



TREN URBANO UPR-MIT Professional Development Program

**Annual Report – Group VI
1998-1999**

Submitted to

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Frederick R. Harris, Inc.**

Submitted by

**Benjamín Colucci, PhD, PE
Director**





FOREWORD



***Benjamín Colucci, PhD, PE, Director
Tren Urbano UPR-MIT Professional Development Program***

It is exciting to report all the activities performed and the accomplishments during the fifth year of the Tren Urbano UPR-MIT Professional Development Program. Looking back, it is interesting to see how this program has successfully implemented the idea of preparing well-rounded professionals, trained in a team-work multidisciplinary environment, with a deep knowledge of major infrastructure transit projects like the Tren Urbano Project currently under construction in San Juan, Puerto Rico.

The Transportation Technology Transfer Center (TTTC) is currently administering the program after five years under the Civil Infrastructure Research Center (CIRC) at the University of Puerto Rico at Mayagüez. The

program has continued growing and looking for ways and means to enhance it by adding activities, strengthening ties among all the participating institutions, and showcasing the program nationally and internationally.

The Tren Urbano UPR-MIT Professional Development Program produces three valuable long-term benefits for Puerto Rico:

- Strengthened teaching and research programs in the College of Engineering, the School of Architecture, and the Graduate School of Planning.
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- Significantly expanded human re-

sources in urban planning, design, transportation and civil engineering.

- Valuable exportable high technology expertise.

A special word of thanks is due to our sponsors, the Puerto Rico Department of Transportation and Public Works (PRDTPW) and the Highway and Transportation Authority (HTA) through the Tren Urbano Office (TUO).

The program has received national recognition from the Federal Transit Administration (FTA). This agency has made reference to our program as a model to be applied in other parts of the nation under the TEA-21 legislation.

I invite the recipients of this report to get acquainted with this program by carefully reading its content. I also invite you to spread the word and become ambassadors of this idea that allows many professionals to become interested in this innovative approach to education.

In closing, I wish to express a sincere word of thanks to Dr. Antonio González Quevedo, CIRC Director, for his leadership in establishing the program at UPR and its successful growth through the first five years. At the same time, I would like to stress our continuing commitment to make this program even bigger and stronger during the years to come.



ANNUAL REPORT

FIGURES AND FACTS...

The Tren Urbano UPR-MIT Professional Development Program has had a total of 58 students participating from the UPR, of which 25 were enrolled in the summer of 1998.

The program was launched in the summer of 1994, administered by the Civil Infrastructure Research Center (CIRC). Its main activities included the recruitment of the students, coordination of program elements with MIT, the Tren Urbano Office (TUO) and faculty participation and organization of the Encounters in Puerto Rico. The program is currently administered by the Transportation Technology Transfer Center (TTTC).

The faculty and student interns receive clerical and editorial support from the TTTC staff. Office materials, electronic and digital equipment is facilitated to the students to perform their research work.

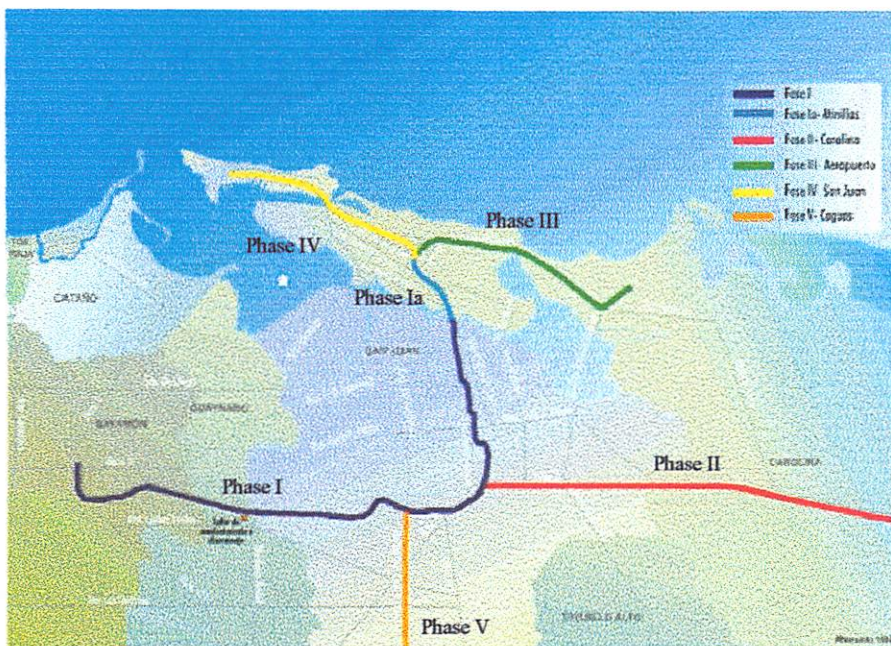
The Tren Urbano Library with over 300 publications including documents of the standard plans of the Tren Urbano project, thesis and technical reports of students, newsletters and a collection of photographs highlighting the most significant activities of the program during the first five years, is also located at the TTTC.

