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Integrated Graduate Education & Research Traineeships: Transportation Technology & Policy Final Grant Report

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FINAL REPORT

National Science Foundation
Integrated Graduate Education and Research Traineeships Grant

TRANSPORTATION TECHNOLOGY AND POLICY

Institute of Transportation Studies
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IGERT FACULTY

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

Principal Investigator

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Chair of the Transportation Technology and Policy Graduate Group, and
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Co-Principal Investigators

Robert Flocchini, Land, Air and Water Resources
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Robert Johnston, Environmental Science and Policy
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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.

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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 experiences 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.

CHAPTER 1: INTRODUCTION

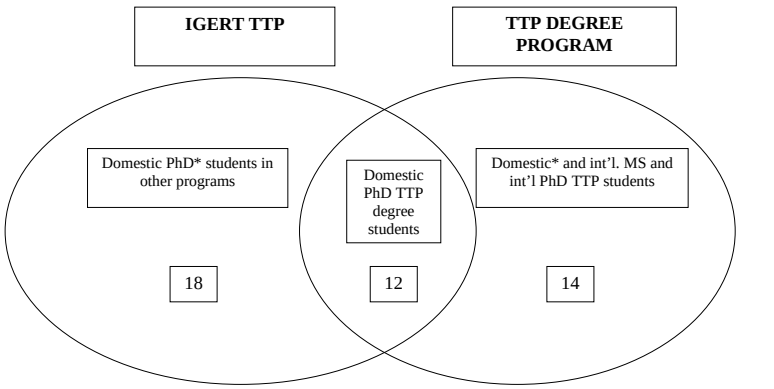
This report has two main purposes: (1) to summarize the activities associated with the National Science Foundation's IGERT grant on Transportation Technology and Policy (TTP) to the Institute of Transportation Studies at the University of California, Davis (ITS-Davis), and (2) to evaluate the effectiveness of the grant. Effects are reviewed in four areas: students, research, the transportation program at the University of California, Davis (UCD), and the UCD campus.

To avoid confusion, it is important to clarify at the outset that the phrase "Transportation Technology and Policy" has two different but overlapping meanings throughout the report. It first refers to the name of an interdisciplinary degree-granting program at UCD, a program which offers the MS and PhD degrees, and which has international as well as domestic students. The TTP degree program was formally approved in February 1997, immediately transferred five existing students from other programs into TTP, and admitted its first cohort of new students in Fall 1997. When the IGERT call for proposals was issued, we realized that the interdisciplinary outlook embodied in the TTP degree program precisely matched the spirit of the IGERT program. Accordingly, it was natural to tailor the theme of our IGERT proposal to the TTP program, and hence to name our IGERT program TTP as well. However, we took care from the beginning to stress that the IGERT program would be open not just to TTP degree students, but to any eligible transportation student on campus, with a collective balance between technology, policy, and "hybrid" specializations. As shown in the front of this report and in Table 2.2, the majority of IGERT fellows were TTP degree students, but 20 out of 43 were in other programs.

Figure 1.1 illustrates the relationship between the two meanings of TTP: during the grant period, most domestic PhD students in the TTP degree program were TTP IGERT fellows, but domestic PhD students in other programs were also TTP IGERT fellows, and domestic MS as well as international MS or PhD students in the TTP degree program were not TTP IGERT fellows. In the remainder of the report, where the context does not make clear which of the two meanings is intended, we will distinguish them by referring to "TTP degree" or "TTP IGERT", respectively.

The rest of this report is organized into three chapters. Chapter 2 describes the IGERT program activities and accomplishments, Chapter 3 evaluates the effectiveness of the program, and Chapter 4 presents some conclusions and recommendations. A series of appendices provides supporting documentation.

Figure 1.1: Relationship between the TTP IGERT and TTP Degree Programs



Notes: Numbers in each region are illustrative for a given point in time, not cumulative totals for the duration of the IGERT grant. *Out of 43 IGERT fellows in all, 3 were MS only. The proposal allowed for this on an exceptional basis, e.g. where recruiting such a student for the PhD appeared likely.

CHAPTER 2: DESCRIPTION OF PROGRAM AND ITS ACCOMPLISHMENTS

2.1 Overview of the Program

Our IGERT program was relatively simple. As indicated in the Introduction, the theme was Transportation Technology and Policy. As the name suggests, the program strove to integrate the study of those two often-segregated aspects of transportation, and to foster the development of solutions that take both aspects into account. We want those people who are focusing on the technological side of transportation to be aware of the broader behavioral, social, political, and economic context of their work. In this way they can more effectively consider the political and market feasibility of a given technological solution, as well as its downstream environmental and societal impacts. Conversely, we want those focusing on the policy and planning side of transportation to have the rudiments of understanding about the technologies they are regulating and planning for. In this way they can develop more realistic policies, and more effectively analyze the impacts of various policies.

Thus, our primary goal was, and continues to be, to provide education and training that will better prepare students to address today's and tomorrow's complex transportation-related challenges. As detailed in the remainder of this report, the IGERT grant enabled us to attract more, and more diverse, students to the study of transportation; attract new transportation faculty members in several different departments; develop innovative approaches, discoveries, and solutions; and enrich the learning experience here in a variety of ways.

To be eligible for the IGERT program, individuals simply had to be domestic PhD students (or, in a few cases, MS students expressing an interest in continuing for the PhD) in a transportation-related field, with transportation-based research interests. IGERT fellows were identified through annual calls to ITS-Davis faculty, asking them to nominate prospective fellows from among those applying to their respective programs, as well as from among continuing students. Virtually every eligible student nominated in this way was accepted as an IGERT fellow, and funded for up to three years.

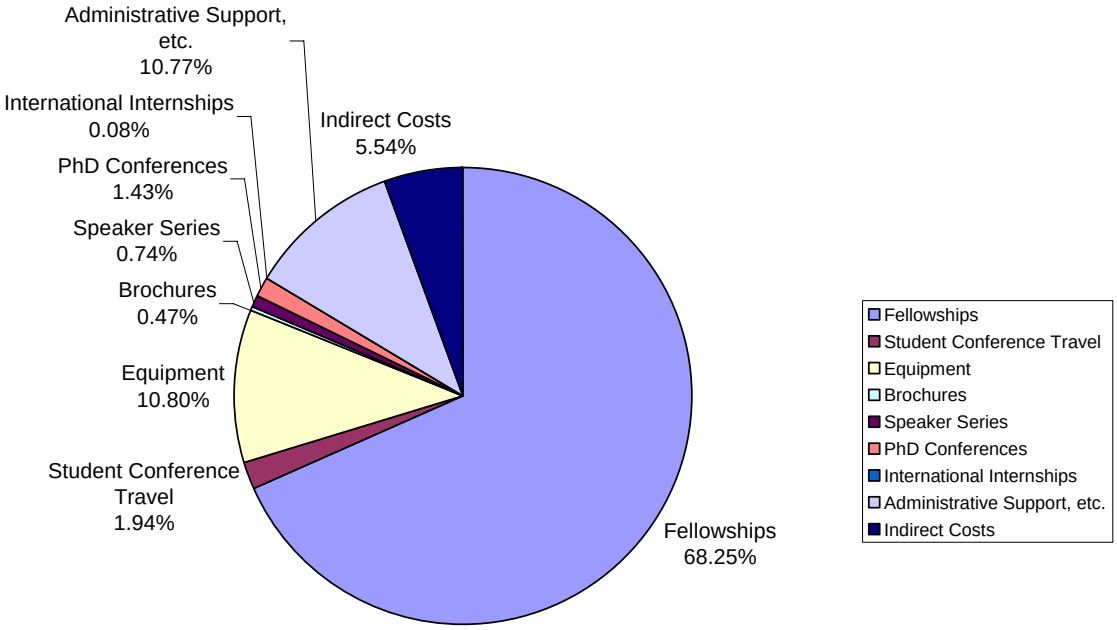
Aside from the requirements to conduct a research project (see Section 2.4) and to attend the weekly ITS-Davis seminars (see Section 2.5), IGERT fellows had no additional expectations placed on them. There were a number of other programmatic components, however. IGERT funding enabled the acquisition of major new items of equipment that supported a variety of research projects (Section 2.3), as well as state-of-the-art general-purpose computers available for shared use by students. In addition, most IGERT fellows purchased personal computers with their educational allowances. These computers were left with ITS-Davis and circulated to non-IGERT students as fellows finished their degrees, thereby helping maintain the computing infrastructure of the program as a whole.

IGERT funding also supported student travel to research conferences (Section 2.4); distinguished visiting speakers at UC Davis (Section 2.5); two graduate student research conferences hosted by ITS-Davis and organized by our students (Section 2.6); several course offerings (Section 2.7); internships, including international experiences (Section 2.8); a number of activities related to new student recruitment (Section 2.9); and the evaluation of the program (Section 2.11 and Chapter 3). And although no direct funding was involved, the IGERT program also prompted a more extensive treatment of ethics in the curriculum (Section 2.10). Each of these activities is described further in the remainder of this chapter.

2.2 Budget

Figure 2.1 illustrates the final allocation of the $2.66 million IGERT budget. More than two-thirds of the budget went directly to student support, with less than 11% spent on administrative activities. Thus, keeping the design of the program "lean" enabled us to maximize the amount available for student support, where we believe it did the most good.

Figure 2.1: Allocation of IGERT Funds: $2.66 Million Total



2.3 Equipment

The initial $200,000 equipment budget provided with the IGERT grant offered the opportunity to acquire several high-value state-of-the-art measurement instruments. This equipment has benefited graduate student education and research in Mechanical Engineering, Civil and Environmental Engineering, Chemistry, and Environmental Science and Policy departments as well as the ITS-Davis-hosted interdisciplinary Transportation Technology and Policy program. Collectively, the equipment is used for measurement of physical phenomena such as the performance and emissions characteristics of alternative vehicle propulsion systems, the measurement of demographic characteristics and travel behavior, and the statistical analysis of data relevant to technological development, policy evaluation, or both. In the evaluation interviews, some faculty noted that the equipment purchased through IGERT enabled research that would not have been conducted otherwise (see Section 3.2.2).

While much of the budget went to specialized equipment residing in the labs of the responsible faculty member, the funding also offered the opportunity to upgrade the general-purpose

computer lab open to all transportation graduate students affiliated with ITS-Davis. This is one of several ways in which IGERT funding also benefited non-IGERT fellows.

Table 2.1 provides a breakdown of how the equipment funds were budgeted and spent.

Table 2.1: IGERT-funded Equipment Purchases

Item	Budget	Total Cost to 9/30/05	Department	Faculty
PC Computer Lab: includes 7 PC's, 1 digital camera, 1 laptop, 1 color printer	$ 40,000.00	$ 44,201.54	ITS-Davis	Mokhtarian, Pat
GTS PC Notebook	$ 14,000.00	$ 7,002.52	Envir. Sci. & Pol.	Johnston, Bob
Analyzer	$ 40,000.00	$ 40,000.57	Civ. & Env. Eng.	Niemeier, Deb
Fuel Cell Equip	$ 10,000.00	$ 7,960.04	ITS-Davis	Burke, Andy
Fuel Cell Tester	$ 20,000.00	$ 19,461.77	ITS-Davis	Burke, Andy
Dynamometer	$ 26,000.00	$ 29,647.21	Mechanical Eng.	Dwyer, Harry
Galvanostat	$ 35,000.00	$ 34,995.75	Chemistry	Palmore, Tayhas
GPS Datalogger	$ 15,000.00	$ -	ITS-Davis	Turrentine, Tom
Total	**$200,000.00**	**$183,269.40**		

2.4 Fellowships

During the first and second years of the IGERT grant, the following types of awards were made (see explanations below): student fees (California), non-resident tuition (out-of-state), Research and Teaching Assistantship matching stipends, dissertation stipends, educational allowance stipends, bonus stipends for students obtaining prestigious outside awards (such as an Eisenhower or EPA STAR fellowship), international internships, and travel to conferences. Initially, we were under the erroneous impression that fellowships had to have “no strings attached”. Accordingly, we were reluctant to offer “full-ride” fellowships, because we considered the research assistantship experience to be an invaluable part of a student's graduate education: the best way to “mainstream” a student into the program, to establish a faculty mentor, to continue training more intensively than the classroom interaction allows, and to lead the student to thesis research topics that are likely to be productive and satisfying both to the student and the mentor. It has been our experience that students on a “full-ride” fellowship are often marginalized members of the program, and flounder when it comes to settling on a solid research topic. Thus, we initially expected IGERT fellowship money to be combined with RA (and potentially TA) support.

At some point we mentioned this issue to NSF staff and were informed that “research fellowships”, in which a requirement for a meaningful research activity was attached to the award, were not only allowed but quite common. We immediately changed our award policy then, and began offering full-ride research fellowships. Thus, starting with the third year of the grant, the research and dissertation fellowships were combined into a single research fellowship category. Receipt of a research fellowship was conditional on the student and the faculty advisor agreeing on a research project that the student would conduct. This change in policy resulted in the ability to give more and larger awards than was previously the case.

Not only was the initial receipt of an award conditional on having a proposed research project sketched out and agreed upon between the student and the advisor, continuation of the award in future years was contingent upon showing satisfactory academic and research progress during

the preceding year. Satisfactory research progress required the completion of at least one substantive research document (report or paper) during the previous year; most students easily met and exceeded that requirement. In a few cases students had to be reminded of this requirement (through a brief probationary period during which a document had to be completed); in a very few cases, continuation of the award had to be suspended or terminated due to non-performance.

Table 2.2 shows the total of individual awards (by department), numbers of students in each department receiving awards, numbers of awards given for each category, subtotal awards by department, and total of all awards given.

The types of fellowships described below were awarded at various points during the IGERT program. Toward the end of the program, we understood that NSF required essentially an all-or-nothing award, i.e. that any IGERT fellow had to be funded at the same, NSF-established rate. Thus, in the final years of the program, most of these types of fellowships were no longer awarded:

Fees and/or Tuition: Covered in-state fees and/or part of the non-resident (out-of-state) tuition depending upon the student's residency status. For out-of-state students, California residency is established after one year, at which point the non-resident tuition is no longer needed.

Research: This fellowship adhered to the student, not to a faculty member's lab or program. The research had to be conducted under a faculty member's supervision, however. Thus, the award was contingent on receipt of a brief (1-2 pp.) description of the proposed research and signed by both a faculty member (agreeing to the supervision) and the student (agreeing to conduct the research). Continuation of the fellowship was subject to suitable progress on coursework and research, as defined by the faculty advisor.

Educational Allowance: This fellowship reimbursed other expenses of education, including books, supplies, and equipment (such as a computer). Equipment purchased this way was the property of UCD, inventoried to UCD, and remained with UCD when the student left. It required budget and justification of proposed expenses and submission of valid receipts for reimbursement after the application was approved.

Teaching: Needless to say, gaining experience teaching is an important part of the professional preparation of many PhD students, and the more opportunities they have to do so, the more competitive they are on the job market (at least the academic job market), all else equal. Allowing advanced PhD students to teach also increases the breadth of curricular offerings in the program, and/or frees ladder-rank faculty to extend their own teaching in new directions. Thus, the student who is teaching, the students being taught, the faculty, and the program as a whole can benefit from such opportunities. This fellowship required submission of an extended course syllabus, justification of the course, and qualifications to teach the course. Funding was contingent upon final enrollment (a minimum of five had to be enrolled, per UCD course requirements). The stipend was based on the formula \$1000 (U * G), where U = number of units (1, 2, or max of 3) and G = 1 if grading is S/U and 2 for letter grading. Thus, a 3-unit graded course would receive the maximum stipend of \$6,000.

