Title

Integrated Graduate Education & Research Traineeships: Transportation Technology & Policy Executive Summary

Authors

Mokhtarian, Patricia L
Tolentino, Joan

Publication Date

2005-12-01

INSTITUTE OF TRANSPORTATION STUDIES
UNIVERSITY OF CALIFORNIA, DAVIS

Year 2005

UCD—ITS—RR—05—26

Integrated Graduate Education & Research Traineeships: Transportation Technology & Policy Executive Summary

Patricia L. Mokhtarian
IGERT Principal Investigator

Joan S. Tolentino
IGERT Program Manager

Institute of Transportation Studies ◇ University of California, Davis

One Shields Avenue ◇ Davis, California 95616

PHONE: (530) 752-6548 ◇ FAX: (530) 752-6572

WEB: http://its.ucdavis.edu/

FINAL REPORT

National Science Foundation
Integrated Graduate Education and Research Traineeships Grant

TRANSPORTATION TECHNOLOGY AND POLICY

Institute of Transportation Studies
One Shields Avenue
University of California, Davis
Davis, CA 95616

December 2005

Prepared by:

IGERT Principal Investigator: Patricia L. Mokhtarian
Professor, Civil and Environmental Engineering
and Chair, Transportation Technology and Policy Graduate Group

IGERT Program Manager: Joan Tolentino, Institute of Transportation Studies

IGERT FACULTY

More complete descriptions of ITS-Davis affiliated faculty are found in Appendix A.

Principal Investigator

Patricia Mokhtarian, Civil and Environmental Engineering
Chair of the Transportation Technology and Policy Graduate Group, and
Associate Director for Education of the Institute of Transportation Studies

Co-Principal Investigators

Robert Flocchini, Land, Air and Water Resources
Director of the Crocker Nuclear Laboratory
Robert Johnston, Environmental Science and Policy
Daniel Sperling, Civil and Environmental Engineering and Environmental Science and Policy
Director of the Institute of Transportation Studies
Steven Velinsky, Mechanical and Aeronautical Engineering
Co-director of the Advanced Highway Maintenance and Construction Technology Center

Faculty Advisors of IGERT Fellows (Names of Fellows)

Lee Branstetter, Economics (Nylander) – no longer at UCD
Andrew Burke, ITS-Davis (Gardiner, Herbert, Kornbluth)
Daniel Chang, Civil and Environmental Engineering (Held, Leeman)
Harry Dwyer, Mechanical and Aeronautical Engineering (Grupp) – emeritus
Robert Feenstra, Economics (Forest, Lepore, Sparber)
Andrew Frank, Mechanical and Aeronautical Engineering (Harmon, Kornbluth)
Joanna Groza, Chemical Engineering & Materials Science (Gardiner)
Susan Handy, Environmental Science & Policy (Hough, Nicholas, Winston)
Robert Johnston, Environmental Science & Policy (Clay, Rodier) – emeritus
Kenneth Kurani, ITS-Davis (Congleton)
Marshall Miller, ITS-Davis (Kershaw, McCaffrey)
Patricia Mokhtarian, Civil and Environmental Engineering (Clay, Ory)
Robert Moore, ITS-Davis (Sundaresan) – no longer at UCD
Debbie Niemeier, Civil and Environmental Engineering (Hendren, Kear, Morey)
Tayhas Palmore, Chemistry (Butlin, Melnick) – no longer at UCD
Daniel Sperling, Civil & Environmental Engineering & Environmental Science & Policy (Badrinarayanan, Brodrick, Caldwell, Chen, Eggert, Friedman, Hamilton, Lutsey, McCarthy, Rachlin, Rivasplata, Weinert, Williams)
Pieter Stroeve, Chemical Engineering & Materials Science (Quinlan)
Steven Velinsky, Mechanical and Aeronautical Engineering (Stiles)
James Wilen, Agricultural Economics (Salon)