In the 1998-1999 program, the level of funding was in excess of over \$400,000. This has made possible an

increase in the number of participants of the program. Thanks is gratefully expressed to the funding and sponsorship of the TUO, Puerto Rico Department of Transportation and Public Works (PRDTPW), The General Management Architectural and Engineering Consultant (GMAEC), UPR, MIT, CIRC and TTTC.

THE TU/UPR/MIT TEAM...

The UPR faculty and research staff continues to increase. This year there was a total of 13 faculty participants including the project director. The professors and their respective Departments are listed below: Antonio Gonzalez, Nelson Irizarry, Felipe Luyanda, Jose Luis Pérez Berenguer, Luis Suárez and Amado Vélez, of the Civil Engineering Department; Professor Gerson Beauchamp of the Electrical Engineering Department; Professor Sonia Bartolomei of the Industrial Engineering Department; Professor Iván Baigés of the Mechanical Engineering Department; Professor Jaime Gutiérrez of the department of Social Sciences, all from UPR-Mayagüez; Professor Aníbal Sepúlveda of the Graduate School of Planning at Rio Piedras, and the Professor Esteban Sennyey of the School of Architecture at Rio Piedras.



MASTER PLAN OF THE MAJOR PHASES OF TREN URBANO

The TTTC administrative staff includes Eng. Gisela Gonzalez, assistant to the director; Rosa Rodriguez and Nereida Morales, secretaries; Waleska Morciglio, editor; Michael Santos, webmaster; René Maldonado, librarian and Héctor Torres, computational support.

THE UPR/MIT/TU RESEARCH PROGRAM...

Research projects are carried out by the participating students, either individually or in groups. Because of the nature of the UPR/MIT/TU program, research must reflect the priorities of the Tren Urbano project. Therefore, the research agenda shifts according to the progress of the project. For this year, the priorities were construction and operation of Phase I. Students were asked to select a topic, which combines their particular interests with questions in the development of the Tren Urbano project. Since students from the UPR begin to participate in the program in July, when they go to MIT for the summer course, they benefit from the MIT students' presentations by getting ideas for their own research and possible collaboration. For this reason, the UPR students are expected to begin their research projects in August.

Undergraduates at the UPR do research for 6 credit hours (3 per semester) as part of the undergraduate research course. Graduate students, on the other hand, do research for 2 years

1999 ASME

ANNUAL CONVENTION

Sergio Pujols and Gustavo Toledo presented their research project entitled "Transportation Options for Finished Vehicles" at the American Society of Mechanical Engineers Annual Convention. The presentation was on April 16, 1999 at Hofstra University, New York.



GROUP 5 MEMBERS:

Victor Avilés, Clary D. Barreto, Carmen N. Centeno, Libby J. Goyco-de-Vera, Sharleen Gracia, Abigail Marcano, Joel A. Martínez, Nahir Mendoza, Tomás Montalvo, Eduardo I. Ortiz, Maribel Pérez, Sergio S. Pujols, Carmen G. Rawls, Gustavo A. Toledo, and Jessica Vargas.

as part of their theses.

There were a total of twenty-five UPR students involved in the program during 1998-99. All the students presented their research projects. Up to and including the fifth group there have been a total of 114 research projects from MIT and UPR.

THE TEAM VISITS A TRANSIT SYSTEM ...

This year, the trip to an existing transit facility was coordinated to the city of Medellín, Colombia in South America. This city has a successful transit system whose characteristics are similar to those encountered in the Tren Urbano Project in San Juan. Students and faculty participated in this exciting experience and gathered information useful for their respective research projects. A word of thanks to the officials of the METRO system at Medellín for their hospitality and excellent internal organization of this event.

IN THE PUBLIC EYE...

One important goal was the creation of our web page. The web page contains all the information about the program and a gallery of photographs depicting the main activities of the program. Exploring internet capabilities to create a virtual community of transit specialists is one of the future activities for our program.

The Program co-sponsored a trip for two students and a professor to Sacramento, California. Sergio Pujols, Gustavo Toledo, and Dr. Iván Baigés met with executives from SIEMENS Corporation in order to gather information that would help them in their research project.

Other forums are available to students who want to disseminate their research results. For several years students have presented their papers at the Junior Technical Meeting, an activity that usu-

ally takes place in March. In 1999, ten UPR students participated. The Junior Technical Meeting is a premier island-wide forum for university students to present their research results to the scientific community. Another forum was the 11th PR-EPSCoR Annual Meeting. Two UPR students made oral presentations in 1999. The theme of this activity was "The Academia/Industry Junction: Technology Transfer as the Bridge to Economic Development." The 1999EP-SCoR and the Caribbean Division of the American Association for the Advancement of Science sponsored this event.

In addition to the JTM, the students and professor have had other opportunities to show the results of their research projects and the program itself. The student Libby Goyco presented her research project at the "11th Engineering and Surveying Congress" that took place on March 25-26 in Bayamón. The Sigma Xi Poster Day took place at the University of Puerto Rico, Mayagüez Campus. Carmen Centeno and Víctor Avilés presented their posters in this event.

In March 10-12, the Second Tren Urbano Fair was held at the Chemical Building at Mayagüez Campus. The Puerto Rico Secretary of Transportation was the keynote speaker of the event. The ITE and NSPE Student Chapters collaborated in the organization of this fair. In excess of 100 students and professors participated in the technical sessions.