Table 2.2: IGERT Student Awards

Dept./ Prog.	No.	Research	In-state fees	Non-resident tuition	RA/ TA match	Educ. allow.	Teach	Disser-tation	Bonus	Int'l intern-ship	Travel	TOTAL
Ag Econ	1	34,731	13,807		5,171	8,798				1,000	1,800	**65,307**
CEE	5	77,532	16,725		3,500	26,275			9,600		800	**134,432**
Chem	2	32,426	9,182			25,095		30,000			1,700	**98,403**
Ch.Engr	1	18,000	3,219			6,281					800	**28,300**
Ecology	3	18,000	6,326			4,669	6,000		960		3,500	**39,455**
Econ	4	54,500	10,260	9,500	2,266							**76,526**
Mech. E	4	132,773	49,418		3,437	32,573		15,000			800	**234,001**
TTP	23	821,519	171,204	94,591	12,045	106,572	6,000		11,040	3,000	24,800	**1,250,771**
TOTAL	**43**	**1,189,481**	**280,141**	**104,091**	**26,419**	**210,263**	**12,000**	**45,000**	**21,600**	**4,000**	**34,200**	**1,927,195**
Actual Expenses		**1,206,785**	**250,084**	**56,786**	**3,006**	**169,092**	**6,000**	**99,176**	**17,592**	**2,062**	**37,733**	**1,848,316**

NOTE: These figures are based on the maximum amounts authorized in the award letters; final actual amounts differ slightly, as indicated in the last row. "No." refers to number of students receiving awards; dollar amounts reflect multi-year totals.

Bonus for Outside Awards: This fellowship was to reward those students who received competitive outside awards such as Eisenhower and EPA STAR fellowships, and hence to motivate them to apply for such awards. It paid them 20% of the outside award stipend, or 20% of what the total university stipend support would have been without the outside award (whichever was larger), up to a maximum of $5,000.

International Internships: This fellowship paid one round-trip coach airfare between Davis, California and the international host institution, plus a $250/month cost-of-living supplement for periods ranging from two to 12 months. The assumption was that the base salary would be paid from some other source – such as by the host, a faculty research grant, or a fellowship of some kind (including IGERT). See Section 2.8 for further details.

Travel Award: Attending professional conferences offers a myriad of benefits, including exposure to cutting-edge research and the opportunity to network with both senior scholars and with peers in one's own cohort of students. Presenting a paper offers further benefits, including gaining experience in the clear communication of technical material, and obtaining critical feedback on one's work. These benefits, directly accrued by the students attending the conferences, are in turn indirectly reflected back into the program as the now stronger and more knowledgeable students integrate their experiences into their further studies, including their interactions with faculty and other students.

This award was given to those students who attended domestic conferences relating to their research. The maximum allowed for students who were not presenting a paper was $800, and for those who presented a paper, $900. Airfare, lodging and meals could be included, subject to UCD's per diem allowances. We originally limited the award to one per year, per student, with a maximum of three awards to any one student. We eventually eliminated those constraints, subject to ongoing review.

2.5 Distinguished Visiting Speaker Series

Each quarter, ITS-Davis sponsors a series of weekly seminars, covering a broad range of topics in transportation technology, policy, planning, and analysis methodologies. IGERT recipients were required to attend these seminars (subject to freedom from conflict with course schedules), thereby exposing them to many diverse facets of the transportion field. The IGERT grant enabled us to sponsor a distinguished speaker each quarter, drawing on more senior and more distant speakers than our previous seminar budget had allowed. Below are the names, affiliations, and topics of the IGERT distinguished speakers we hosted:

- **Winter 99 -** Edward J. Haug, Carver Distinguished Professor, University of Iowa, *Foundations for Vehicle Virtual Proving Ground Simulation* (technology)

- **Spring 99** - Frank S. Koppelman, Professor, Civil Engineering, McCormick School of Engineering, Northwestern University, Evanston, Illinois, *Advances in Logit Choice Models* (policy analysis)

- **Fall 99** - Gloria Jeff, Deputy Administrator, Federal Highway Administration, Washington, DC, *Partnerships in the 21st Century* (policy)

- **Winter 00** - David Kittelson, Professor, Mechanical Engineering, University of Minnesota, *Measurement of Engine Exhaust Particle Size* (technology)

- **Spring 00** – Joseph Berechman, Professor and Chair, Public Policy, Tel Aviv University, Israel (visiting at City University of New York), *Transport Infrastructure Investment and Economic Growth* (policy analysis)

- **Fall 00** – Mark Levine, Director, Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory, Berkeley, CA, *Transportation, Energy, and Carbon Emissions in China* (policy/technology)

- **Winter 01** – Robert Williams, Senior Research Scientist for the Center for Energy and Environmental Studies, Princeton, NJ, *Toward Zero Emissions for Coal in Transportation and Other Applications* (technology/policy)

- **Spring 01** – Eileen Claussen, President, Pew Center on Global Climate Change, Arlington, Virginia, *Transportation and Climate Change Policy* (policy)

- **Winter 02** – Martin Wachs, Director, Institute of Transportation Studies, University of California, Berkeley, *Thinking Differently About Transportation Finance* (policy)

- **Spring 02** – Terry Friesz, Professor, Systems Engineering & Operations Research, George Mason Univ., *Some Unsolved Problems Related to Dynamic Traffic Assignment and Disequilibrium Design* (technology)

- **Fall 02** – Paul Waddell, Associate Professor of Public Affairs and Urban Design and Planning, University of Washington, Seattle, *The Tangled Web of Transportation and Urban Development: Recent Advances in Urban Simulation* (policy/technology)

- **Winter 03** – Richard Forman, Professor, Harvard University, *Road Ecology: To Mesh Transportation and Nature* (policy)

- **Spring 04** – Chandra Bhat, Associate Professor and Associate Chairman for Administration and Planning, Department of Civil Engineering, University of Texas, Austin, *A Utility-Theory Based Model of Multiple Discreteness: Formulation and Application to Leisure Time-Use Decisions* (policy analysis)

- **Spring 04** – Mei-Po Kwan, Associate Professor and Chair of Graduate Studies, Dept. of Geography, Ohio State University, *Internet Use, Space-Time Constraint and Human Activity Patterns* (policy/technology)

2.6 Graduate Research Conferences at UC Davis

We hosted two graduate student research conferences as part of our IGERT grant: one in Year Two with a policy/planning focus, and one in Year Four with a technology focus. Agendas for the two conferences are included as Appendix B.

2.6.1 Travel Behavior, Planning, Modeling and Policy, April 3-4, 2000

The first conference was held April 3-4, 2000 at the Buehler Alumni Center at UC Davis, and was attended by 60 people. Of those 60, 41 were students, 16 were with government entities, and 3 were with industry. There were 19 people from the Sacramento area, which comprised the industry and government attendees. Twenty-two students made presentations, representing the following universities: UC Davis, University College London, UCLA, UC Berkeley, University of South Florida, UC Irvine, University of Delaware, University of Minnesota, University of Toronto, Umea University, Sweden, University of Michigan, UC Santa Barbara, Texas A & M, and University of Massachusetts.

The conference focused on travel behavior/policy/planning. Keynote speakers were: Dr. Wyn Jennings (National Science Foundation) who presented a talk on the history of IGERT, goals of the program, why ITS-Davis was selected, and what ITS-Davis should strive for; and Hani Mahmassani (L. B. Meaders Professor of Civil Engineering, University of Texas, Austin and President, International Association for Travel Behaviour Research), who gave a commentary on lessons learned from past and current travel behavior research, with a look to the future.

2.6.2 What will Move You? June 26-27, 2003

The second conference was held June 26-27, 2003 at the Buehler Alumni Center at UC Davis, and was attended by 71 people. Of those 71, 67 were students and 4 were with government entities from the Sacramento area. Twenty-one students made presentations, representing the following universities: UC Davis, Northwestern, University of Utah, Massachusetts Institute of Technology, University of Florida, Georgia Tech, University of Washington, Texas A & M, University of Minnesota, University of Texas, University of North Carolina, California Polytechnic - San Luis Obispo, Ohio State, Vanderbilt, Pennsylvania State, and West Virginia University.

The conference focused on new mobility, social aspects of technology, and advanced propulsion and fuels. Keynote speakers were: Jeff Morales, Director, California Department of Transportation; Thomas Gross, Senior Executive Member, Board of Directors, U.S. Department of Energy, who spoke on future transportation goals; John Wallace, Former Director, Ford Motor Company's TH!NK Technologies Division, the title of whose talk was "May You Live in Interesting Times"; and Susan Shaheen (Special Topics Speaker) from the Innovative Mobility Research Program, University of California, Davis, who spoke about opportunities for enhancing transportation management and choice.

2.7 New Courses Offered

ITS has been able to offer a number of ad hoc courses, leveraging IGERT funding with other available resources to broaden its curriculum. Some of these courses were one-time or occasional, while others are intended to be permanent. Transportation Technology is a core requirement for the TTP program, intended to provide a foundation in transportation technologies to those from a non-engineering background, and is currently offered every year, taught by Paul Erickson, Assistant Professor of Mechanical & Aeronautical Engineering. Two new courses introduced for the 2004-05 academic year include a Transportation Orientation Seminar, which will be offered every Fall and led by Susan Handy, Associate Professor of Environmental Science & Policy; and Leadership, Professionalism, and Ethics seminar, offered every Spring

and led by Daniel Sperling, Professor of Civil & Environmental Engineering and Environmental Science and Policy. Both courses will be offered to first year students and other interested students.

Collectively, these courses have served transportation students in a variety of programs including Transportation Technology & Policy (TTP), Civil & Environmental Engineering (CEE), Mechanical and Aeronautical Engineering (EMA), Chemistry (CHE), Economics (ECN), and Chemical Engineering & Materials Science (ECM). Following are the 27 ad hoc courses (19 one-time or occasional; 8 on their way to becoming permanent) that have been offered during the term of the IGERT grant, along with enrollments for each course. Further discussion of selected courses is found in Section 3.3.2, and brief syllabi are included in Appendix C.

Fall 98

- Instructor Tim Lipman, PhD candidate, *Basic Principles of Transportation, Energy & Environmental Systems* (technology). Tim Lipman was funded by IGERT to teach this course. Total enrollment was 5 (all TTP students).

Winter 99

- Instructor Shimshon Gottesfeld, Los Alamos Nuclear Lab, *Processes and Materials In Polymer Electrolyte Fuel Cells* (technology). Total enrollment was 12 (11 TTP students and 1 ECM student).

- Instructor Mark Delucchi, Research Scientist, *Full Social Costs of Transportation* (policy analysis). Total enrollment was 6 (4 TTP students and 2 CEE students).

- Instructors Tom Turrentine, Research Anthropologist, and Ken Kurani, Research Engineer, *Reflexive Methods in Transportation Research* (policy analysis). Total enrollment was 5 (all TTP students).

Spring 99

- Instructor John Holtzclaw, Sierra Club, *World Class Transit For the Bay Area* (policy analysis). Total enrollment was 10 (9 TTP students and 1 CEE student).

Fall 99

- Instructor Ken Kurani, Research Engineer, *Workshop on the Future of Mobility* (technology/policy). Total enrollment was 7 (5 TTP students, 1 CHE student, and 1 CEE student).

Winter 00

- Instructor Andy Burke, Research Engineer, *Electric Energy Storage and Conversion Technology* (technology). Total enrollment was 3 (all TTP students).

- Instructors Lee Branstetter, Assistant Professor, Economics and Robert Feenstra, Professor, Economics, *Transportation Economics* (policy analysis). Assisted by

Teaching Assistant Adam Forest, PhD candidate from the Economics Department and partially funded by IGERT. Total enrollment was 7 (6 TTP students and 1 Economics student).

Spring 00

- Instructor David Friedman, PhD candidate, *Basic Principles of Transportation, Energy & Environmental Systems* (technology). David Friedman was funded by IGERT for this course. Total enrollment was 5 (all TTP students).

Winter 01

- Instructors Tom Turrentine, Research Anthropologist, and Ken Kurani, Research Engineer, *Space, Time, and Identity* (policy). Total enrollment was 5 (all TTP students).

Spring 01

- Instructor Robert Moore, Director, Fuel Cell Vehicle Modeling Program, ITS-Davis, *Fuel Cell Systems, Vehicles, and Fuels* (technology). Total enrollment was 8 (6 TTP students, 1 CEE student, and 1 Mech. Engr. student).

Winter 02

- Instructor Sitaram Ramaswamy, Fuel Cell Vehicle Modeling Program, ITS-Davis, *Fuel Cell Vehicle Technology*. Total enrollment was 8 (3 TTP students, 3 EMA, 1EEC, 1MEC)

Spring 02

- Instructor Tim Lipman, Postdoctoral Researcher, *Key Principles of Transportation, Energy, and Environmental Systems.* Total enrollment was 15 (8 TTP, 7 CEE)

Fall 02

- Instructor Pat Conroy, Automated Traffic Management Information Systems (ATMIS) Program Manager, Program for Advanced Transit and Highways (PATH), UC Berkeley, *Intelligent Transportation Systems.* Total enrollment was 13 (9 TTP, 4 CEE)

- Instructor C.C. Chan, Fellow, Royal Academy of Engineering, UK, *Modern Electric-Drive Vehicle Technology.* Total enrollment was 13 (11 TTP, 1 CEE, 1 EMA)

Winter 03

- Instructor Marshall Miller, Research Engineer, Fuel Cell Modeling Program, ITS-Davis, *Fuel Cells and Energy Storage.* Total enrollment was 16 (10 TTP, 5 EMA, 1 CEE)

- Instructor Susan Handy, Associate Professor, Environmental Science & Policy, *Transportation-Land Use Connection.* Total enrollment was 12 (7 TTP, 1 ARE, 4 CEE)

Spring 03

- Instructor Michael Clay, PhD Candidate, *Urban Modeling*. Michael was funded by IGERT to teach this course. Total enrollment was 5 (2 TTP, 3 CEE)

- Instructor Patricia Mokhtarian, Professor, Civil & Environmental Engineering, *Traveling for its Own Sake: A Multidisciplinary Exploration.* Total enrollment was 2 (1 TTP, 1 CEE)

- Instructor Marshall Miller, Research Engineer, Fuel Cell Modeling Program, *Hydrogen Technologies and Pathways.* Total enrollment was 13 (all TTP students)

- Instructor Brett Williams, MS/PhD Student, *Key Technological Principles of Transportation, Energy, and Environmental Systems.* Total enrollment was 4 (all TTP students)

Fall 03

- Instructor Joan Ogden, Associate Professor, Environmental Science & Policy, *Hydrogen Journal Review*. Total enrollment was 17 (13 TTP, 2 CEE, 2 EMA, 1 undergraduate)

Winter 04

- Instructor Paul Erickson, Assistant Professor, Mechanical & Aeronautical Engineering, *Introduction to Transportation Engineering.* Total enrollment was 5 (4 TTP, 1 EMA)

- Instructor Bob Moore, Researcher, ITS-Davis, *Fuel Cell Fundamentals.* Total enrollment was 19 (10 TTP, 9 EMA)

- Instructor Lewison Lem, PhD, Transportation Policy Manager, Automobile Association of America, *Current Transportation Funding in CA and the Bay Area.* Total enrollment was 6 (all TTP students)

Spring 04

- Instructor Susan Handy, Associate Professor, Environmental Science & Policy, *Transportation Planning & Policy.* Total enrollment was 17 (10 TTP, 7 CEE)

- Instructor Mark Delucchi, Research Scientist, ITS-Davis, *Study of Dual-Transportation-Infrastructure/New-Town Plan.* Total enrollment was 2 (all TTP students)

2.8 Internships

Internships offer advantages in three different respects: the sponsoring organization benefits from the intelligence and up-to-date education of extremely bright students; the student benefits from the application of "classroom" knowledge and newly-learned analytical and conceptual skills to meaningful real-world problems; and the program (other students and faculty alike) benefits from the real-world feedback brought back by the student and from forging stronger ties to external organizations. In each case a fresh perspective is brought, fostering a creative cross-fertilization.