IGERT STUDENTS

STUDENT	GEN-DER	PROGRAM	UNDERGRAD MAJOR	FACULTY ADVISOR	ADVISOR'S HOME DEPT.
Badrinarayan, P.	M	TTP	Geography	Sperling	CEE/ESP
Brodrick, C.J.	F	TTP	Environmental Eng.	Dwyer	MAE
Butlin, Nathan	M	Chemistry	Chemistry	Palmore	Chemistry
Caldwell, Matthew	M	TTP	Eng'g Physics	Erickson	MAE
Chen, Belinda	F	TTP	Biology, Environment	Sperling	CEE/ESP
Clay, Michael	M	TTP	Regional Planning	Johnston	ESP
Congleton, Chris	M	TTP	Culture, Technology	Kurani	ITS
Eggert, Anthony	M	TTP	Mechanical Eng.	Sperling	CEE/ESP
Forest, Adam	M	Economics	Economics	Feenstra	Economics
Friedman, David	M	TTP	Mechanical Eng.	Moore	ITS
Gardiner, Monterey	M	TTP	Materials Science	Groza	Chem. Engr.
Grupp, David	M	Mech Eng	Mechanical Eng.	Dwyer	MAE
Hamilton, Pete	M	TTP	Engineering	Sperling	CEE/ESP
Harmon, Fred	M	Mech Eng	Electrical Eng.	Frank	MAE
Held, Anthony	M	CEE	Civil Engineering	Chang	CEE
Hendren, Patricia	F	TTP	English	Niemeier	CEE
Herbert, Jesse	M	TTP	Chemical Eng.	Groza	Chem. Engr.
Hough, Jill	F	TTP	Agric. Economics	Sperling	CEE/ESP
Kear, Tom	M	CEE	Civil Engineering	Niemeier	CEE
Kershaw, Tod	M	TTP	Electrical Eng.	Miller	ITS
Kornbluth, Kurt	M	Mech Eng	Mechanical Eng.	Frank	MAE
Leeman, Whitney	F	CEE	Civil Engineering	Chang	CEE
Lepore, Jason	M	Economics	Economics	Feenstra	Economics
Lipman, Tim	M	Ecology	Anthropology	Sperling	CEE/ESP
Lutsey, Nicholas	M	TTP	Agricultural Eng.	Sperling	CEE/ESP
McCaffrey, Zach	M	TTP/Mech E	Computer Eng.	Miller	ITS
McCarthy, Ryan	M	CEE	Structural Eng.	Ogden	ESP
Melnick, Ryan	M	Chemistry	Biophysics	Palmore	Chemistry
Morey, Jennifer	F	Ecology	Community/ Reg'l Environment	Niemeier	CEE
Nicholas, Mike	M	TTP	Natural Science	Ogden	ESP
Nylander, David	M	Economics	Economics	Branstetter	Economics
Ory, David	M	CEE	Civil Engineering	Mokhtarian	CEE
Quinlan, Forest	M	Chem Engr	Engineering	Stroeve	Chem. Engr.
Rachlin, Aaron	M	TTP	Geology	Sperling	CEE/ESP
Rivasplata, Charles	M	TTP	Civil Engineering	Sperling	CEE/ESP
Rodier, Caroline	F	Ecology	History	Johnston	ESP
Salon, Deborah	F	Ag Econ	Physics	Wilen	Ag & Re-source Econ
Sparber, Chad	M	Economics	Economics	Feenstra	Economics
Stiles, Jim	M	Mech Eng	Mechanical Eng.	Velinsky	MAE
Sundaresan, Meena	F	TTP	Mechanical Eng.	Moore	ITS
Weinert, Jonathan	M	TTP	Mechanical Eng.	Sperling	CEE/ESP
Williams, Brett	M	TTP	Philosophy	Sperling	CEE/ESP
Winston, Emily	F	TTP	Mechanical Eng.	Handy	ESP

ACKNOWLEDGEMENTS

Some descriptive portions of this report have been taken from ITS-Davis Biennial Reports and the ITS-Davis electronic newsletter, e-news (see http://www.its.ucdavis.edu/news/index.html). These documents are mostly written by Jamie Knapp, with contributions from ITS-Davis faculty and staff.