In April 9-10, Libby Goyco, Joel Martínez and several professors from the program participated in the First Tren Urbano Fair held at the Luis Muñoz Marín Park. The main objective of their participation was to evaluate the marketing strategies used by the Tren Urbano to promote ridership and awareness of the intermodal aspects of the system.

In May 26, the Closure Activity was held at the Tren Urbano Office with the purpose of giving students the opportunity to present their finished projects.

JOINING FORCES...

This professional development

program has benefited from the participation of many professionals, other than faculty members, that have selflessly collaborated to the enhancement of the Program. This year, professionals from Boston transit systems, and consulting offices participated sharing their thoughts with our students. Many professionals at the Tren Urbano Office in San Juan, were actively involved in our visits to the Tren Urbano Project and facilities. The professionals representing the international community have significantly contributed to the multidisciplinary and cross-cultural vision of the program. The representatives from the rail transit systems of Caracas, Medellín and Sao Paulo have given us a flavor of the potential success that a well designed, planned and operated system can provide to a highly populated metropolitan area such as San Juan.

We look forward to continue expanding the network of Transit professionals and institutions collaborating with our Program.

A LOOK TO THE FUTURE ...

The UPR/MIT/Tren Urbano Professional Development Program will continue its commitment with the Faculty of Engineering, the Graduate School of Planning and the School of Architecture. In addition, a faculty member from the School of Business Administration will be included in the program to strengthen the interdisciplinary nature of the Program with emphasis in market research. A professor from the Social Sciences

*Faculty members and students
also share time together
outside of class...*



Department will be incorporated in order to address social behavior aspects that should be considered in the process of implementing an infrastructure project of this nature.

The initiative of the UPR/MIT/Tren Urbano Professional Development Program has opened new venues to be explored by other University programs. This approach has been considered by the FTA as a model that can be implemented to support professional development and technology transfer in other FTA funded projects. Many of the characteristics of this program make it advantageous for all the participating institutions and students. The incorporation of practical, bilingual and multi-disciplinary experiences into the academic life, allows Universities to produce well-rounded

professionals with the necessary training to face the new millennium. In the same vein, this program allows the future professionals to put in perspective their desire for new knowledge and challenge them to learn more and serve better.

The future is not completely predictable, the advances in computers and telecommunications provide the basis of innovative ideas that we would like to develop. The combination of distance learning and the internet allows us to envision a virtual educational community that can be focused in professional development programs. It is desirable to have faculty members joining highly qualified practitioners to establish interactive conversations via dedicated chat

rooms in the internet. Using these available technologies, the knowledge will reach new dimensions. Many ways can be used to implement professional development programs with the features of the program described herein, being multi-campus, interdisciplinary, bilingual with strong entrepreneurial commitment, closing the gap between the professional community and academia in the new millennium.

CLOSURE...

Sincere thanks to all of those who have contributed to our Program.

Some of the students participating in this Program have already graduated and are currently working with different firms and contractors involved in Tren Urbano.

SECOND TREN URBANO FAIR Co-SPONSORED BY THE UPR/MIT/TU PROGRAM

'This year was the Second Tren Urbano Fair co-sponsored by the UPR/MIT/Tren Urbano Professional Development program. The fair took place in the Chemistry building at the UPR-Mayagüez. Dr. Fred Soltero Harrington, UPRM Chancellor, Dr. Carlos I. Pesquera, DTPW Secretary and Ramón Vásquez, R&D Director, attended the fair.'

BELOW: STUDENTS FROM CAMPUS TAKE TIME TO LEARN ABOUT THE PROJECT AND TREN URBANO.



ABOVE: UPR RESEARCH STUDENTS PRESENT THEIR PROJECTS AT

BELOW: STUDENTS AT DIFFERENT ACADEMIC LEVELS FROM AROUND THE ISLAND VISIT THE FAIR.



We look forward to see their contributions to the socio-economic development of Puerto Rico with emphasis in improving the mobility and accesibility in the San Juan metropolitan area with the Tren Urbano as a feasible alternative toward this mean.

The financial support provided by Frederick R. Harris Inc. and the Tren Urbano Office is greatly appreciated.