Domestic organizations that have committed to hosting ITS-Davis graduate student interns include: Arco, the California Environmental Protection Agency (Cal/EPA), Calstart, California Energy Commission, Edison EV (Electric Vehicle), Exxon, EV Global Motors, New Mexico State Highway and Transportation Department, Nissan North America, Inc., Saft America, Edison Southern California, California Air Resources Board, California Fuel Cell Partnership, Volpe National Transportation Systems Center, International Energy Agency, Ford Motor Co., Hydrogen Research Institute in Canada, Yellowstone National Park, and Surface Transportation Policy Project. We involve other organizations as opportunities arise.

In response to NSF's call, we obtained a supplemental grant for international internships, which were used to fund travel and cost of living expenses for working with an international host (see Section 2.3). In addition to the advantages of internships in general, international internships in particular offered some extraordinary benefits to IGERT fellows. These opportunities enabled students to partner with the best researchers in their specialty, anywhere in the world. Challenges that transcend national boundaries can be addressed creatively by multinational teams with a common purpose, potentially accelerating the solution to societal and scientific problems. And important insight can be obtained through cross-national comparisons of political and social issues and responses. Participants in this component of the program became better prepared for the global character of current and future scientific endeavor, and gained valuable exposure to the particular culture of their host institution.

Five industry, non-profit, and academic partners were initially identified as prospective host institutions: The French National Institute for Transport and Safety Research (INRETS), Lyon France; Daimler Chrysler AG, Berlin and Stuttgart, Germany; University College, London, United Kingdom; Technical University of Munich, Germany; and Tsinghua University, Beijing, China. Only two IGERT fellows, both women, have been funded by this fellowship. One worked for the International Energy Agency in Paris, France, during Fall 2000; the other worked for DaimlerChrysler in Germany during 2002-2003. In the latter case, the internship formed the basis for the recipient's dissertation research. In addition, however, several other IGERT fellows have had significant international experiences during their studies at UCD, in the United Kingdom, Belgium, China, Japan, Bangladesh, Africa, Guatemala, and Canada (see Appendix D).

In retrospect, it is perhaps not surprising that the international internship option would not be heavily exercised. The typical internship lasts at least three months, and the 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.

Following are some of the internships (domestic and international) that have taken place during the IGERT grant period, with IGERT recipients noted in bold:

- **CJ Brodrick**, Engine Fuel & Emissions Engineering, 1997-1999
- **Jesse Herbert**, Los Alamos National Laboratory, 2000; French National Institute for Transport and Safety Research, 1998; Exxon Research and Engineering, 1998
- **Deborah Salon**, International Energy Agency (Paris), Fall 2000
- Brian Abbanat, California Energy Commission in the light-duty vehicles department, 2000-2001
- Joshua Cunningham, California Air Resources Board in the Zero-Emission Vehicle Implementation Section, 1999-2000
- Richard Counts, California Fuel Cell Partnership, 2000-2001; Arthur D. Little, 2001
- **David Friedman**, California Energy Commission, 1998
- **Patricia Hendren**, US Dept. of Transportation, Federal Highway Administration, 1999; Volpe National Transportation Systems Center, Summer and Fall 2001
- Ethan Abeles, Fort Clatsop National Memorial, Oregon, 2001
- Thomas Barron, Yellowstone National Park, 2002
- **Monterey Gardiner**, Hydrogen Research Institute, Canada, 2003
- Tara Goddard, Exec. Fellowship Program, Office of the Governor and CSU Sacramento, 2003
- **Kurt Kornbluth**, DEKA, New Hampshire, 2004
- **Nicholas Lutsey**, California Air Resources Board, 2003-2004
- **Meena Sundaresan**, DaimlerChrysler Fuel Cell and Alternative Powertrain Vehicles, Germany, 2002-2003
- John Wallace, DaimlerChrysler, 2003
- **Jonathan Weinert**, Ford Motor Co. at California Fuel Cell Partnership, South Coast Air Quality Management District, 2003
- **Brett Williams**, Ford Motor Co. at California Fuel Cell Partnership, 2003

2.9 Recruitment

A variety of recruitment activities was undertaken within the auspices of the IGERT grant. Samples of recruitment materials generated during the grant period are provided in Appendix E.

2.9.1 Brochures

IGERT funding supported the development of a brochure (referred to as the "umbrella brochure") and poster, advertising all transportation programs at UCD. This was the first time such materials were developed here and they have been valuable for informing interested parties about the breadth of transportation education and research available at UCD. The brochure was later changed to a flyer format which lowered the cost of both printing and mailing. The flyer and

poster are still distributed at conferences, recruitment seminars, and to UCD colleagues and departments. In addition, the materials are distributed to potential students after their initial contact with either transportation faculty or staff. Even though international students were not eligible for fellowship support, IGERT played a role in attracting the best students from anywhere in the world to the program.

2.9.2 Other Recruitment Activities

In an effort to reach out to groups that might have an interest in the transportation program, brochures and posters were distributed to historically underrepresented and minority colleges and universities. Success has been limited! Organizations that have been contacted include the Louis Stokes Alliances for Minority Participation, GEM (Graduate Degrees for Minorities in Engineering and Science, Inc.), McNair, American Indian AISES, Gates Millennium Scholars Program, and CALESS (Chicano and Latino Engineers & Scientists). When names of individual student participants in these programs were provided, we sent materials to those students who had indicated interests relevant to transportation. No applications resulted from those contacts.

One issue particularly salient to our program is that students never state "transportation" as their interest (if categories are provided, that is never one of the categories), but many interest areas could potentially involve transportation as an application area. That is, students could conceivably be interested in transportation through a great many traditional subject areas, such as economics, psychology, sociology, anthropology, mathematics, statistics, geography, physics, chemistry, and of course engineering. One of our best IGERT fellows was an English major; we have also had several history majors. Thus, it is difficult to target students very accurately based on their subject-area expression of interest.

In November 2000, PI Prof. Patricia Mokhtarian presented a recruitment seminar at South Texas Community College, which was attended by 40-50 people, mostly of Hispanic background. The seminar was very well received and produced some possible leads and/or potential transfers to UCD. In addition, she was able to speak with an engineering professor from University of Texas Pan American who expressed interest in informing potential transfer students about the possibilities available at UCD, including the IGERT program. We provided him with flyers advertising our program and IGERT funding, but ultimately received no applications through that channel. We recognize that to have much chance of being effective, such efforts require an ongoing commitment of time and energy. We also recognize that it is quite difficult to find that time on a sustained basis, especially with a small prospect of payoff.

In general, the number and quality of our domestic applicants appears to be most closely tied to the condition of the economy, with an inverse correlation. For example, applications for the 2001-02 and 2002-03 years were quite strong, coinciding with the weaker economy in place at that time.

2.10 Ethics

IGERT has been instrumental in raising awareness of the need to incorporate ethics issues more extensively into the program. We felt it was important not just to sequester ethics into a single course, but also to embed it holistically into other courses in which such issues naturally arose. As a result, several of the core courses in our curriculum have now incorporated units on ethics into them, so that the typical student will be exposed to various aspects of the subject multiple

times during her/his studies here. For example, TTP 200 (Transportation Survey Methods) includes two hours of lecture time on ethics in survey research, and ECI 254 (Discrete Choice Modeling) includes at least an hour on ethics in modeling and forecasting. During the faculty interviews (see Section 2.10.4), four other faculty members indicated teaching ethics in their classes. In Spring 2002, renowned transportation professor Martin Wachs of UC Berkeley, author of the book *Ethics in Planning*, spoke on ethics to a joint session of ECI 254 and ECI 251 (Regional Travel Demand Forecasting). The talk was advertised in regular campus media, and attracted a dozen or more visitors as well.

We also include several alternative courses on professional development in our approved curriculum and encourage students to take one by ensuring that the course counts toward the degree unit requirements. Finally, the newly-developed spring seminar on Leadership, Professionalism, and Ethics exposes students to ethical issues from the perspective of government, industry, and non-profit leaders. This seminar is required of students in the Transportation Technology and Policy degree program and strongly encouraged for transportation students in the Civil and Environmental Engineering program, and can be taken multiple times for credit.

2.11 Evaluation

2.11.1 Data Base Development

A number of variables were monitored for purposes of evaluating the program on an on-going basis. To assist with gathering and compiling this information, a database was created for ITS-Davis in the summer of 1999, using MS Access. It contains 14 tables and 9 customized reports. Currently there are more than 1000 contact records. The contact types are as follows: potential transportation students; transportation students who have applied, either through TTP or CEE; current transportation students; transportation students who have either graduated or left UCD; seminar speakers, both past and future; ITS faculty members; and IGERT recipients. The database is an integral part of the successful administration of the graduate program, and has been considered by another department for possible inclusion into administration of their program. Appendix F to this report contains several samples of the database screens, as well as reports generated from the database.

Following are the tables, along with a few of the more important fields within those tables:

Contacts – Name, address, e-mail, birthdate, sex, ID number, quarter entering UCD, advisor, department, status (i.e. current or graduated), objective (i.e. MS or PhD), degree status, track (if a TTP student), and specialization.

Residency and Application Type – Residency status (i.e. international, domestic, or permanent resident), application type (international or domestic), green card number (if applicable), county of citizenship, and ethnicity.

Student Status Dates – Applicant status (i.e. current, denied, declined), Course Work Only (an initial admission status acting as a probation period), filing fee date, PELP date (the latter two referring to options for temporarily suspending studies or for continuation of thesis work after completion of course work), graduated date, thesis or dissertation committee members, title of thesis, advancement to candidacy date, and completed thesis date.

Undergraduate Colleges – Name of college, major, date graduated or pending date of graduation, degree, GPA, rank, and whether the transcript has been received.

Graduate Colleges – Same fields as Undergraduate Colleges.

Scores – TOEFL and GRE exam dates and corresponding scores, where applicable.

Letters of Recommendation – Name and institution, date of receipt.

Honors – Any noteworthy awards that a student may have received.

Funding – Aid that the student has applied for and whether it was awarded.

Notes – Documents needed from the student, or any other notes.

IGERT – Amount and date awarded (more specific information is kept on a spreadsheet separate from the database).

Faculty – This tracks the faculty members affiliated with the TTP program, listing their home department, area of interest, academic status, and the various options for their contribution to the graduate group.

Seminar – Name of presenter (or possible presenter), whether they are an IGERT Distinguished Speaker, date of presentation (or future date), title of the presentation, and any relevant notes.

2.11.2 Alumni Surveys

We developed and pretested an alumni survey, and in the summer of 2001, we began sending out surveys to all graduated students. The plan was to survey all graduate students once immediately after completing their degree, and again about one year later, to ascertain how perceptions might have modulated with time. The two surveys were similar but not identical, and are included as Appendix G. They include questions about the students' overall impression of the UCD graduate program, other graduate schools considered, what attracted them to UCD, the single most important factor in their decision to attend UCD, participation in internships, evaluation of internship(s), what they liked most about their graduate experience at UCD, what they liked least, how well the program met their expectations, suggestions for enhancing the experience here, further comments about UCD's graduate transportation programs, information relating to current employment and job searches, and general questions relating to their degrees (type of degree, when obtained, which program attended, and funding).

The plan to survey students twice proved difficult to achieve in practice, with a number of respondents not completing even the first survey until (or not even after) several reminders, and the second survey being even more elusive. For that reason, and because the sample size is small at best, our analysis is based on a single survey per respondent, which will have been completed up to a year or so after graduation.

We reviewed each completed survey as it came in for ongoing feedback about the program. Doing so, for example, alerted us to some degree of dissatisfaction with the relevance of the seminar series, and we took steps to address that concern. In Chapter 3, we statistically analyze

the surveys, comparing key descriptive statistics for IGERT fellows and associates (NSF's term for students who were not directly funded by IGERT but who were associated with the program and may have benefited from some of its aspects; we will use "associates" and "non-IGERT students" interchangeably). That analysis is based on 25 completed surveys: 11 from IGERT fellows (an additional 17 IGERT fellows are still pursuing their degrees; 7 more left before completing their degrees) and 14 from non-IGERT students.

2.11.3 Mid-course Corrections

We informally monitored the program on a continuous basis, inviting comments from students and faculty at any time, as well as reviewing the alumni surveys in real time as described above. Such feedback led us, for example, to restructure the core requirements of the TTP program shortly after receiving the IGERT grant. We replaced a set of specific core courses with a set of core areas, and offered several ways of fulfilling the requirement for knowledge in each of the core areas.

In other cases we introduced refinements to IGERT-related policies over time. The change to offering full-ride research fellowships, noted earlier, is one such refinement. Another one is that around 2001, we began to mandate attendance at the ITS-Davis seminar series as a requirement for all IGERT recipients. While the seminar series has always been required for TTP and CEE students, who comprise the vast majority of transportation graduate students at UC Davis, we realized that an IGERT fellow in chemistry or mechanical engineering, for example, doing transportation-related research on vehicle propulsion technologies, could complete a degree in their disciplinary area while receiving very little exposure to the broader interdisciplinary context of their work. Requiring attendance at the seminars exposed all transportation students over time to a variety of different perspectives with respect to the study of transportation.

2.11.4 Faculty Interviews

At the conclusion of the program, we interviewed as many faculty advisors of IGERT students as were willing. After repeated contacts, we succeeded in interviewing nine of the 16 faculty advisors still active at UCD (two others had left UCD, and one had retired). These nine faculty collectively advised 23 of the 43 recipients of IGERT funding, and comprise the core faculty, advising the core students, of the program (many of the remaining students only participated for a short time). The insights obtained from these interviews are incorporated into the discussion of the evaluation results in Chapter 3.

CHAPTER 3: EVALUATION RESULTS

There are a number of dimensions along which it is desirable to evaluate the IGERT program. With respect to ***students***, it is natural to ask:

- Has IGERT helped UCD attract better and/or more diverse students to transportation?
- Has IGERT helped improve the training experience for transportation students at UCD?
- Has IGERT facilitated better career outcomes for transportation students at UCD?