TABLE OF CONTENTS

cover letter, poster, old brochure, new brochure, recruitment seminar flyers, Power Point recruitment talk, e-mail recruitment message

F. Database Screens
G. Alumni Evaluation Surveys
H. TTP and CEE Annual Program Statistics
I. List of Papers and Research Reports Produced with IGERT Funding
J. Overviews of Selected IGERT-Supported Research Projects
K. Campus-Level Diversity Recruitment Activities
L. Campus-Level Responsible Conduct of Research (RCR) Activities

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The UC Davis IGERT grant for Transportation Technology and Policy (TTP) began October 1, 1998 and officially concluded September 30, 2005, although no students were funded in its seventh and final year. The TTP theme of the grant was shared by the degree-granting program of the same name (the students in which overlapped, but did not completely coincide, with IGERT recipients), and focused on the need to integrate the often-segregated policy and technology sides of transportation, so as to better prepare students to address today's and tomorrow's complex transportation-related challenges. The budget totaled $2.66 million, which directly funded 43 students in eight different degree programs (including research, teaching, international internships, and travel activities), 14 distinguished speakers, two graduate research conferences, a variety of recruiting practices, laboratory and computing equipment, project administration, and this evaluation. More than 2/3 of the budget directly funded students.

In less than 15 years, the Institute of Transportation Studies at UC Davis (ITS-Davis, established in 1991) has vaulted into the top ranks of university transportation centers. IGERT has had everything to do with this meteoric rise: the IGERT grant was active for nearly half of that period, and was seminal in supporting numerous and diverse research and educational activities of the Institute. Table ES.1 summarizes the growth in various key indicators during the approximate time the IGERT grant was in force.

Table ES.1: Growth in Key Transportation Indicators at UC Davis

	1997-98	**2004-05**	**Percent increase**
Faculty associated with ITS-Davis	37	54	46%
Departments/organizations of all faculty associated with ITS-Davis	12	18	50%
Depts./orgs. of core transportation faculty	6	9	50%
Transportation graduate students	40 (est.)	80	100%
Industry and foundation support	$500 K	$1.5 M	200%
Total research expenditures	$2.12 M	$2.96 M	40%

As shown by the table and discussed at greater length throughout this report, the IGERT grant enabled ITS-Davis to:

- attract more, and more diverse, students to the study of transportation;
- encourage the campus to create more transportation faculty positions;
- attract outstanding new transportation faculty members in several different departments;
- broaden and deepen the curricular offerings in transportation;
- foster new research and education collaborations;
- develop innovative research approaches, discoveries, and solutions; and
- enrich the learning experience at UC Davis in a variety of ways.

Although the evaluation of the program is necessarily largely qualitative, a number of observations can confidently be made. In this section we highlight some of the key impacts of the

IGERT program at UCD; other valuable observations can also be found in Chapters 2 and 3 of the report.

- IGERT was a significant factor in leveraging new faculty positions in transportation for the campus, and played a role in making the campus transportation research and education milieu an attractive one to prospective faculty hires. The outcome was an increase in the number of transportation faculty on campus (at least six new full-time tenured or tenure-track appointments during the life of the IGERT program, in four departments), extraordinarily high-caliber new faculty, and a firm commitment to interdisciplinary education in general and the TTP program in particular on their part.

- The IGERT grant appeared to help increase the gender diversity of transportation students at UCD, as 23% of IGERT recipients were female, compared to 19% of non-IGERT transportation students enrolled during the same period. This is likely due in part to our higher-than-average proportion of women faculty: 11 (20.4%) of the 54 faculty associated with the Institute of Transportation Studies (ITS-Davis) are women, compared to an average of 8% women faculty in engineering colleges nationwide. However, targeted efforts to recruit underrepresented minority students were not effective and were difficult to sustain.

- Although the transportation program at UCD has had little difficulty in recruiting sufficient qualified students through relatively ad hoc methods, there are some challenges to doing so in a more systematic way, given the relative lack of visibility of transportation as a field of study to undergraduates, and the diverse disciplinary avenues by which students can arrive at an interest in transportation.

- Perceptions of the effectiveness of their graduate program at UCD differed little between IGERT and non-IGERT alumni, with average ratings for both groups falling between "good" and "very good" on most aspects. Transportation students who did not receive IGERT support directly still benefited in numerous indirect ways from the IGERT grant.

- Due in large part to the consciousness raised by the emphasis of the IGERT program on the subject, ethics issues are now taught in a number of core and elective classes taken by transportation graduate students at UC Davis.

- Although the international internship opportunity offered through IGERT was not heavily utilized, students continue to take part in significant international collaborative activities outside the rubric of IGERT.