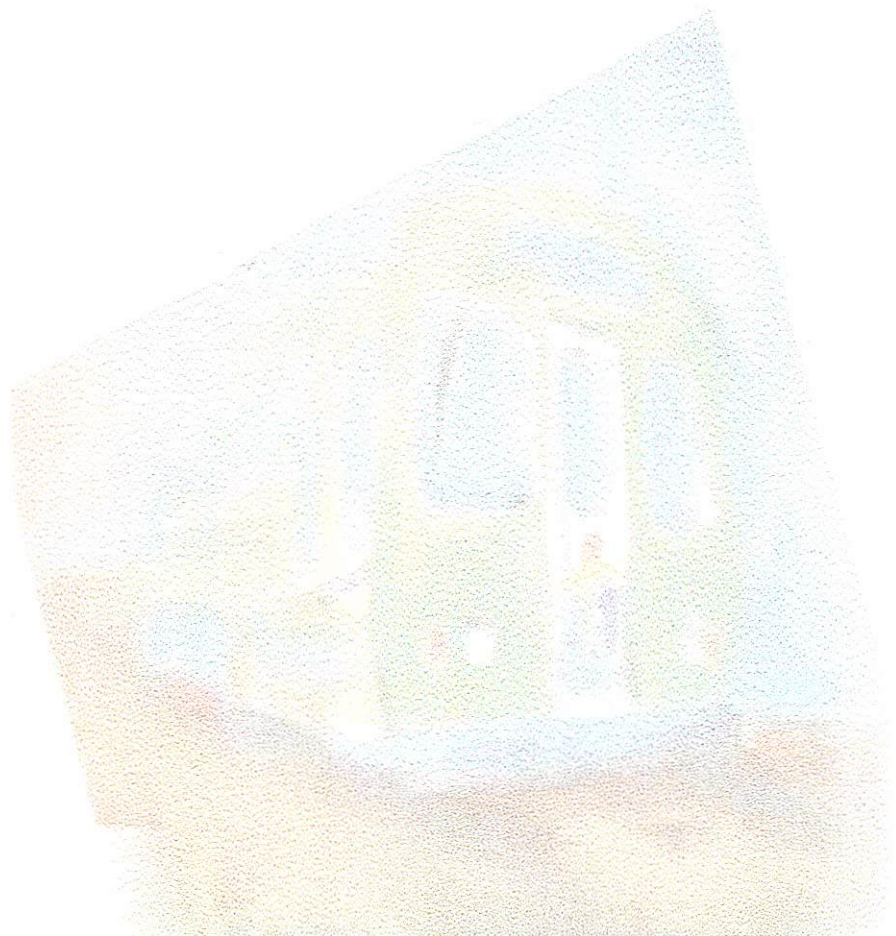
The UPR/MIT/TU Professional Development Program has experienced steady growth over the past years. With responsibility, sense of interdisciplinary effort, team work and focused development, The Tren Urbano/UPR/MIT Professional Development Program has established itself as one of the strongest innovative educational programs in the transportation arena.

STUDENT RECRUITMENT PROCESS

In March a brochure explaining the program and its scope was prepared in order to inform the target audience. The students eligible to participate are those in third, fourth or fifth year, or students entering the graduate programs from Civil, Electric, Industrial or Mechanical Engineering, Planning and Architecture. A meeting was held at the end of March to orient those students interested in participating. In April the applications were received along with a curriculum vitae, academic transcript, letters of recommendation and an essay explaining their motivation to participate in the program as well as their area of interest in the Tren Urbano project. The students were evaluated by the Selection Committee comprised of faculty members from the Departments participating in the Program. The selected students were notified in May. The brochure and application forms are included in the appendix.

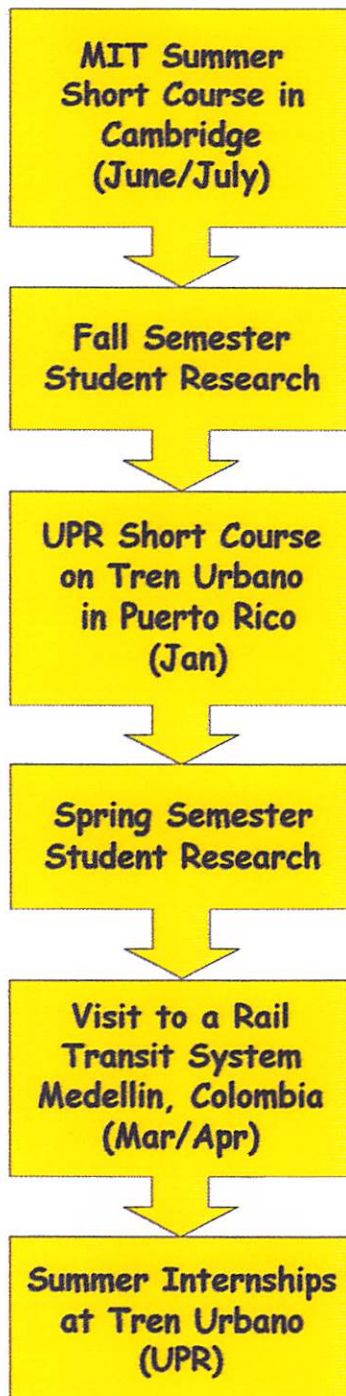
Planning and architecture students are typically graduate students, while civil and electrical engineering students are mainly undergraduates.

The interests of the students range from public transportation, management, design, illumination, security, user characteristics, and frequency of use of rail transit systems. ** [incluir mas temas]





PROGRAM ELEMENTS



The success of the program relies on the growth and dedication of the students, interdisciplinary and interuniversity interchange, quality of the research projects, and the participation of the students in the summer internship. All of this is reached through the six essential key elements that define the main activities of the program. Following is a brief description of each.