With respect to ***research***, we would like to know:

- Has IGERT funding led to important new knowledge?
- Has IGERT stimulated new discoveries that would not have occurred otherwise?

With respect to the ***transportation program at UCD***, we ask:

- Has IGERT stimulated new, especially interdisciplinary, collaborations that would not have occurred otherwise, or accelerated such collaborations?
- Have IGERT resources been synergistically leveraged to contribute to other accomplishments of the program, and conversely?
- Has IGERT contributed to the internal and external visibility of the program?

And with respect to the ***UC Davis campus***:

- Has the IGERT philosophy become institutionalized at the campus level?
- If so, what steps has the campus taken to support IGERT programs in particular and the interdisciplinary integration of training and research in general?

Obtaining rigorous statistical answers to these questions is impossible, for a number of reasons. Many of the questions are inherently subjective (what constitutes "better", or "important"?), and many metrics are not quantifiable. "What would have happened otherwise" is obviously uncertain. The number of student participants is small; the number completing degrees during the term of the grant is even smaller. Many effects of IGERT may take several years to emerge. Comparing IGERT and non-IGERT students to ascertain whether IGERT "made a difference" is problematic, for two reasons: first because of the small sample sizes; and second because it is not only reasonable to expect that IGERT would benefit associates as well as fellows in many ways, but desirable that it do so – inevitably contaminating (in a good way!) the associates so that they are not a true control group. Thus, our evaluation is necessarily more qualitative than quantitative, although we do discuss some quantitative results where possible (keeping these caveats in mind). Below, we address each of the above questions in turn.

3.1 Student-Related Effects

3.1.1 Has IGERT helped UCD attract better and/or more diverse students to transportation?

Our IGERT students are extremely accomplished. The table in Appendix D lists some of their important awards and activities. Collectively, they have earned 13 prestigious and competitive

national scholarships; participated in 15 internships with industry, government, and think-tanks, including four international ones; received three national awards for best dissertation, best presentation, and outstanding student, respectively; received two regional best student awards; and four ENO Transportation Foundation awards.

Are they better, and/or more diverse ("than what?" will be addressed below)? As noted in the introduction to this chapter, adjectives such as "better" are highly subjective, and even "diverse" has a formal meaning in the context of affirmative-action-type policies, but can also be interpreted more broadly in terms of variation in backgrounds, experiences, and perspectives. Accordingly, we address this question in several different ways. First, we comment on the nature of the TTP degree program. Next we compare the gender distribution of IGERT and non-IGERT students. Then, we examine recent trends in the average GRE scores of enrolled graduate students in transportation in our two largest programs: the TTP and CEE degree programs. Finally, we statistically compare IGERT and non-IGERT students in terms of Graduate Record Examination (GRE) scores and entering and final grade-point averages (GPAs).

From the beginning, an important part of the philosophy behind the TTP degree program has been to increase the diversity – in the broad sense – of students receiving training in transportation. Before the formation of the TTP program, the only way to get a graduate degree in transportation at UCD (as is true for the vast majority of other transportation programs in the country) was through the Civil and Environmental Engineering (CEE) department. The CEE department understandably feels that if students are to receive a degree with a CEE label on it, they should share some level of core knowledge with other civil engineers. This means that any CEE transportation graduate student entering without a civil engineering undergraduate degree must take up to nine basic civil engineering classes – requiring a full year or more – in addition to their transportation curriculum, even though they will never use such classes in the typical transportation career.

Needless to say, this requirement constituted (and still does, for CEE-based programs at universities having similar policies and no alternatives) a formidable "barrier to entry" into the transportation field – a barrier that we believe disproportionally affects women. The TTP degree program, by contrast, welcomes students from any conceivable background, subject only to taking five prerequisite classes (two courses in calculus, one in linear algebra, and calculus-level probability/statistics and microeconomics). We have been pleased to see the resulting variety in undergraduate majors held by our TTP students, including city/regional planning, sociology, economics, business, history/American culture, physics, botany/biology, philosophy, computer science, mathematics, and English as well as various engineering areas.

Although this inclusive philosophy of the TTP degree program predated the TTP IGERT award, IGERT synergistically supported that philosophy, and enabled us to support a larger number of these diverse students than would otherwise have been possible. For example, one of the English majors was a female IGERT fellow who became an advanced mathematical modeler, creatively applied several multivariate statistical techniques in her dissertation, and is now working for a consulting firm that is known for its cutting-edge transportation model development.

With respect to gender, IGERT did appear to enrich the transportation graduate student body at UCD. Table 3.1 shows that 23% of IGERT fellows were female, compared to only 19% of non-IGERT students enrolled during the same period. Interestingly, however, at 26% women during the same period, the "traditional" CEE degree program actually shows greater gender diversity

than either the IGERT program (though the difference may not be significant) or the TTP degree program (at 18% women). At UCD, the college of engineering in general and CEE in particular are relatively unusual in the proportion of women faculty and students. Among universities granting 20 or more PhDs in engineering in 2003, UCD ranks sixth in the nation both in terms of percent of women obtaining PhDs in engineering (29.1%) and percent of full-time women on the engineering faculty (15% in 2005, compared to less than 8% nationwide in 2001, according to http://www.nsf.gov/sbe/srs/seind04/append/c5/at05-23.pdf, accessed August 29, 2005). The CEE department at UCD is even more gender-diverse, with five (19%) full-time ladder-rank female faculty members out of 26 in 2005. Three of those five women are in the transportation group of CEE and are also members of the TTP faculty. TTP has four more full-time women faculty members with home appointments in other departments, for a total of 7 (17.5%) out of 40 (see listing in Appendix A). Eleven (20.4%) out of the 54 ITS-Davis affiliated faculty are women. We believe that gender diversity among the faculty plays an important role in attracting women students to transportation – evidently especially in CEE.

Table 3.1: Gender Distribution of Students by IGERT Status and Program, 1998-2005

	Female	Male	TOTAL
IGERT	10 (23%)	33 (77%)	43 (100%)
non-IGERT	18 (19%)	75 (81%)	93 (100%)
TTP degree program	11 (18%)	49 (82%)	60 (100%)
CEE degree program	12 (26%)	35 (74%)	47 (100%)

Our transportation students (especially in the TTP program) vary not only in terms of disciplinary background and gender, but also in terms of life experiences. Many have come to us from the workforce rather than straight from a bachelor's degree. Several have worked in the automotive industry; others for environmental non-profits, and others have done extensive volunteer work related to the environment and other causes. Many of the domestic students have lived for extended periods in other countries, and/or speak a second language. There is only only one disadvantaged minority (Hispanic male) among our students, and he was an IGERT fellow who is nearing the completion of his dissertation. However, many different ethnic backgrounds exist among the student body as a whole, including non-IGERT international students (at some point during the IGERT grant period) from China, Taiwan, Japan, Korea, India, Israel, Turkey, Belgium, Germany, Argentina, Brazil, South Africa, and Canada.

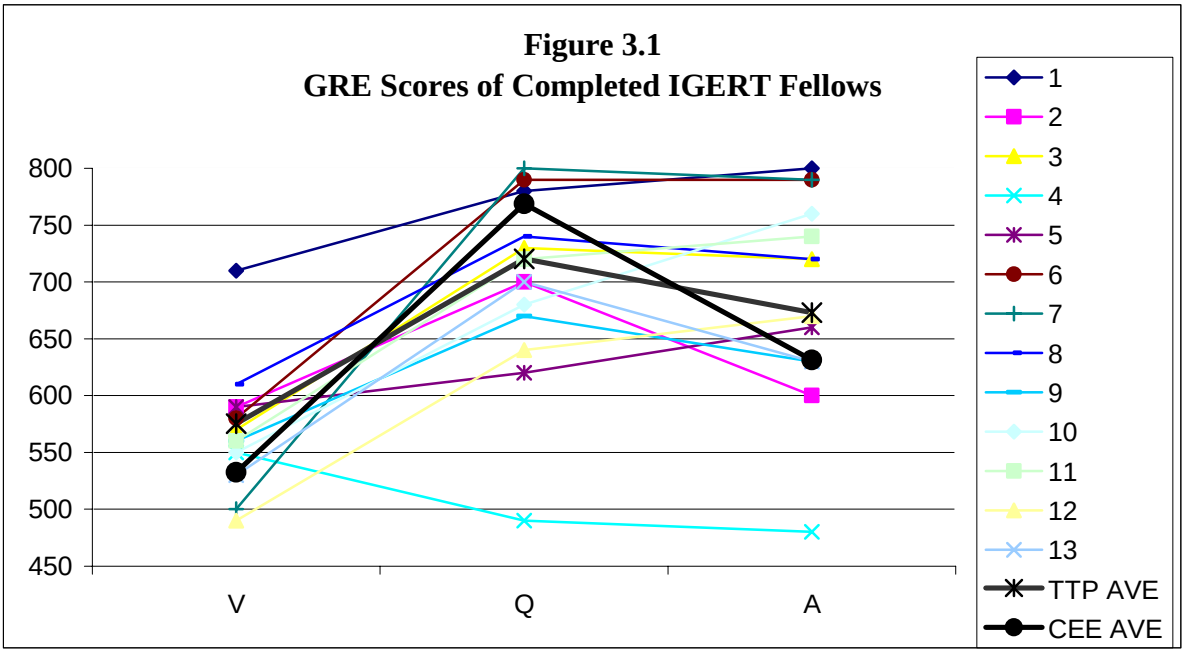
Collectively, this variety among our students provides a tremendously dynamic learning environment. The sharing of different perspectives and experiences facilitates a cross-fertilization of ideas that we believe to be unique among transportation programs in the US. It is certainly far more heterogeneous than the typical civil engineering transportation program.

Having argued that our students are diverse, it is fair to ask, "are they better?" At this point we restrict ourselves to considering their qualifications when they enter the program; the next two subsections treat their training during the program, and their career outcomes immediately after finishing the program. Even with this restriction, the question "are they better" raises two questions of its own: (1) better on what dimension(s), and (2) better than what? With respect to the first question, a number of quality dimensions are arguably of interest. Ideally, we want our incoming students to be better scholars, with all the varied meanings that term can have: more intelligent, more creative, more insightful and critical, more persistent and careful, more produc-

tive in qualitative as well as quantitative terms. But we could also mean better citizens (in the broad sense of the word), better leaders, better entrepreneurs, more well-rounded people. With respect to the second question, we could answer, "better than our students were in years past", "IGERT students better than contemporaneous non-IGERT students", or "better than students in similar programs without IGERT".

As discussed earlier, it is not possible to conduct a rigorous evaluation in all of these respects, but some analyses are of interest. We will examine Graduate Record Examination (GRE) scores and grade-point averages (GPAs) because they *are* quantifiable and because they are commonly thought to have at least *some* correlation with scholarship potential, while remaining fully aware that they are very imperfect indicators of student quality. A student with only average or even below-average GREs may well be "better" than an above-average-scoring student, on dimensions such as creativity, insight, and even intelligence. Such a student may also have been admitted due to other unusual qualifications such as a distinctive background or perspective as discussed above. In fact, a comparison of the GRE scores of completed IGERT fellows with historical mean scores for all TTP and CEE students indicates that most IGERT recipients were "below average" on one or more of the three scores. As Figure 3.1 shows, only two out of 13 completed IGERT students were above the TTP average on all three GRE scores, and one of those two only completed an MS. Along the same lines, the correlation of IGERT fellows' undergraduate GPAs with their final graduate GPAs is a statistically insignificant 0.14. Thus, in point of fact, GRE scores and incoming GPAs (at least, given some minimum threshold) seem to have little bearing on the ability of a student to successfully complete the PhD.

Figure 3.1
GRE Scores of Completed IGERT Fellows



Nevertheless, it is of interest to examine recent trends in the average GRE scores of enrolled graduate students in transportation in our two largest programs: the TTP and CEE degree programs. Figure 3.2 shows those trends (additional statistics for those two programs from 1999 to 2004, with respect to inquiries, applications, admissions, enrollments, and funding status, as well as breakdowns by gender and domestic/international status, can be found in Appendix H). Inspection of the figures, together with a regression of scores against time, shows a significant positive trend for the verbal TTP scores. The quantitative CEE scores show a significant, though

modest, negative trend (of about three percentile points a year). No other trends are significant for either program, suggesting that IGERT has had little effect on the overall quality of students entering the two main transportation programs, as captured by this imperfect metric.

Figure 3.2a
Average GRE Percentiles of Newly-Enrolled TTP Students
(1999-2004)

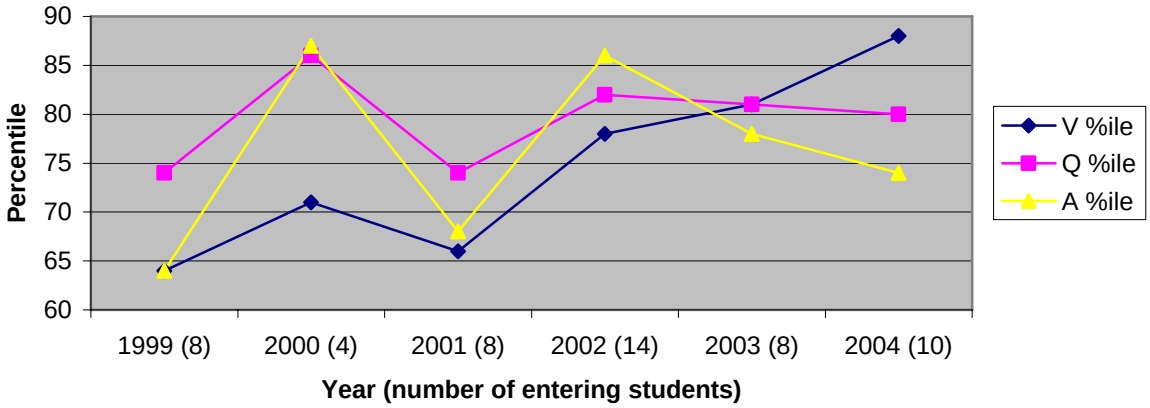
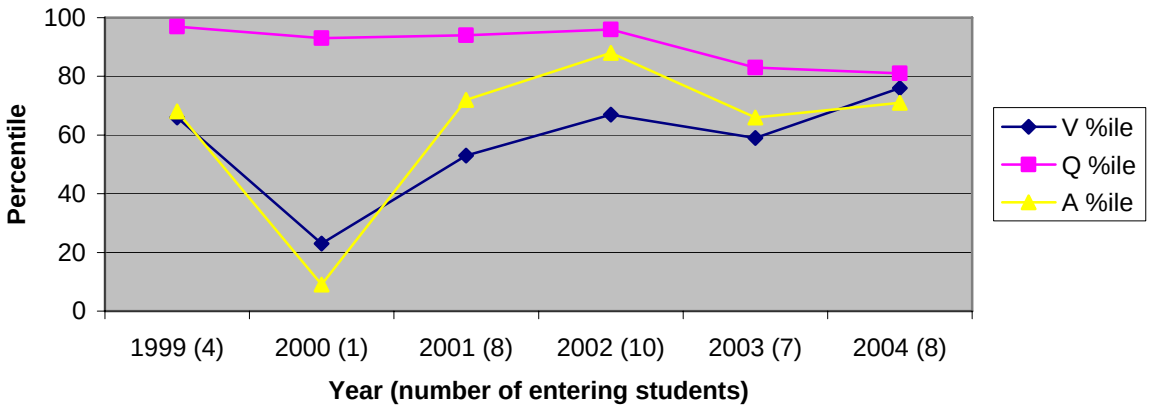


Figure 3.2b
Average GRE Percentiles of Newly-Enrolled CEE Students
(1999-2004)



Similarly, Table 3.2 statistically compares IGERT and non-IGERT students in terms of GRE scores and entering and final GPAs. The means for IGERT students on all of these quantitative indicators are equal to or (most often) higher than those for non-IGERT students. However none of the differences are statistically significant except for the percentile of verbal GRE scores ($p=0.08$). Thus, IGERT students may be marginally better than non-IGERT ones in terms of classical indicators of academic preparation, but the differences are relatively minor.

