Transportation Fellowship Program was established by ISTEA in 1991. [4] The objectives of this program are to:

- Attract the nation's brightest minds to the field of transportation,
- Enhance the careers of transportation professionals by encouraging them to seek advanced degrees, and
- Retain top talent in the transportation industry.

This fellowship program helps upgrade the scope of knowledge of the entire transportation community in the United States and encompasses all transportation modes. The purpose of the Eisenhower Graduate Transportation Fellowships is to sponsor people interested in pursuing a Master's or Doctorate (or equivalent) degree in a field of study directly related to transportation. In response to the Nation's goal of improving highway safety and reducing fatalities, additional consideration is given to studies and research related to the analysis of crash data and human factors, crash countermeasures selection, roadway and roadside design, and safety improvement programs, among other topics.

Within the Eisenhower program there is a component directed at identifying talent from Hispanic Serving Institutions (HSI), including the UPRM campus. The PR-T² Center has been administering the program since 1994, benefiting over 50 students, many of which are current leaders within the local transportation field.

IV. Entrepreneurial Training and Technical Assistance Program (ETTAP)

The PR-T² Center, with the collaboration of the Office of Small and Disadvantaged Business Utilization (OSDBU), participated since 1997 in ETTAP. This program, through partnership agreements with Minority Educational Institutions (MEIs), including HSI and Historically Black Colleges and Universities, combined the efforts of MEIs, government, and the private sector to focus on providing transportation-related assistance and procurement information to small, women-owned and disadvantaged

business. ETTAP focused on three transportation-related areas: [5]

- Training and technical assistance on the use of and access to electronic commerce and the Internet
- Transportation-related student internships
- Information dissemination and outreach activities regarding the Presidential Welfare-to-Work Initiatives to hire individuals off the welfare rolls and to support the USDOT Garrett A. Morgan Technology and Transportation Future Programs.

ETTAP provided training and development to students in K-12 levels in transportation-related fields through the use of internships and fostered interdisciplinary opportunities for students in the field of transportation. Figure 5 presents one of the interns giving a transportation-related seminar to middle-school students. The ETTAP program agreement increased the skills and understanding of technical issues and research skills of students, including students with disabilities, promote and encourage the participation of students with disabilities in transportation-related contracts and fostered interdisciplinary opportunities for college students in the field of transportation.



FIGURE 5
ETTAP INTERN GIVING A TRANSPORTATION-RELATED SEMINAR TO MIDDLE-SCHOOL STUDENTS.

V. Engineering Projects in Community Service (EPICS)

The PR-T² Center director and the UPRM Department of Civil Engineering and Surveying, in collaboration with Purdue University, participated in the EPICS Program [1]. EPICS is an innovative program that creates partnerships between teams of undergraduate students and non-for-profit local community organizations to solve engineering-based problems in the community. During the years 2002 and 2003, engineering students worked in collaboration with students from the Department of Social Sciences, Humanities and other disciplines from the UPR Mayagüez and Aguadilla Campuses, and with the University Institute for the Development of the Communities, in community service projects in over 35 communities of the western region of Puerto Rico. Figure 6 presents one of the EPICS activities in one of the communities selected for the service projects.



FIGURE 6
EPICS COMMUNITY SERVICE ACTIVITY.

Surveys, inspections documenting deficiencies in the built infrastructure, and coordination of social activities to improve the self-esteem of the community were conducted. Posters and technical oral presentations were made by the students to the communities and to local transportation officials, of which many of the recommendations have been implemented.

VI. UPRM/URI Summer Internship Program

Since 2004, UPRM and URI have participated in a Summer Exchange Internship Experience. The Summer Exchange Student Program is sponsored by the URI Transportation Center and the Dwight David Eisenhower Transportation Fellowship Program of the FHWA. Students from URI conducted research work in Mayagüez under the supervision of professors from the UPRM College of Engineering in areas associated with fiber reinforced materials, landslide-prone sites, vehicle-pedestrian crashes/highway safety, improvement in text and video information in variable message signs through simulation and geotechnical engineering laboratory characterizations. The exchange program provides a new arena to learn from other faculty researchers, different culture and traditions, and help them to become independent and to develop other soft skills that are required to become a successful professional in engineering and transportation-related disciplines.

VII. International Collaborations

The PR-T² Center has collaborated with international organizations and governments to provide information on the FHWA Transportation Technology Transfer Program and the Puerto Rico public transportation system, including the characteristics of the “Público” system and the TU. Several of these international collaborations are:

- The “Congreso Panamericano de Carreteras” (COPACA) in 1988 requested several presentations in Buenos Aires, Argentina, about the Rural Technical Assistance Program (RTAP) and specifically about the tasks, organizations and accomplishments of our Center to consider extending the transportation technology transfer concept throughout Latin America.
- COPACA and the FHWA in 1988 requested the assistance of the Center’s Directors in the Founder’s

Conference of the Pan-American Institute of Highways that was held in Phoenix, Arizona. The participation of the Directors, due to their bilingual capabilities, was instrumental in the development of formal documents that led to the creation of the PIH that extended the RTAP concept to countries in the Caribbean and South America.

- The Federal Transit Administration in 1990 requested the assistance of the Center's Directors to provide technical information on the Puerto Rico "Público" system to the government of South Africa since the kombi system was experienced major operational problems. Presentations were made in South Africa to government officials from their Department of Transportation and professors from the University of Pretoria.
- Since 1996, due to involvement of the Center's Directors in the UPR/MIT/TU and UPR/PUPR/ATI Professional Development Programs, the "Asociación Latino Americana de Metros y Subterráneos" (ALAMYS) has invited professors to participate in its Annual Conference held in Latin America cities. Presentations have been made regarding the SJMA public transportation system that led ALAMYS to accept the PRHTA as a full member of this prestigious organization.

CONCLUSIONS AND FUTURE CHALLENGES

Education, training, technology transfer and professional development are about people. Those that train have the responsibility and play a vital role in the preparation of the transportation workforce and in motivating them to do a job of excellence. The PR-T² Center has played a key role in the development of transportation professionals, providing continuing education to local transportation officials and in providing a bridge with North, Central, and South America and the Caribbean in sharing and adapting the latest technology in a bilingual setting using the university as the education backbone of the system.

A new generation of transportation professionals will be required to address the challenges that will emerge from the recently enacted federal legislation entitled SAFETEA-LU (Safe, Accountable, Flexible, Efficient, Transportation Equity Act - Legacy for Users), PL 109-59. The development of innovative research projects using highly competent interdisciplinary and bilingual professionals that address local and national transportation and infrastructure issues, public transportation, and highway safety to all users will be one of the PR-T² Center's priorities in the UPR/PUPR/ATI component. The PR-T² Center will continue its active role in educating engineers, surveyors, and other transportation-related professionals that serve municipalities and local transportation officials with the latest technology to contribute to the knowledge-based in transportation in Puerto Rico, the Caribbean and the hemisphere.

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