- The MIT summer course is conducted by the Center for Transportation Studies (CTS) at MIT, in **Cambridge**, Massachusetts. It includes an intense **seven**-day introduction to public transit through presentations to practitioners, UPR and MIT researchers and professors. After a trip to Boston is made in order for them to share the experience of living in a city with an extensive mass-transit system, learning through case studies how an urban railway is developed and operates.
- The winter conference is held in the metropolitan area of San Juan, Puerto Rico. This consists of lectures, presentations, field trips and social-cultural activities that aid in understanding the different transportation problems of the city and the role that the TU will play in solving them.
- Student intern research projects take place in the spring and fall semesters. During the student's

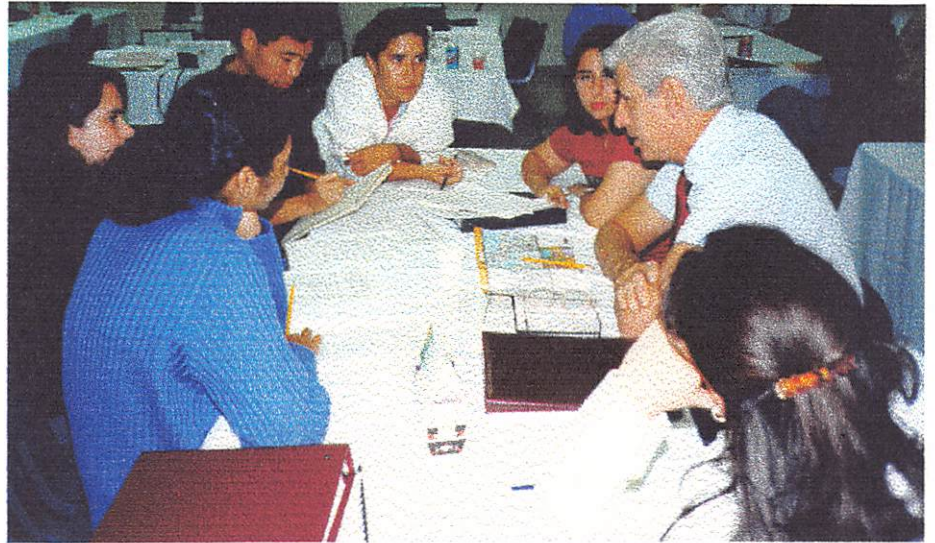
investigation, they learn about the different aspects of a project, such as engineering, transportation systems, architecture, social factors, urban planning, marketing, financing, safety and public participation.

- An annual visit to an operating urban rail transit system takes place during the Holy Week. Field trips to different transportation facilities are coordinated to view public transit facilities.
- Summer hands-on work internships with the TU consultants and contractors intensifies the learning experience by offering a real work environment for professional performance and productivity. The students participate in an orientation session and bi-weekly intern meetings.
- Potential post-graduation employment by TU consultants and contractors occurs because of the intensive training received from the program.



SUMMER COURSE IN MIT

The MIT summer short course was conducted by the Center for Transportation Studies (CTS) at MIT, at Cambridge, Massachusetts. Twenty-five students and ten faculty members from the University of Puerto Rico participated. The course included an introduction to public transportation in Boston, presentations by practitioners, researchers and professors. Civic leaders from the community also share their experience during the planning of the southwest corridor of the orange line. A worthwhile and productive exercise was also performed, which includes the organization of teams of students and professors to evaluate the "best and worst" of public transportation in Boston and how this



UPR and MIT students working with an MIT professional

knowledge can be effectively applied for the benefit of the Tren Urbano project.

Field trips to the T-line and the Southwest corridor, Control Center of the Mass Transit Authority, the Central

Artery Tunnel, VOLPE Center, and Smart routes, were also coordinated.

The students gave their presentation, completed the initial training in Boston, and proceeded to work in the fall on their research project.



Students from UPR and MIT receive lectures in the areas of planning, architecture and engineering as well as marketing and management.



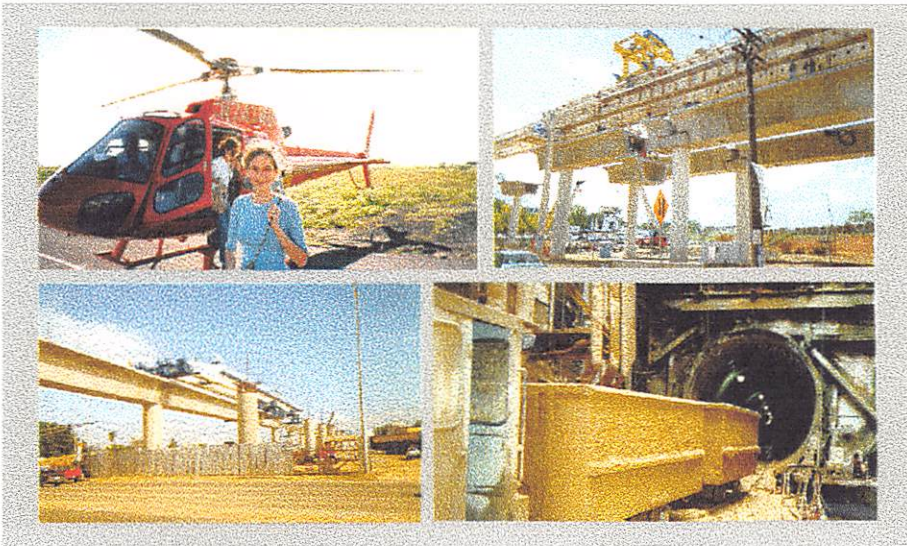
STUDENT RESEARCH PROJECTS

The following table shows the names of the students participating in the program, their majors and the titles of their research projects. In terms of major, the group includes the following: BA: Business Administration, CE: Civil Engineering, EE: Electrical Engineering, IE: Industrial Engineering, ME: Mechanical Engineering, SP: Planning, and SA: Architecture