Table 3.2: Comparison of GPAs and GREs for Completed IGERT and non-IGERT Students

	IGERT ave. (N=13)	non-IGERT ave. (N=35)	p-value of t-test on difference
Pre-UCD GPA	3.39[1]	3.37[2]	0.85
Final UCD GPA	3.78	3.72	0.28
GRE V	569	533[3]	0.15
GRE Q	697	690[3]	0.83
GRE A	692	647[4]	0.17
GRE V (%ile)	76	66[5]	0.08
GRE Q (%ile)	75	75[5]	1.00
GRE A (%ile)	82	73[5]	0.18

[1]N=12, [2]N=24, [3]N=32, [4]N=31, [5]N=30. Shaded row indicates measure that differs significantly between IGERT and non-IGERT students.

3.1.2 Has IGERT helped improve the training experience for transportation students at UCD?

Similar to the issue of the number of dimensions along which a student can be "better", the graduate transportation "training experience" at UCD is multifaceted. Although measurement of those various facets is necessarily subjective, it is not altogether qualitative. In particular, the alumni survey (see Section 2.10.2) asked recent graduates about a variety of aspects of their UCD program, and we statistically compare the perceptions of IGERT and non-IGERT students below. Following that, we discuss some qualitative indicators of the training experience.

Interpretation of all data from the alumni surveys should be prefaced with the following caveats. By construction of the program at NSF, IGERT fellows were all domestic, and almost all were PhD students (as mentioned earlier, we were authorized to offer IGERT fellowships to a small number of MS students who were good prospects to continue for the PhD, so three of our IGERT fellows only completed an MS). Therefore, the most appropriate comparison of IGERT fellows would be to domestic PhD non-IGERT students. There were almost no such students, however: because our program is relatively small, and our commitment to student fellowships under IGERT was large, virtually every domestic PhD student in transportation during the grant term received IGERT funding. Perhaps the next most appropriate comparison would be to any PhD non-IGERT student, whether domestic or international. There still were not enough of those in our survey database, however (only 5 of the 14 associates completing surveys were PhD students). To have any quantitatively meaningful comparison whatsoever, it was necessary to pool all non-IGERT students together. This means, however, that the IGERT/non-IGERT status indicator is strongly correlated with the PhD/MS status indicator, and also correlated with the domestic/international indicator. Both of the latter, then, are factors confounding any differences observed between the IGERT and non-IGERT groups.

The degree program is yet one more issue, both within and across groups. Within group, the fact that students were in different programs may increase the variance in the responses. Across group, the distribution by program varied, with many more non-IGERT than IGERT students in the CEE program, and less diversity of program among non-IGERT students collectively (see Table 3.3). The latter, therefore, is one more confounding factor for IGERT/non-IGERT differences.

Table 3.3: Degree Program Distribution of Alumni Survey Respondents

	IGERT (N=11)	non-IGERT (N=14)
Transportation Technology and Policy	6 (55%)	6 (43%)
Civil and Environmental Engineering	1 (9%)	7 (50%)
Ecology	1 (9%)	1 (7%)
Agricultural Economics	1 (9%)	–
Chemistry	1 (9%)	–
Chemical Engineering	1 (9%)	–
TOTAL	**11 (100%)**	**14 (100%)**

With those caveats in mind, Table 3.4 compares the mean ratings of IGERT and non-IGERT students on a number of aspects of their graduate programs. All of the means fall between 2.8 and 4.2, where 3="good" and 4="very good" on a 5-point scale. Strikingly, the mean perception significantly differs between IGERT and non-IGERT students for only three traits (taking 0.10 as the threshhold level of statistical significance, in view of the small sample size; no differences were significant at the 0.05 level): "availability of courses on desired topics", "giving me constructive teamwork experience", and "providing networking opportunities with other professionals". In all three cases, the mean perception was more positive for IGERT students, suggesting a higher-quality experience at least on these dimensions, though again the result may be related, for example, to the higher proportion of PhD students among the IGERT group.

As indicated above, it is unsurprising to find few differences between IGERT and non-IGERT students: there is reason to expect associates to benefit nearly as much as fellows from many elements of the IGERT program. Specifically (see Chapter 2 for further detail), non-IGERT students benefited by the enhanced facilities, state-of-the-art equipment, improved course offerings, distinguished seminar speakers, the two research conferences hosted by UCD, and the greater visibility of transportation at UCD. To the extent that IGERT helped attract better students (whether as IGERT fellows directly, or as non-IGERT students who were nevertheless influenced by the presence of the prestigious award), associates also benefited from interacting with those better students.

When asked how well the program met expectations overall, IGERT students were considerably (significant at 0.06) more positive than non-IGERT students (means of 4.6 and 3.7, respectively, on a 6-point semantic differential scale ranging from "much worse than expected" = 1, to "much better than expected" = 6). Note that non-IGERT students were not particularly disappointed on the whole (3 on the scale corresponds to "about what I expected", and 4 to "in some ways better, in some ways worse than expected"); rather, IGERT students were simply more pleasantly surprised.

In qualitative terms, the program offers a number of distinctive opportunities that, we argue, improve the training experience for IGERT and non-IGERT students alike. Most of these opportunities are discussed elsewhere in this report, but we summarize them here for convenience:

Table 3.4: Perceptions of the Graduate Program

How would you rate the following aspects of your UCD graduate program? 1=poor, 2=fair, 3=good, 4=very good, 5=excellent			
	IGERT ave. (N=11)	non-IGERT ave. (N=14)	p-value on t-test of difference
a. overall quality of faculty with respect to classroom teaching	3.8[1]	3.5	0.270
b. quality of interaction with my faculty advisor	3.6	4.0	0.391
c. my research experience	3.6	4.0	0.371
d. program advising/guidance	3.4	3.3	0.861
e. personal nature of the program	3.9	3.6[2]	0.378
f. camaraderie with fellow students	4.1	4.2	0.727
g. availability of courses on desired topics	3.7[1]	3.0	0.061
h. improving my public speaking skills	4.0	3.4[2]	0.189
i. improving my technical writing skills	3.7	3.9	0.568
j. improving my critical thinking skills	3.8	4.1	0.491
k. giving me constructive teamwork experience	3.6	3.1	0.080
l. internship opportunities	3.1[1]	2.9	0.734
m. the ITS seminar series	4.0	3.7	0.484
n. providing networking opportunities with other professionals	4.1	3.4	0.076
o. assistance in finding employment	2.8	2.9[2]	0.794
p. career preparation	3.4	3.3	0.835
q. treatment of ethics issues	3.3[3]	3.3[1]	0.947
How well did the program meet your expectations? 1=much worse than expected; 2=worse than expected;3=about what I expected; 4=in some ways better, in some ways worse than expected; 5=better than expected; 6=much better than expected			
	4.6[1]	3.7[4]	0.058

[1]N=10; [2]N=13; [3]N=12; [4]N=11. Differences on shaded aspects are significant at p = 0.1 or better.

- *New courses:* The IGERT program, combined with other funding, helped stimulate the development of numerous new permanent and ad hoc classes (see Sections 2.7 and 3.3.2).
- *Conferences/workshops:* ITS-Davis, with funding from IGERT and other sources, hosted an average of four conferences and workshops per year during the grant period. The two completely IGERT-funded graduate student research conferences are discussed in more detail in Section 2.6, with programs provided in Appendix B.
- *Internships:* An average of 2-3 students a year take advantage of the numerous optional internship opportunities available (see Section 2.8), with government, industry, or non-profit host organizations.
- *Business development program; entrepreneurship and research grant competitions:* See Appendices C and D for details regarding the Business Development Program and the annual Little Bang/Big Bang Business Plan Competition. In addition, ITS-Davis has recently inaugurated a semi-annual Competitive Research and Project Grant program, with funding from the Friends of ITS-Davis. Launched in May 2003, Friends of ITS-Davis is an alumni contact and support group, whose goals are (1) to organize and engage our graduates and other friends of ITS-Davis; and (2) to build a culture of individual giving in support of various student activities. The Friends fund will support up to three research or special student projects a year, at up to $4,500 each. Proposals are solicited through a semi-annual call. Preparing these proposals and obtaining feedback on how to make them more competitive provides students invaluable training in problem and approach identification, literature review, critical thinking, and persuasive communication.
- *Conference travel:* Section 2.4 describes the travel awards funded through IGERT. In addition, travel for non-IGERT students was funded (in lesser amounts) through other sources, including the University of California Transportation Center, the Friends of ITS-Davis, and corporate gifts to ITS-Davis.
- *Outstanding Thesis/Dissertation Award:* This award is also funded by the Friends of ITS-Davis, and provides $1500 per person to the authors of the transportation-related MS thesis and PhD dissertation judged most outstanding among those submitted during a given calendar year at UCD. These awards provide internal and external recognition for the best research being conducted here, and help motivate students to go that "extra mile" for the highest quality outcome.
- *Computer Resource Fund:* Also through Friends of ITS-Davis giving, about $4500 a year is set aside to support the computing needs of ITS-Davis students. Students can apply to the fund for group or individual needs. While ITS-Davis maintains computer labs for ordinary requirements, and faculty research grants cover many out-of-the-ordinary needs, this fund provides support for needs (and some "wants") that are not otherwise funded, and would "fall through the cracks".

3.1.3 Has IGERT facilitated better career outcomes for transportation students at UCD?

With respect to career outcomes, "better" truly is in the eye of the beholder. Accordingly, the main basis we have for inferring career satisfaction is the self-reports from the alumni survey. Table 3.5 compares IGERT and non-IGERT students on four questions from the survey. With respect to the type of employer, we see that three-quarters of the (eight) IGERT respondents found employment in educational institutions, although in most cases as a postdoctoral scholar or staff researcher rather than a tenure-track faculty member. (This, of course, is not atypical of science and engineering PhDs seeking an academic career – many or most of these respondents

are likely to eventually find a permanent faculty position). The most recent known positions of all 43 IGERT fellows are shown in Table 3.6.

Table 3.5: Comparison of Job Characteristics for IGERT and Non-IGERT Respondents

How would your employer be classified?				
	IGERT (N=8)		**non-IGERT (N=12)**	
education	6	75.0%	4	33.3%
industry	1	12.5%	1	8.3%
consulting	1	12.5%	2	16.7%
government	0	0.0%	5	41.7%
non-profit	0	0.0%	0	0.0%
other	0	0.0%	0	0.0%
How would you rate this job with respect to its compatibility with your immediate career goals?				
	(N=8)		**(N=13)**	
It's exactly the sort of thing I had in mind	4	50.0%	7	53.8%
It's not perfect, but it fits me in some ways	4	50.0%	4	30.8%
It's not a good fit, but it looked like my best choice for now	0	0.0%	2	15.4%
In what range does your current job-based annual income fall before taxes?				
	(N=6)		**(N=12)**	
$30,000 or less	0	0.0%	1	8.3%
$30,001-40,000	1	12.5%	3	25.0%
$40,001-50,000	2	25.0%	2	16.7%
$50,001-60,000	1	12.5%	5	41.7%
$60,001-70,000	1	12.5%	1	8.3%
$70,001-80,000	1	12.5%	0	0.0%

Returning to Table 3.5, by comparison, only a third of the (12) non-IGERT students found academic positions, whereas 42% of them joined a government agency (compared to no IGERT students in that category). However, as mentioned earlier, this difference in distribution is confounded by the difference in degree distribution, with most of the associates pursuing MS degrees rather than PhDs, and the converse true for the IGERT fellows.

In terms of compatibility with their immediate career goals, the IGERT respondents were split evenly between feeling that their current job was exactly what they had in mind, versus not perfect, but a good fit in some ways. In contrast, a higher proportion of the associates (54%) considered their job to be exactly what they had in mind, but unlike the IGERT group, a few of the associates also had to "settle" for a job that wasn't a good fit but was the best they could do at the time.

In terms of reported job-based income, that of the IGERT fellows clearly exceeded that of the associates, on average. Sixty-three percent of the IGERT fellows reported incomes greater than $50,000 a year, compared to 50% of the associates. Again, however, this result could be explained by the higher proportion of PhDs among the IGERT respondents.

Table 3.6: Current Employment of All IGERT Fellows

Employment	Number
Still pursuing UCD degree	17
Education	
UC Davis	3
UC Berkeley	2
Auburn University	1
James Madison University	1
Seattle University	1
University of Hawaii	1
Industry	
California Fuel Cell Partnership	1
DaimlerChrysler	1
Solar Turbines, Inc.	1
UTC Fuel Cells	1
Consulting	
Cambridge Systematics	1
Government	
US Air Force	1
Non-profit	
Union of Concerned Scientists	1
Unknown	10

With respect to job satisfaction, however, we might reasonably expect neither the degree distribution nor any of the other confounds discussed above to have much of an effect – there is no *a priori* reason to expect an MS graduate to have a less satisfying job than a PhD, and so on. As shown in Table 3.7, there is in fact no significant difference between IGERT and non-IGERT respondents in terms of their satisfaction with the content of the work, their supervisor, and their salary, with most means falling between 4 (satisfied) and 5 (very satisfied) on the five-point scale. There *are*, however, significant differences with respect to fringe benefits, opportunity for professional development, and overall. In every case, the means for IGERT students are higher (still falling between 4 and 5) than those for non-IGERT students (falling between 3=neutral or mixed and 4), and in fact this is also true even for the three aspects on which there is no statistically significant difference. Thus, the evidence supports the conclusion that the IGERT program contributed to a more positive initial career outcome for the fellows. Although a devil's advocate might point out the possibility of a response bias, in which those who are less satisfied with their career outcomes might be less motivated to respond (out of embarrassment or apathy), there is no reason to expect such a bias to be manifested more strongly in one group or the other (the cover letter to the survey did not mention IGERT, so respondents were not pre-conditioned to associate any of their responses with the IGERT program). Thus, the differences between the two groups appear to be genuine.