- IGERT fellows and their co-authors have produced at least 33 journal articles, conference proceedings, and book chapters, and 56 research reports. The research covers a wide variety of topics, including telecommuting, work status choice, smart parking, carsharing, regional transportation and land use models, attitudes toward travel, hydrogen-fueled and/or fuel-cell vehicles, light-duty diesel vehicles in Europe, rural vehicles in China, heavy-duty truck auxiliary power units, low-speed modes, air quality policy and modeling, and transnational comparisons of transportation modeling and planning. Much, perhaps most,

of this research would not have occurred without IGERT, including studies using the equipment that IGERT made it possible to purchase.

- The presence of the IGERT grant contributed substantially to the image and reality of ITS-Davis having a vital, thriving program that warrants further investment on the part of others. Thus, it was instrumental in:

    - attracting other key sources of funding (US Departments of Transportation and Energy; University of California Transportion Center; Honda endowment; industry, foundation, and individual support);
    - generating and supporting major new initiatives (Fuel Cell Vehicle Modeling Program; Transportation and the Hydrogen Economy; Road Ecology Center; Pavement Research Center; China Center for Energy and Transportation; fundraising campaign with the College of Engineering; new faculty positions approved for campus-wide Transportation and Energy for the Future initiative); and
    - fostering closer ties with other parts of campus, notably the Graduate School of Management through its Business Development Certificate Program and Little Bang/Big Bang entrepreneurship competitions (see Appendices C and D).

- Many if not most of the elements of the TTP IGERT program have been institutionalized at UCD. The TTP degree program per se is certainly here to stay. New faculty are solidly rooted and are likely to make outstanding careers here. New courses are making their way through the course approval process. The internship program is likely to remain small in scale, but unquestionably valuable.

- At the campus level, a number of institutionalization activities have occurred and are underway, including establishing a new administrative position, holding regular meetings of key personnel across all current and prospective IGERT grants, offering centralized support of recruiting and professional development activities, and offering financial and other support of new IGERT proposals (see Section 3.4.2 for details).

The TTP IGERT grant has not only offered a tremendous benefit to transportation research and education at UCD, we believe that the IGERT program nationwide has had a galvanizing effect on graduate education in the United States. We have only three suggestions to offer to NSF with respect to the IGERT program:

1. Judging by the experience at UCD, multiple IGERT grants on the same campus generate a synergistic effect in terms of visibility to the administration, and administrative support in response, that exceeds the sum of their parts. Thus, we would hope that at a minimum, the prospect of a future IGERT award constituting the third or fourth award to a given university would not be considered a liability. At a maximum, that outcome could arguably be considered an asset, and hence counted as a merit rather than a demerit of a given proposal.

2. Only two of our IGERT recipients took advantage of the international internship opportunity offered through IGERT (although several others had significant international experien-

ces outside of IGERT). As indicated, the typical internship lasts at least three months, and the international internship program was set up to allow periods of two months to a year. For many students, an absence of even two months (especially in a foreign country) could be difficult to manage, particularly for those with families (young children, working spouses, etc.). In addition, the barriers of distance, language, and culture do make it more difficult to lay the initial groundwork for the connection between student and host. Thus, our recommendation with respect to such programs in the future is to support "mini-internships" of much shorter durations – e.g. a week to a month. In this way, a student can travel abroad, often in connection with an international conference that will be an invaluable experience in its own right, and then stay behind (or come early) to work with an international host for a few days or weeks. Making one or two such visits a year for the several-year duration of one's PhD program could be extremely effective, especially partnered with modern communication technologies that enable the continuation of any collaborations from a distance.

3. As we understand the policy, NSF sets the stipend rate for its training programs, and requires that any fellowship recipient be paid at that rate. When the stipend rate was $15,000 a year, as it was at the outset of the grant, that was roughly commensurate with (actually a few hundred dollars less than) the typical engineering research assistant's (RA's) salary at UCD. As the set rate kept rising, however, it eventually far outstripped the standard RA salary. The NSF stipend has now doubled to $30,000 a year, whereas annual RA salaries for TTP and CEE students at UCD are $18,285 – 23,602 (for 50% time during the nine-month academic year and 100% for the three summer months). The specific salary within that range is not at the discretion of the program, but is tied to educational milestones such as whether the student has an MS degree or has passed the PhD qualifying exam or not. Thus, a new graduate student without a prior MS would receive a 64% higher stipend as an IGERT fellow than as an RA. Such a large disparity in support between two students in the same degree program naturally led to some resentment and jealousy of the "haves" on the part of the "have-nots". We urge NSF to allow programs at least some flexibility in setting stipend amounts, to more closely reflect local circumstances and practices.