STUDENT NAME	MAJOR	RESEARCH TITLE
Douglas Acevedo	BA	Best Marketing Strategies for Integrated Public Transportation Systems
Victor Avilés	CE	Análisis de las cláusulas de penalidades e incentivos del contrato de KKZ/CMA
Clary Barreto	CE	Design of Passenger Car Interface Areas for Tren Urbano
Carmen Centeno	CE	Evaluation of Fare Collection Systems
Carmen Correa	SP	Hato Rey Nuevo Centro Station: Intermodal Integration Study
Lisa Fernández	SP	Rehabilitación y desarrollo de vivienda en las comunidades Minillas, Campo Alegre, Hipódromo y Figueroa en el casco urbano de Santurce
Libby Goyco	CE	Development of Successful Public Transit Marketing Strategies for the Tren Urbano
Sharleen Gracia	IE	Fare Collection Integration
Abigail Marcano	CE	Evaluación cuantitativa y cualitativa del sistema de transportación
Joel Martínez	CE	Analysis of Intermodal Transfer Facilities for some Stations of Tren Urbano
Nahir Mendoza	CE	Traffic Calming: A Study of Its Application to the Tren Urbano
Tomás Montalvo	CE	Techniques for Prediction of Ground-Borne Vibrations Caused by Subway Trains
Criseida Navarro	SP	Un sistema de transportación colectiva intermodal e integrado como alternativa al deterioro de las primeras comunidades suburbanas del municipio de Bayamón. El impacto de las estaciones Bayamón Centro y Complejo Deportivo del Tren Urbano y el nuevo expreso Río Hondo sobre la rehabilitación de su entorno
Eduardo Ortiz	EE	Anti-slip/slide Break Control System for Tren Urbano
Maribell Pérez	CE	Geotechnical Conditions Along Future Extensions of the Tren Urbano System
Sergio Pujols	ME	Transportation Options of Finished Vehicles
Carmen Rawls	CE	Análisis de los retrasos en el proceso de reclamaciones en un contrato "diseño-construcción"
Damary Rivera	IE	Tool Design for the Operations Workforce Planning and Budget Analysis
Carlos Rodríguez	SA	Train Road Environmental Exchange Plan Tren Urbano Puerto Rico
Tanya Román	SA	Desarrollo e implementación de los medios de orientación en el Tren Urbano
Alexis Rosado	CE	Geotechnical Analysis of Río Piedras
Gustavo Toledo	ME	Transportation options of finished vehicles
Luis Urquiza	CE	Geotechnical Analysis of Río Piedras
Jessica Vargas	CE	Fare Integration Plan for the Públicos and Tren Urbano
Miguel Vicéns	SA	Desarrollo e implementación de los medios de orientación en el Tren Urbano
Emilie Viqueira	SP	Proyecto de planificación que incorpora mecanismos fiscales y esquemas financieros para darle un uso eficiente a los terrenos aledaños al Tren Urbano de Bayamón Central



1999 ENCOUNTER SAN JUAN, PUERTO RICO



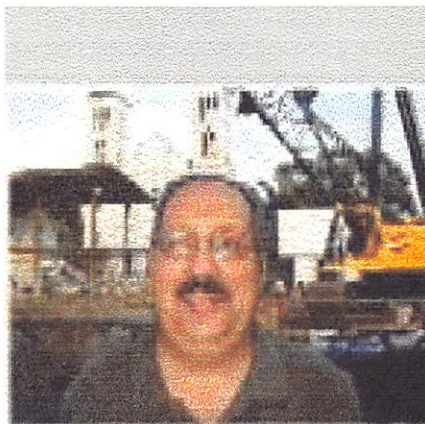
Highlights of Phase I Alignment Tours

In January 1999, the UPR and MIT students participated in the Encounter with two primary objectives:

1. To provide an introduction and overview of TU to the MIT and UPR students while acquiring experience visiting TU facilities.
2. Provide an introduction to the social-cultural background and issues affecting the TU project by incorporating a tour of the metropolitan area.

At the *V Annual Encounter*, held at the TUO, the students presented poster sessions covering the progress attained in their respective projects in the areas of planning, architecture,

engineering marketing and management. The faculty and research staff lectured a wide range of topics from aspects of Puerto Rican culture to specific technical details on the TU project.



**Dr. Antonio González
Quevedo
Program Coordinator
(1994 - 1999)**

Distinguished professionals from the Transportation Community from the United States and Latin America were invited, including faculty members and administrators from successful rail transit systems.