Table 3.7: Comparison of Job Satisfaction Ratings for IGERT and Non-IGERT Respondents

What is your degree of satisfaction with the following aspects of your job? 1=very dissatisfied, 2=dissatisfied, 3=neutral or mixed, 4=satisfied, 5=very satisfied			
	IGERT ave. (N=8)	**non-IGERT ave. (N=12)**	**p-value on t-test of difference**
a. Content of the work	4.6	4.3	0.366
b. Supervisor	4.8	4.2	0.126
c. Salary	4.0	3.3	0.120
d. Fringe benefits	4.3	3.3	0.025
e. Opportunity for professional development	4.8	3.8	0.030
f. Overall	4.6	3.9	0.060

3.2 Research-Related Effects

3.2.1 Has IGERT funding led to important new knowledge?

The primary purpose of the IGERT program may be to provide multi/interdisciplinary training to a new generation of scientists and engineers, but it is impossible to separate the education function of IGERT from its research function – as attested by the "I", for "Integrating" "Education" and "Research", in IGERT. That is, the training is not only to impart a body of knowledge drawing from multiple disciplines, but also to conduct research that crosses disciplinary boundaries and that makes a difference. If the research conducted by IGERT fellows only constituted so much busywork, it would not be an effective use of the funding, nor, for that matter, an effective training experience. Accordingly, one metric of the success of the grant should be the scholarly productivity of the trainees.

From the late 1998 start of our IGERT grant to the present, a span of about 7 years (although no students received funding during the final year, 2004-05, research begun previously with IGERT funding may not have been completed or published until then or later), IGERT fellows and their co-authors have produced at least 40 reprints (journal articles, conference proceedings, and book chapters) and 56 research reports. In keeping with the broad themes of our IGERT grant, 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 among others.

Obviously, space considerations prohibit summarizing all the new discoveries contained therein, but below we provide brief overviews of studies representing four of the major themes of transportation research at ITS-Davis (the names of IGERT fellows are bolded). A complete list of publications produced with IGERT funding is provided in Appendix I, and overviews of selected additional projects can be found in Appendix J.

Theme 1: Environmental Impacts of Transportation

What is the past and present contribution of leaded gasoline combustion to the global dioxin budget? (**Leeman**, Chang, Reiner, Kolic, MacPherson, Ouchida) Leaded gasoline sales accounted for approximately 21% of global gasoline sales as late as 2000, and lead was heavily utilized world-wide as an anti-knock additive until the late 1990s, although its use in California was phased out as early as 1981. Burning leaded gasoline is known to have deleterious health effects, but the extent of the role played by automobiles in generating dioxin emissions has not been firmly established. Because long-range transport and distribution of fine particles occurs and some polyhalogenated dibenzodioxins or polyhalogenated dibenzofurans (PHDD/F, referring to mixed chlorinated and brominated dioxins and furans) would have long residence times in the environment and bioconcentrate, we hypothesized that vehicles burning leaded gasoline have contributed significantly to the global dioxin budget in the past and possibly continue to do so in the present. By analyzing archived hi-vol air filters (1974-1980), collected from an area in California that historically had few or possibly no major stationary dioxin sources, and performing a study of other known sources, the research provided compelling evidence of a vehicular contribution to ambient polychlorinated dibenzodioxins/dibenzofurans (PCDD/F) in the Riverside urban area during the period 1974 – 1980. A strong correlation ($r^2 \approx$ 0.8 to 0.9) with a dominant motor vehicle emissions, i.e., 24-hr average CO was established. The results of the research suggest that vehicular sources were important in emitting and distributing PCDD/F throughout the environment in the past. Continued leaded gasoline combustion may currently pose health risks in areas where it is still utilized, and may still contribute significantly to the global PCDD/F budget, especially if PHDD/F transformation occurs. This research was supported by the IGERT, NIEHS and UC Toxic Substances Research and Teaching programs and would not have been possible without the funding by these multidisciplinary programs.

Theme 2: Advanced Environmental Vehicles and Propulsion Systems

Development of Advanced Electrochemical Capacitors Using Carbon and Lead Oxide Electrodes for Hybrid Vehicle Applications (Burke, **Kershaw**, Miller) This work has led to commercialization, and further work surrounding the hybrid ultra capacitor. The device was built in the hybrid vehicle research lab, and would not have happened at all without IGERT. This was a technological advance.

What is the optimal density and siting of hydrogen fuel stations? (Handy, **Nicholas**, Sperling) The lack of hydrogen fuel stations is a major barrier to the introduction of hydrogen vehicles. Given the high cost of constructing hydrogen stations, it is desirable to build as few stations as possible while still adequately serving consumers. This project developed a GIS model for siting a network of hydrogen stations in Sacramento County, California. For a network with 30% as many retail fuel stations as now, average driving time from home to a station would be just 16 seconds more than it is with the full existing network of stations. With 5% of existing stations supplying hydrogen, the average driving time to a station could be as little as 4 minutes in Sacramento County. These results suggest that a few strategically sited stations could be sufficient to satisfy a large number of prospective consumers and provide encouragement that this barrier to the introduction of hydrogen vehicles can be easily overcome.

Theme 3: Information/Communication Technologies and Travel

Does telecommuting prompt residential relocation farther from work? (**Ory**, Mokhtarian) Many studies have shown telecommuting to have short-term benefits in terms of reducing commute travel. But some researchers have questioned the long-term benefits, suggesting that the ability to telecommute may motivate people to move even farther from work than they currently do. If the one-way commute length increases enough, total commute travel may increase even though telecommuting reduces the frequency with which the commute is made. This study analyzed the retrospective telecommuting and residential relocation behavior of current and former telecommuting employees over a 10-year period, and compared it to that of a non-telecommuting control group. We found that most often, telecommuting seemed to be an effect rather than a cause of residential relocation farther away. That is, those who had already moved away for other reasons adopted telecommuting so as to reduce their commuting. Thus, telecommuting appears to be a beneficial strategy even in the long term – reducing commute travel from what it would be otherwise, rather than increasing it due to facilitating further decentralization. In either case, we also found that the average total commute distance of telecommuters was less than or at most equal to that of non-telecommuters, indicating that even if telecommuting stimulated more distant relocations, it more than compensated for any additional travel thereby generated.

Theme 4: Travel Behavior Analysis/Transportation Demand Modeling

Urban spatial competition models (Johnston, **Rodier, Clay**, Gao) Prof. Robert Johnston and his students have applied urban spatial competition models to the Sacramento region for several years, partly based on IGERT support. They have shown the usefulness of these models for policy analysis and have also evaluated the models for accuracy. Johnston and his co-workers in three nations have also performed a comparison of various urban models, using the same datasets. The Sacramento Area Council of Governments (the regional transportation planning agency of the region) has recently adopted one of these models for official use in land use and transportation planning and is making improvements to it.

3.2.2 Has IGERT stimulated new discoveries that would not have occurred otherwise?

As noted above, it is not possible to know definitively what would have happened without IGERT. Based on the faculty interviews and common sense, however, it is clear that IGERT funded more students than the program would have been able to support financially otherwise, and that most students we couldn't have funded would not have come. Perhaps some of the research conducted by IGERT fellows represented a faculty "agenda" that would have been addressed eventually through some other means, but at that point it would have presumably displaced the other research that can now take place because some items on the "agenda" were completed sooner rather than later. In other cases, the research conducted by the IGERT fellow was clearly the student's "agenda", or a joint creation of student and faculty, which the faculty mentor would never have pursued unilaterally.

Even more subtly and indirectly, we argue that the general environment created by our diverse student body (as described in Section 3.1.1) fertilized new ideas and approaches that would not have been generated in a more homogeneous intellectual milieu. For example, the Hydrogen Pathways program (see Section 3.3.3) expanded beyond treatment of engineering issues relating to the design of vehicles and fuel cells, to include studies of image and prestige in vehicle and energy choices. The same is true of ITS-Davis' fledgling China energy/transportation initiative.

Several faculty members mentioned the equipment purchased with IGERT funds, and noted that certain research could not have been conducted without it, and would not have been conducted had IGERT not funded the equipment.

3.3 Program-Related Effects

3.3.1 Has IGERT stimulated new, especially interdisciplinary, collaborations that would not have occurred otherwise, or accelerated such collaborations?

Here again, we must rely on qualitative indicators, specifically the assessment of interviewed faculty members. In response to the question, "Is there anything that IGERT made possible that wouldn't have happened otherwise?", one interviewee noted faculty research involving eight faculty members in at least three different departments, saying, "This research is largely focused on analysis and modeling of transportation systems, activities, and technologies. ITS-Davis is now collaborating with faculty in chemistry, chemical engineering, and materials science to form a center of excellence in fuel cell and hydrogen storage science." For example, a faculty member in Mechanical and Aeronautical Engineering is collaborating with one in Chemical Engineering/ Materials Science and one in Civil and Environmental Engineering / Environmental Science and Policy, through advising a doctoral student on fuel cell research (relating to materials and corrosion). This continues a prior collaboration among two of the faculty members and a researcher at ITS-Davis, jointly advising an IGERT fellow on fuel cell research involving knowledge of transportation systems, mechanical engineering, and materials/ processing.

As another example, a faculty member in urban planning (Environmental Science and Policy) mentioned her collaboration on a study of hydrogen fuel station siting (see Section 3.2.1), and indicated that she would not have had any involvement with the hydrogen fuel cell program at all if IGERT had not facilitated the project.

While these are new collaborative arrangements, the infrastructure at UCD in general and ITS-Davis in particular has long fostered multidisciplinary teamwork, and prior arrangements have been nurtured – through IGERT-funded students among other means – during the IGERT grant period. These include collaborations of policy analysts with engineers on the impacts of various alternative-fuel policies; chemical, civil and mechanical engineers on alternative fuel vehicle modeling and hydrogen storage; civil engineers with geographers and urban planners on studies of attitudes toward travel and impacts of information/communication technologies on travel; economists and engineers on the demand for travel in developing countries; and market researchers with engineers on the demand for conventional and alternative-fuel vehicles.

Inter- and multidisciplinary collaboration occurs not only among faculty members, but between faculty and students. As noted earlier, IGERT *did* have a direct role in bringing students with a diverse set of disciplinary backgrounds to the program, students who then often worked with faculty members having different backgrounds. For example, faculty in civil engineering have supervised students with undergraduate majors in anthropology, sociology, geography, business, and so on. In each case the student's background has enriched the faculty member's knowledge, and contributed to research products that are better than they would have been with only the more narrow and homogeneous perspective of any single faculty member.

Overall then, interdisciplinary research is thriving at ITS-Davis, and IGERT receives a great deal of the credit for maintaining existing cooperative relationships and stimulating new ones. IGERT played a significant role both in fostering a general climate of sharing and collaboration, and in the practical contribution of funding to support "non-traditional", i.e. interdisciplinary, students. Many of these students would otherwise have either (1) fallen into a traditional department doing traditional disciplinary work, or (2) not come to graduate school at all, not having found something meeting both their research interests and their financial need.

3.3.2 Has IGERT stimulated new, especially interdisciplinary, course offerings?

One of the challenges facing interdisciplinary graduate groups (such as TTP) at UCD is that they receive no guaranteed formula-driven state funds for administration, as conventional departments do. Nor, by the same token, do they generally have any full-time ladder-rank faculty permanently assigned to them – most or all of their tenure-track faculty have full permanent appointments in a traditional department. Since these traditional departments are providing 100% of a faculty member's salary, they generally expect her or him to teach a full load in that department. While this expectation is understandable, it does make it difficult for interdisciplinary programs to develop new courses that are tailored to the program's particular needs. This problem can be addressed in several different ways:

- The interdisciplinary program's curriculum may be based largely on courses taught through traditional departments, with the novelty of the program lying in the assembly of courses from a variety of departments.
- A faculty member may teach a class designed especially for the graduate group, on an overload basis.
- Faculty members' home departments may be persuaded to allocate one or two courses from their full load to the interdisciplinary program. Some departments may see this as a reasonable contribution to promoting a general climate of interdisciplinary education and research, which can be seen as indirectly advantageous to traditional disciplines as well; in other cases the department may directly benefit from the interdisciplinary class (e.g. where it is relevant to, and desirable for, the department's own students).
- If funding is available, researchers, students, and/or outside professionals can be paid to teach classes tailored to the program.

The TTP program has made effective use of all these strategies. In its early days, nearly the entire curriculum consisted of existing courses taught through conventional departments. Over time, many tenure-track faculty members have taught TTP classes, generally one-time offerings, as an overload. Also over time, several departments – specifically Economics, Environmental Science and Policy, Civil and Environmental Engineering, and Mechanical and Aeronautical Engineering – have agreed to allow faculty members to teach TTP-oriented classes as part of their normal course load. And from the beginning, TTP has relied heavily on non-ladder rank instructors to offer a variety of classes to meet programmatic needs.

Below, we first list the current permanent TTP-oriented course offerings, together with a brief description and comment relating to each one (note that six of these courses have been implemented during the IGERT grant period, with several presently undergoing the approval process to make them permanent). Then, we select several ad hoc classes from the large number offered to transportation students during the IGERT grant period, listed in Section 2.6, and describe them

in more detail. Course syllabi for these selected classes, and many of the other ad hoc classes, are provided in Appendix C.

3.3.2.3 Permanent TTP-Oriented Classes

To further illustrate the multidisciplinary nature of TTP instruction, the home department of each instructor is noted, but all instructors are also faculty members of the TTP degree program.

TTP 200, Transportation Survey Methods (instructor – Patricia Mokhtarian, Civil and Environmental Engineering): Describes the types of surveys commonly used in transportation demand analysis; discusses experimental and quasi-experimental research designs, survey design principles, sources of errors in behavior research, ethical issues in behavioral research; presents factor and cluster analysis methods, together with practice on real-world data sets. This class was originally taught through the Civil and Environmental Engineering department, and is still required of CEE transportation students. We believe it to be distinctive, however (compared to research methods classes in the typical engineering-based transportation/ CEE program, which provide a more mechanical/statistical view of data analysis) in its multidisciplinary approach. It draws heavily on topics taught in quantitative social science, psychometrics, econometrics, statistics, and marketing research classes.

TTP 210, Fundamentals of Transportation Technology (instructor – Paul Erickson, Mechanical and Aeronautical Engineering)**:** Without technical training, policy makers run the risk of enacting laws that run contrary to the fundamental laws of science. This course trains future policy makers in the fundamental principles of thermodynamics, fluid mechanics and heat transfer as they relate to transportation. It is a core class in the TTP degree program. As shown in Section 2.6, it has been taught (under several similar names) on an ad hoc basis since the beginning of the program, several times by PhD students with IGERT funding. But the lack of a ladder-rank faculty member to take it on a permanent basis was a severe liability. Fortunately, that deficiency has now been remedied with the hire of Prof. Paul Erickson in Mechanical and Aeronautical Engineering, who has willingly adopted the class as his own.

TTP 220, Transportation Planning and Policy (instructor – Susan Handy, Environmental Science and Policy)**:** This course provides an in-depth understanding of the transportation planning process at the regional level as it is shaped by federal policy. Topics include history, institutions, Federal transportation authorization bills, the regional planning process, air quality conformity, the project development process, modeling, financing, intermodal planning, and integrated transportation and land use planning. This is a brand-new class that could not have been offered before the hire of Prof. Handy a few years ago. It adds much-needed breadth on the *policy* side of our Transportation Technology and Policy curriculum.

TTP 281, ITS-Davis Transportation Seminar Series (instructors – various): Weekly seminars by guest speakers, on varied topics. The course exposes our students to the best and most current research in a variety of fields, and fosters relationships with the scholars conducting that research (as well as with leading government, industry, and non-profit professionals). It also gives students the opportunity to develop their own presentation skills before a friendly "home-town" audience. Although this seminar series predates IGERT, IGERT enriched it immeasurably through funding distinguished speakers on a quarterly basis (see Section 2.4).