Representatives from major contractors, for example Seimens Transportation Partnership of Puerto

Rico provided status reports on the design and construction of the project. Government officials, including Dr. Carlos I. Pesquera, Secretary of the Department of Transportation and Public Works presented critical issues concerning the project.

Visits to the Phase I alignment were made by bus with a tour guide from the TUO and by helicopter ride.



TRIP TO RAIL TRANSIT SYSTEMS MEDELLÍN, COLOMBIA

The annual trip to a transit system was the Medellín Metro in Colombia from March 28 through April 1, 1999. Twenty-five UPR students participated in the visit accompanied by ten professors, an engineer from the Puerto Rico Highway and Transportation Authority, and a specialized engineer and technology transfer specialist from the TUO.

Dr. Jaime Gutiérrez gave an orientation about the Colombian culture and public transportation system to the students and professors. It was held at the UPR, Mayagüez Campus on March 24, 1999.

Students and professors participated in activities including lectures from the Metro management team and visits to



The research team at a Metro station about to board the train. (Medellín)

the control center, train stations and maintenance facilities.

The technical sessions were geared towards the importance of early preparation of the users and the importance of marketing based on the culture of the users of public transpor-

tation systems. The importance of understanding the cultural needs was essential in the successes of the implementation of the Medellín Metro. This is one of the most important lessons learned by our group in this trip.



UPR students and faculty of Group V that participated in the visit to the rail transit system in Medellín, Colombia.



SUMMER INTERNSHIPS

An integral part of the program is the summer internship work experience with Tren Urbano consultants and contractors. **The Tren Urbano Office is in charge of coordinating the internships.** The role of the Transportation Technology Transfer Center is to inform students of the opportunities with summer internships. These internships enhance the classroom learning experience by offering a real life work environment, which emphasizes professional performance and productivity. As part of their responsibilities, students participate in bi-weekly intern meetings. **They also receive stipends during their internship.** This year a total of twenty students participated in student internships.

*The UPR/MIT/TU
Professional Development
Program was presented
at the NSF-EPSCoT
Convention held at the
Best Western Hotel,
Mayagüez, Puerto Rico
May 21, 1999*

A Summary of Major Activities Performed during year 1998-99

The UPR/MIT/Tren Urbano Professional Development Program has incorporated other activities that complement and strengthen the main program elements. For example: Technical presentations, publications in recognized newsletters, organization of a Tren Urbano Fair in Mayagüez, and creation of our web page

The following list presents a summary of the activities performed during this year.

Fall 1998:

Delineation and definition of research projects.

Article "UPR/MIT/Tren Urbano Professional Development Program" by Colucci B. and González A. published in the UTRC newsletter, Region II, City University of New York.

Spring 1999:

V Encounter of Tren Urbano including poster sessions

Article "UPR/MIT/Tren Urbano Professional Development Program" by Colucci B. and González A. published in Tecnomundo Magazine, a publication of the CIAPR (Professional Council of Engineering and Surveying)

Tren Urbano Fair in Mayagüez, official presentation of our web page.

Presentation "*Human Resources Development Program for the Tren Urbano*" ASCE. Miami, Florida.

Presentation of various posters at Sigma-Xi activity. Mayagüez, PR.

Presentation "*Transportation Options for Finished Vehicles*" ASME Annual Convention, New York.

Presentation of various research topics at the "Junior Technical Meeting" sponsored by NSF-EPSCoR, Mayagüez, PR.

Presentation "*Professional Development Program in a University Setting: Tren Urbano Initiative*" NSF-EPSCoT Convention, Mayagüez, PR.

Visit to Medellín Metro

Presentation: "*Transportation Partnerships for the New Millennium*" FTA-Region IV Regional Conference. Atlanta, Georgia.

Tren Urbano Office overview for next group of students before their course in Boston.

Article "Un nuevo enfoque para el desarrollo profesional de los estudiantes: Iniciativa UPR/MIT/Tren Urbano" by Colucci, B. published in Crónicas, a magazine of the University of Puerto Rico.