TTP 282, Transportation Orientation Seminar (organizer – Susan Handy, with different faculty speaking on each topic): Weekly seminars introducing various topics in transportation research and education, focusing on topics of particular interest at UCD. This course is required of new TTP students, and strongly recommended for new CEE transportation students. Recall that especially TTP students come from a variety of backgrounds; as such, they often have only a sketchy and parochial idea of "what transportation is about". This seminar not only gives them an overview of many of the basic areas of research within transportation, it also introduces them to the UCD faculty members specializing in each of those areas. This course was inaugurated Fall 2004, with great success.

TTP 283, Professionalism, Leadership, and Ethics Seminar (organizer – Daniel Sperling, with different outside speakers each week): Speakers from industry, government, academia, and NGOs lead discussions about succeeding and performing in the professional world. They address leadership, ethics, and other workplace issues. This class is required of TTP students and strongly recommended for CEE transportation students. It is an outstanding opportunity for them to meet leading transportation professionals, and to learn more about careers outside of academia. It was offered for the first time in Spring 2005, to great acclaim by the students.

TTP 292, Internship in Transportation Technology and Policy (instructors – various)**:** The IGERT grant focused our attention more intensely on the benefits of internships, and prompted the establishment of this course to provide academic credit for the internship experience. While such a course is routine for undergraduate programs at UC Davis, it is uncommon to find it in graduate programs. The addition of this course further emphasizes to students the importance we place on the internship experience.

TTP 396, Teaching Assistant Training Practicum (instructors – various): This course provides academic credit to students serving as teaching assistants, and also credits the faculty advisor with the time spent mentoring the TA.

Economics 145, Transportation Economics (instructors – Robert Feenstra or Christopher Knittel, Economics): This class examines fundamental problems of planning and financing transportation infrastructure, the economics of the automobile industry, and the impacts of government regulation and deregulation on the airline and trucking industries. This class was developed especially for the TTP program, although it also serves economics majors and hence is through the economics department.

3.3.2.4 Selected Ad Hoc TTP Classes

Electric Energy Storage and Conversion Technologies (instructor – Dr. Andrew Burke)**:** This course introduces students to energy storage and conversion systems that are used in electric and hybrid vehicle powertrains including batteries, ultracapacitors, and fuel cells. It presents the basic science of these technologies, and the modeling and control of them as components in electric and hybrid vehicles. For each technology, the present state of the art will be summarized and projections of likely future progress discussed. The course also introduces students to testing batteries, ultracapacitors, and fuel cells through a series of lab sessions in the UCD EV Power Systems Laboratory.

Processes and Materials in Polymer Electrolyte Fuel Cells (instructor – Dr. Shimshon Gottesfeld): This course provides a detailed description of the physicochemical processes in fuel

cells and how they determine merit performance parameters of such energy conversion devices. The polymer electrolyte fuel cell is described from a physical electrochemistry perspective, highlighting the nature of electrode processes and transport processes in the polymeric membrane electrolyte. Structural materials requirements are examined, highlighting the perspectives of electrochemical stability in addition to mechanical properties. Such a fundamental examination of chemical & physical processes in the cell and relevant materials properties are tied to the performance of the polymer electrolyte fuel cell, including primarily energy conversion efficiency and power density.

The Full Social Cost of Transportation (instructor – Dr. Mark A. Delucchi): Every year, American drivers spend hundreds of billions of dollars on highway transportation. They pay for vehicles, maintenance, repair, fuel, lubricants, tires, parts, insurance, parking, tolls, registration, fees, and other items. These expenditures buy Americans considerable personal mobility and economic productivity. But the use of motor vehicles costs society more than the hundreds of billions of dollars spent on explicitly priced motor-vehicle goods and services in the private sector. Some of the motor-vehicle goods and services provided in the private sector are not priced explicitly, but rather are bundled in the prices of non-transportation goods and services. In this course, we will study what the social costs of transportation are, why we care about them, how we estimate them, and what we do with the estimates.

World Class Transit for the Bay Area (instructor – Dr. John Holtzclaw, Sierra Club): Over the coming years, an enormous infusion of transportation investment will be targeted at the Bay Area. Unfortunately, there is still no coherent vision for the potential of a truly world class public transit system for the Bay Area. Instead, the region is characterized by 27 transit operators forming a poorly coordinated system. As new funding becomes available, the lack of vision becomes apparent: low-cost bus service is diminished in the urban core, while high-cost rail projects are extended through the region's periphery. This graduate seminar explores public transportation in theory and in practice in the San Francisco Bay Area. The focus of the class is on producing a report on the state of public transportation in the Bay Area which will identify cost-effective, sustainable means of improving transit facilities and increasing ridership. This will encompass analysis of transportation pricing, identifying weak links in transit connections, the integration of new infrastructure with the need for land use and pricing reforms, and the investigation of new technologies that can increase the reliability of transit.

Urban Modeling (instructors – Michael Clay and Prof. Robert Johnston): This course provides students with the theory behind three major urban models, as well as hands-on experience in using them, evaluating them, and interpreting their output. The three models are a simple GIS land use allocation model designed by Johnston (UPlan), a complex GIS model being used by several regional transportation agencies in the U.S. (Places), and a spatial competition (economic) model, MEPLAN.

3.3.3 Have IGERT resources been synergistically leveraged to contribute to other accomplishments of the program, and conversely?

The IGERT grant was one among a number of funding sources contributing to the success of the transportation research and education program at UC Davis – albeit one of the largest. It is impossible to prove that IGERT "caused" some of these other sources to materialize. However, it can confidently be said that the presence of the IGERT grant contributed substantially to the image and reality of ITS-Davis having a vital, thriving program that warranted further investment on the part of others. In some cases, IGERT and the other funding sources served to main-

tain and expand the status quo; in other cases they served to launch and nurture exciting new programmatic developments. Both functions were critical to success.

Other funding sources/research initiatives available during the grant period and coming online shortly thereafter include the following:

- The *University of California Transportation Center (UCTC)* annually provided approximately $85,000 in student fellowships, $45,000 for teaching and technology transfer activities, $2,000 for student travel to conferences, $120,000 in competitive faculty research grants, and $30,000 in competitive dissertation-year fellowships.

- Starting in 2006, UC Davis has been named a *"Tier 2" university transportation center* in its own right, with $1 million in annual funding from the federal and state departments of transportation. This is a signal mark of ITS-Davis' success in the eyes of the policy-making community.

- In 1998, the *U. S. Department of Energy* authorized two Centers of Excellence at UC Davis, as part of its *Graduate Automotive Technology Education (GATE)* program: the Fuel Cell Vehicle Center and the Hybrid Vehicle Drivetrain Program. The goal of the GATE program is to train a future workforce of automotive engineering professionals to overcome technology barriers preventing the development and production of cost-effective, high-efficiency vehicles for the U.S. market. Each UCD center received $500,000 for curriculum development and fellowships, and comprised two of only ten such awards made nationwide. In August 2005, UC Davis received a follow-on award (one of eight nationwide) of nearly $600,000, to merge the two centers and continue its education, research, and industry collaboration functions.

- The *Fuel Cell Vehicle Modeling Program (FCVMP)* was launched in 1998 and concluded in 2003. Twenty major automotive companies, suppliers of fuel cell related technologies, and major energy suppliers gave $100,000 each, together with financial support from the U. S. Department of Energy, the California Air Resources Board, and other government agencies. The program analyzed fuel cell vehicle performance, efficiency, and emissions utilizing the most likely fuel types and system combinations; organized consensus on key technical issues; and played an important role in fuel selection planning.

- The four-year *Transportation and the Hydrogen Economy: Pathways and Strategies* (*Hydrogen Pathways)* research program was launched in 2002 to evaluate the technical, economic, environmental, business, and policy implications of a hydrogen transportation future, and to engage the various stakeholders. At the time of this writing, there were 15 corporate and five governmental sponsors, with a total budget of almost $1 million. On April 20, 2004, California Governor Arnold Schwarzenegger participated in the grand opening of the UC Davis hydrogen fueling station, and took the opportunity to sign Executive Order S-7-04 to create a California Hydrogen Highway Network by 2010. The UCD station is the first publicly-accessible station in the network.

- In spring 2003, UC Davis' John Muir Institute of the Environment and ITS-Davis launched the *Road Ecology Center*, an integrated program to advance multidisciplinary research in the emerging, cutting edge area of road ecology. The center is based on the understanding that human communities and natural ecosystems share common needs for

sustainable and friendly transportation systems. It seeks to develop a broad, interdisciplinary program where researchers and policy makers work together to design sustainable transportation systems. The center's primary research initiatives are being developed around two main topics: design of transportation systems, and effects of roads on natural landscapes and on human and nonhuman populations.

- In 1999, *American Honda Motor Company* provided an endowment of $500,000 to advance new mobility studies.

- In all, *industry and private foundation* support to ITS-Davis has approximately tripled since the IGERT program began in 1998, from about $500,000 a year to $1.5 million annually. This is clear and tangible evidence of the growing strength of the transportation research and education program at UCD.

- Two ITS-Davis faculty have been recipients of the highly competitive and prestigious *National Science Foundation CAREER* awards: Debbie Niemeier and Michael Zhang.

- Annual expenditures on *transportation research* at UCD from all sources total $9 million. This includes research by several centers affiliated with ITS-Davis: the Advanced Highway Maintenance and Construction Technology Research Center, the UC Davis – Caltrans Air Quality Project, the Pavement Research Center, the Information Center for the Environment, and the Road Ecology Center. Several of these represent new research directions inaugurated within the IGERT grant period.

- ITS-Davis launched the *Friends of ITS-Davis* program in 2003. The program organizes and engages graduates and other Institute friends, and seeks individual giving in support of various student activities. Donations have averaged about $50,000 a year in the first two years of the program. In addition to the activities funded through this program that are described in Section 3.1.2, a sizable portion of the annual giving is set aside for an endowment fund.

ITS-Davis continues its growth trajectory with some new initiatives still in the planning stages:

- The *China Center for Energy and Transportation* is being launched with $200,000 from Chevron and $100,000 from the International Relations department in the University of California Office of the President. Other funding is being sought. Two PhD students, including one IGERT fellow, are now in China at Tongji University for one year working on their dissertations.

- Together with the College of Engineering, a *major fundraising campaign* is being designed, to build a new $24 million environmental vehicle center and to endow professorships, student fellowships, and a variety of other educational, research, and outreach activities.

- UC Davis recently invited programs to propose new initiatives around which the campus would focus its faculty hiring priorities over the next several years. ITS-Davis, together with the College of Engineering, proposed joint initiatives on *Transportation and Energy for the Future*. This joint endeavor was one of nine selected by the campus, and the one with the largest number of new faculty proposed. A total of *12 new faculty in the energy*

and transportation areas will be hired over the next few years under this initiative. Collectively, their appointments will reside within at least four different colleges or divisions, testimony to the multidisciplinary nature of the proposal.

In addition to its diversifying and growing funding mechanisms, major accomplishments of ITS-Davis during the IGERT grant period also include the hiring of six new ladder-rank faculty members across several different departments – dedicated to transportation and committed to the interdisciplinary spirit of the TTP IGERT and degree programs. In most cases, the hiring departments were also supportive of the ITS-Davis and TTP participation of the new member, and facilitated that participation through sharing the new faculty member's course load between the department and TTP. The acquisition of these outstanding new faculty have immeasurably enhanced the depth and breadth of the educational curriculum and the research agenda for transportation at UCD. Three are women, further increasing the already strong gender diversity of the program (see Section 3.1.1).

The new faculty include the following:

- *Paul Erickson*, Assistant Professor, Mechanical and Aeronautical Engineering. PhD 2002, University of Florida. Specializes in energy conversion methods applied to transportation.

- *Yueyue Fan*, Assistant Professor, Civil and Environmental Engineering. PhD 2003, University of Southern California. Specializes in network optimization and civil infrastructure systems management.

- *Susan Handy*, Associate Professor, Environmental Science and Policy. PhD 1992, University of California, Berkeley. Specializes in urban planning, and relationships between transportation and land use, and joined UC Davis after 8 years on the faculty at the University of Texas, Austin.

- *John Harvey*, Associate Professor, Civil and Environmental Engineering. PhD 1992, University of California, Berkeley. Specializes in the characteristics of paving materials and their use in structural design. Harvey directs the multi-million-dollar Caltrans-funded Pavement Research Center, which he brought from Berkeley.

- *Sangtae Kim*, Chemical Engineering and Materials Science. PhD 1999, University of Houston. Specializes in mass and charge transport in nano-structured ionic and mixed conducting oxides, interfacial defect thermodynamics and kinetics, solid oxide fuel cells, gas separation membranes.

- *Joan Ogden*, Associate Professor, Environmental Science and Policy. PhD 1977, University of Maryland, College Park. Specializes in technical and economic assessments of new energy technologies, and joined UC Davis after 20 years as a researcher at Princeton University.

New faculty indicated in the evaluation interviews that the presence of the IGERT grant was an important factor in their decision to come to UC Davis – it constituted a tangible symbol of the ongoing success of the program, and of the interdisciplinary philosophy to which they themselves subscribed. In the words of one faculty member, "Yes, IGERT affected my decision to

come here, and I was aware of it well before coming here. The TTP program was critical to my decision to come here, and IGERT was important in the establishment of the program. The ability of IGERT to support PhD students made UCD all the more attractive."

In addition to new faculty joining UCD, ITS-Davis has substantially expanded the number of faculty affiliating with the Institute. The 1997-98 Biannual Report for the Institute listed 37 faculty associates; there are now (see Appendix A) 54 faculty associates, an increase of 46%. The Institute grew not only in number of faculty but in the diversity of programs represented: the faculty members in 1997-98 represented 12 departments/organizations, compared to 18 currently – an increase of 50%. The diversity of the core faculty has broadened commensurately: faculty identified as most strongly affiliated with ITS-Davis in 1997-98 belonged to just six departments/organizations, whereas the currently strongest-affiliated faculty are drawn from nine. Thus, ITS-Davis has succeeded markedly in expanding its reach, attracting fresh thinking to transportation through the application of a variety of disciplinary approaches, and fostering new collaborations through providing a common meeting ground across disciplines.

3.3.4 Has IGERT contributed to the internal and external visibility of the program?

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 in external visibility and respect, both directly and indirectly. 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. Directly, it has had the obvious impact of enabling us to fund more students than would otherwise have been possible. Indirectly, the level of funding for an individual student, plus the fact of having the prestigious grant itself, brought a higher-quality and more eclectic set of students than would have come otherwise, elevating the quality of the program and creating a synergistic effect for continuing to attract outstanding students. Also, as discussed above, IGERT 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) – extraordinarily high-caliber new faculty, with a firm commitment to interdisciplinary education in general and the TTP program in particular.

Internally, it is fair to say that ITS-Davis was already visible to and respected by campus administration. However, the IGERT grant certainly further enhanced that image. Among other benefits, it was a significant factor in leveraging some of the new transportation faculty positions for the campus. It also helped publicize ITS-Davis to other *faculty* on the campus, and by virtue of the student support and other opportunities it offered, helped draw more faculty under the ITS-Davis umbrella and further strengthen the affiliation of those who already identified with the Institute to some degree. At least five faculty advisors of IGERT fellows, from four different departments and three different colleges, had *no* recorded affiliation with ITS-Davis in 1998, and at least three others had relatively weak linkages.