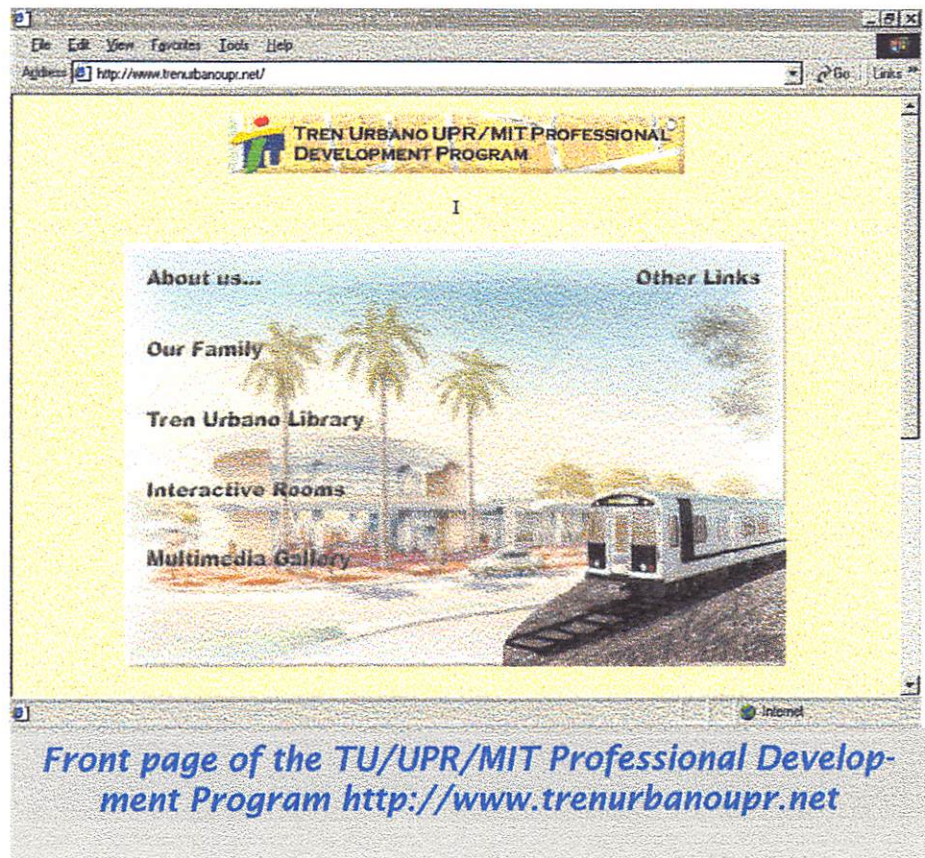


WEB PAGE

The web page of the Tren Urbano/UPR/MIT Professional Development Program (<http://www.trenurbanoupr.net>) was developed during the months of February and March. The web page was launched at the Second Tren Urbano Fair held in the Chemistry building at UPRM on March 10, 1999. This page is constantly being updated with the most recent information concerning the Program.

The web page is divided into the following sections:

- Overview – an introduction to the UPR/MIT/Tren Urbano Professional Development Program
- Objectives – a brief summary of the objectives of the Program
- Student Interns – information and photographs of the students participating in the Program
- Faculty Advisors – information on the professors and their academic backgrounds and on their relationship to the Tren Urbano Project and the Tren Urbano Program
- Research Projects – abstracts from the research projects of Group V
- Activities – recent and future



- activities related to the Tren Urbano Project, and to the scientific community. There is also information on different forums for presenting research projects and on activities directly related to the Program
- Photo Gallery – photos from different activities, and from the different groups of students who have participated in the Program
- Sponsors
- Acknowledgements

- Links – links to the Highway and Transportation Authority, the Massachusetts Institute of Technology, the Department of Transportation and Public Works, the Transportation Technology Transfer Center, the University of Puerto Rico at Mayagüez, and the University of Puerto Rico at Río Piedras
- Application Form – a form available for students wishing to apply to the Program



SUMMARY OF BENEFITS AND A LOOK TO THE FUTURE

The objectives of the program, which are geared towards developing a cadre of bilingual professionals able to plan design, construct, operate and manage urban rail transit systems and specifically the Tren Urbano, were achieved once again in our fifth year of the program. Specifically:

- MIT graduate and undergraduate students came to the UPR for an 8-day program.
- UPR graduate and undergraduate students went to MIT for an intensive summer course and participated in the study tours to the Medellín Metro. These cross-cultural components enrich our interdisciplinary approach.
- Knowledge of rail systems as related to Puerto Rico and Tren Urbano was fortified by hands-on participation in cross-disciplinary interactions.
- Sharing expertise and applying theory to a real world situation was possible due to the opportunity created to bring together faculty and students in engineering planning and architecture, and professionals from public and private sectors.
- MIT and UPR students exchanged ideas, research and collaboration.
- The Steering Committee Meeting was established and met in February, March and May to discuss the general guidance of the program.
- The use of the Internet for graduate and undergraduate research was stressed.
- Students were motivated to pursue careers in transportation.
- Students developed technical skills.

Even when the objectives were achieved and the FTA designated the program as a model project for its new national technology transfer program, there is always room for improvement. The following recommendations were made for year 6:

- There should be a primary consultant who is involved directly in the Tren Urbano project for each student researcher.
- The courses should have more direct participation from people involved in the Tren Urbano project.
- The Program should concentrate on interdisciplinary activities.
- Joint research projects between MIT and UPR should be emphasized

Acknowledgements.

Special thanks to Dr. Didier Valdés for his collaboration in the preparation of the annual report.

The administrative support provided by Gisela González, Rosa Rodríguez, Nereida Morales, and the students that work at the Technology Transfer Center is greatly appreciated.

The collaboration of Dr. Felipe Luyanda in allowing the Center to administer this program is greatly appreciated

The support provided by the faculty mentors throughout the program is also acknowledge.

The collaboration of the CIRC staff during the transition, namely Daisy Morales, Lissette de la Cruz, and Waleska Morciglio is also acknowledged.

Finally, the author acknowledge the support provided by the Civil Engineering Department in the planning and coordinating the use of its facilities.

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Eng. Gisela Rodríguez



Nereida Morales



Rosa I. Rodríguez
Secretary



Hector Torres
System Administrator



Michael J. Santos



René Maldonado
Librarian

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