3.4 Campus-Related Effects – Institutionalization

3.4.1 Institutionalization of the TTP Program

The UC Davis campus has long been hospitable to interdisciplinary research and education. For example, interdisciplinary "graduate groups" (degree-granting programs, of which the TTP program is one) have been a fact of life here for literally decades. While graduate groups are possible at any UC campus, UC Davis in particular has embraced them more wholeheartedly than all the other campuses. More than half of the graduate students at UC Davis are enrolled in graduate groups rather than in traditional disciplinary departments. This means that the institutional support for continuing a program like TTP after the expiration of the IGERT grant is firmly in place (although there is room for improvement, as discussed later). The ongoing accomplishments described in previous sections provide further support for the continuation of the TTP program and philosophy.

Thus, the TTP program *per se* is certainly here to stay – it is already the largest transportation program on campus, and likely to remain that way because of its accessibility to those from a variety of backgrounds (whereas its nearest "competitor", the traditional civil and environmental program, is not attractive to non-engineers due to the substantial amount of "remedial" coursework that would be needed to finish as an engineer). The new faculty are solidly rooted and are likely to make outstanding careers here. The new courses are making their way through the course approval process. The internship program is likely to remain small in scale, but unquestionably valuable. New funding from corporate gifts, donations from alumni and friends, and government grants is helping to replace the funding of research fellowships, conference travel, distinguished speakers, and other components of the IGERT program.

3.4.2 General Campus Institutionalization Activities

Although much of the needed institutional infrastructure was already in place prior to the IGERT grant, IGERT has definitely made a mark on the campus at large as well. As Dean of Graduate Studies Jeffery Gibeling states, "The NSF IGERT program has had an important impact on sustaining and expanding interdisciplinary graduate education at UC Davis, and I remain strongly committed to doing all that I can to ensure the success of existing and future IGERTs on our campus." This impact and commitment are doubtless due in part to the eventual presence of three funded IGERT programs at UCD, with a number of others being proposed in subsequent years (decisions pending on some at the time of this writing). It is an important message that 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.

The campus response to the IGERT program has taken several forms: a new administrative position, regular meetings of key personnel across all current and prospective IGERT grants, centralized support of recruiting and professional development activities, and financial and other support of new IGERT proposals. Each of these is briefly described below.

3.4.2.1 New Administrative Position and Cross-IGERT Consultation

UC Davis Graduate Studies has created a 50%-time administrative position, Faculty Assistant to the Dean of Graduate Studies, responsible for the support and coordination of training grants such as IGERTs. It has also spearheaded the formation of the IGERT Coordinating Committee,

an active working group that meets monthly to develop, evaluate, and re-envision recruitment, assessment, and outreach activities; and the IGERT PI Council that meets on a quarterly basis to exchange ideas among current and potential IGERT investigators. UC Davis also sponsored a University of California system-wide IGERT Workshop (March 15, 2004) to confer on issues of opportunity and diversity, and organized a UC Davis IGERT Symposium to provide an occasion for past and present students from the existing and recently expired IGERTs to reflect on the opportunities provided through their engagement in these programs.

3.4.2.2 Campus-level Recruitment Activities

In addition, Graduate Studies at UCD organizes a number of strategic recruiting activities designed to assist the IGERT programs in attracting a diverse cohort of graduate students to our campus each year. The efforts that specifically support IGERT programs, including integration with our NSF Alliances for Graduate Education and the Professoriate (AGEP) program, are described in Appendix K. The Office of Graduate Studies also provides career and professional development programs and services through several program initiatives. The Director of Outreach, Recruitment and Retention oversees the Professors for the Future Program, Professional Development Series (PDS), AGEP, McNair Scholars Undergraduate Research Program, and UC LEADS (Leadership Excellence through Advanced Degrees) to prepare underrepresented graduate and undergraduate students for academic and research careers.

3.4.2.3 Campus-level Responsible Conduct of Research (RCR) Activities

The campus has just launched a new pilot program for the Responsible Conduct of Research (RCR), titled "*Building a Solid Foundation for Research Integrity*." Appendix L contains a flyer with general information about the pilot or Phase I program. The program has been developed in consultation with faculty and administrative leaders, and is supported by the Graduate Student Association and the Postdoctoral Scholars Association. Discussions are underway regarding Phase II (2006-2007), specifically about the needs of campus training grant recipients for a comprehensive RCR curriculum.

3.4.2.4 Commitments to New IGERT Proposals

Graduate Studies makes the following specific commitments to new IGERT proposals:

- To assist in attracting a talented pool of domestic students from around the country, Graduate Studies will provide a total of 12 nonresident tuition fellowships for first-year students: two in the first year, three each in years 2 through 4, and one in year 5. These fellowships will be for the full amount of nonresident tuition. At the 2004-05 rate of $14,694, the total commitment for nonresident tuition is $177,000.

- To promote the development of new courses that will result in lasting curricular impacts, Graduate Studies will provide one-time teaching buyout funds for a faculty member to develop a new course related to the IGERT grant. This funding will be at the standard campus rate of approximately $7,000 for one quarter.

- Recognizing the common interests of IGERT and other training grant programs in courses on ethics, scientific integrity, advanced communication skills, etc., Graduate Studies has proposed to aggregate existing campus courses and develop new courses

under a single campuswide designation. We will continue these efforts to support truly interdisciplinary graduate courses of value to the IGERT programs.

- In support of the important outreach functions associated with IGERT programs, Graduate Studies will assist the IGERT in supporting 50% of the salary of a full-time outreach coordinator from internal or external sources. This assistance will involve fostering collaboration with other IGERTs, NIH training grants, and other programs with an outreach component, as well as coordinating with existing outreach programs in Graduate Studies. The goal is to ensure that a single outreach coordinator is employed full-time to support two or more projects, with 50% effort devoted to a single given IGERT.

CHAPTER 4. CONCLUSIONS AND RECOMMENDATIONS

4.1 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 4.1 summarizes the growth in various key indicators during the approximate time the IGERT grant was in force.

Table 4.1: 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	$500K	$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.

- 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).

4.2 Comments to NSF

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 salute the National Science Foundation for its vision of improving integration across disciplines, and the integration of research, education, and practical training – as well as for its boldness in acting on that vision through the establishment and continuation of the IGERT program. The fruits of that vision and boldness will continue to be realized for years to come.

We have only three comments to offer to NSF with respect to the IGERT program.

1. As mentioned earlier, at least 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. We also earlier discussed the fact that only two IGERT recipients took advantage of the international internship opportunity offered through IGERT (although several others had significant international experiences 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. A final comment, not mentioned elsewhere in the report, relates to the size of the fellowship stipend. As we understand the policy, NSF sets the stipend rate, 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.

APPENDIX A

ITS-DAVIS AFFILIATED FACULTY

TRANSPORTATION TECHNOLOGY & POLICY
GRADUATE GROUP FACULTY

LastName	FirstName	Department	Academic Status	Area of interest	Email
Aldredge, III	Ralph	MAE	Senate	Combustion propulsion and emissions	rcaldredge@ucdavis.edu
Azari	Rahman	STA	Federation	Air pollution and transportation demand models	asazari@ucdavis.edu
Berry	Alison	Env. Hort.	Senate	Road ecology	amberry@ucdavis.edu
Bhargava	Hemant	MGMT	Senate	Economics of network industries; optimization	hemantb@ucdavis.edu
Bunch	David	MGMT	Senate	Development and use of behavioral models of consumer purchase decisions	dsbunch@ucdavis.edu
Burke	Andrew	ITS	Federation	Electric and hybrid vehicle design, batteries, ultracapacitors, fuel cells, and vehicle energy simulation models	afburke@ucdavis.edu
Chang	Dan	CEE	Senate	Production and control of air toxics and improved dispersion modeling tools	dpchang@ucdavis.edu
Delucchi	Mark	ITS	Federation	Social costs of motor vehicle use, fuel cycle analyses of air pollution, energy, and greenhouse gases, costs of electric-drive vehicles	madelucchi@ucdavis.edu
Dwyer	Harry	MAE	Senate	Heavy duty trucks, transit buses, fuel cells	hadwyer@ucdavis.edu
Erickson	Paul	MAE	Senate	Fuel cells, hydrogen generation, emissions	paerickson@ucdavis.edu
Fan	YueYue	CEE	Senate	Networks, system optimization, risk mgmt. of lifeline systems	yyfan@ucdavis.edu
Farzin	Y. Hossein	ARE	Senate	Economics of air pollution, fossil fuels, GHG, international trade and development and their relations to transportation	farzin@primal.ucdavis.edu
Feenstra	Robert	ECN	Senate	Industrial organization, international trade	rcfeenstra@ucdavis.edu
Francis	Mark	DES	Senate	Community and urban design	mofrancis@ucdavis.edu
Frank	Andrew	MAE	Senate	Vehicle design concepts and demonstrations, Hybrid Electric Vehicles using electricity, fuel consumption and emissions reduction concepts for all classes of vehicles	aafrank@ucdavis.edu
Groza	Joanna	ECH	Senate	Materials characterization and processing	jrgroza@ucdavis.edu
Handy	Susan	ESP	Senate	Transportation planning, land use planning, travel behavior	slhandy@ucdavis.edu
Harvey	John	CEE	Senate	Pavements: road/street/highway/airport/port/rail, and design, construction, maintenance, management, and interactions of pavement activities and traffic	jtharvey@ucdavis.edu
Jenkins	Bryan	EBS	Senate	Alternative Fuels/Engines	bmjenkins@ucdavis.edu
Johnston	Bob	ESP	Senate	Transportation planning and policy analysis, including the improvement and use of regional travel demand forecasting models to evaluate policy alternatives	rajohnston@ucdavis.edu
Kennedy	Ian	MAE	Senate	Engine emissions and related health effects	imkennedy@ucdavis.edu
Kleeman	Michael	CEE	Senate	Transportation, air quality interaction, emissions	mjkleeman@ucdavis.edu
Knittel	Chris	ECN	Senate	Industrial organization, political economy, empirical finance, and applied econometrics	crknittel@ucdavis.edu
Kurani	Ken	ITS	Federation	Travel behavior, consumer/user reponse to new transportation and information technology, research methodology	access@foothill.net
Lubell	Mark	ESP	Senate	Transportation & land-use planning, smart growth, sustainable communities, collaborative planning	mnlubell@ucdavis.edu
Mokhtarian	Pat	CEE	Senate	Travel behavior modeling; travel demand forecasting; impacts of telecommunications on transportation, land use, and the environment; and transportation-land-use interactions	plmokhtarian@ucdavis.edu
Niemeier	Deb	CEE	Senate	Transportation air-quality, land use-transportation relationships, air quality impacts of developing countries, air quality-transportation regulatory and policy issues, and infrastructure prioritization	dniemeier@ucdavis.edu
Ogden	Joan	ESP	Senate	Alternative fuels, hydrogen, fuel cells, energy infrastructure	jmogden@ucdavis.edu

Palazoglu	Ahmet	ECH	Senate	Dynamic modeling and control of chemical process systems	anpalazoglu@ucdavis.edu
Ravani	Bahram	MAE	Senate	CAD/CAM, robotics and kinematics, design and manufacturing, automated highway technology	bravani@ucdavis.edu
Rocke	David	EAD	Senate	Statistical Analysis of emissions and fuel composition	dmrocke@ucdavis.edu
Sabatier	Paul	ESP	Senate	Policy implementation, bureaucratic decision-making, role of science in policymaking, air pollution policy	pasabatier@ucdavis.edu
Schwartz	Seymore	ESP	Senate	Environmental policy analysis applied to issues of hazardous and solid waste management; applications of risk assessment to environmental decision making; dynamics of scientific controversy in environmental policy	sischwartz@ucdavis.edu
Sperling	Dan	CEE	Senate	Alternative fuels and electric-drive vehicles, technology policy, energy and air quality impacts of transportation, developing countries	dsperling@ucdavis.edu
Stroeve	Pieter	CHE	Senate	Batteries, fuel cells, surface modification of electrodes, in situ electrochemical AFM	pstroeve@ucdavis.edu
Turrentine	Tom	ITS	Federation	Lifestyle and travel behavior, survey design methodology, efficient and clean vehicle markets, road ecology	tturrentine@sbcglobal.net
Velinsky	Steve	MAE	Senate	Mechanical design, vehicle design and dynamics, solid mechanics, automated highway technology	savelinsky@ucdavis.edu
Wexler	Anthony	MAE	Senate	Particle emissions from vehicles	aswexler@ucdavis.edu
Wilen	James	AGR	Senate	Microdecision analyses, urban structure, spatial analyses	wilen@ucdavis.edu
Zhang	Michael	CEE	Senate	Traffic flow models, traffic operations and control, analysis and design of urban transportation networks, intelligent transportation systems	hmzhang@ucdavis.edu

In addition, the following faculty members are affiliated with ITS-Davis:

Lowell Ashbaugh, Crocker Nuclear Laboratory
Thomas Cahill, Applied Science
William Fawcett, Chemistry
Robert Flocchini, Crocker Nuclear Lab
Sangtae Kim, Chemical Engineering and Materials Science
Ryuichi Kitamura, Institute of Transportation Studies
Jay Lund, Civil and Environmental Engineering
Janet Momsen, Geography
Alexandra Navrotsky, Chemical Engineering and Materials Science
Robert Powell, Chemical Engineering and Materials Science
Jim Quinn, Environmental Science & Policy
Subhash Risbud, Chemical Engineering and Materials Science
Julie Schoenung, Chemical Engineering and Materials Science
Catherine Toft, Evolution and Ecology

APPENDIX B

PROGRAMS OF THE TWO GRADUATE STUDENT RESEARCH CONFERENCES

INSTITUTE OF TRANSPORTATION STUDIES
UNIVERSITY OF CALIFORNIA, DAVIS

1st IGERT Graduate Student Research Conference

Travel Behavior, Planning, Modeling and Policy

April 3-4, 2000

University of California, Davis
Buehler Alumni Center, AGR Room

Monday, April 3, 2000

8:00 a.m.	Check-in/Continental Breakfast
9:00 a.m.	Welcome/Introductions Deb Niemeier, ITS-Davis
9:00 a.m.	Using Technology to Make Policy
10:15 a.m.	Break
10:30 a.m.	Using Technology to Make Policy (continued)
11:15 a.m.	Breakout Session – Technology Joy Dahlgren, PATH Scott Rutherford, University of Washington, Seattle
12:00 p.m.	Lunch
1:30 p.m.	Land Use & Transportation, Survey Methods & Transportation Data
2:50 p.m.	Break
3:10 p.m.	Land Use & Transportation, Survey Methods & Transportation Data (continued)
4:10 p.m.	Breakout Session – Future Research Issues in Transportation and Land Use Tom Turrentine, ITS-Davis
5:30 p.m.	Reception – Putah Creek Lodge
6:30 p.m.	Dinner – Putah Creek Lodge Keynote Speaker: Dr. Wyn Jennings, National Science Foundation

Tuesday, April 4, 2000

8:30 a.m.	Continental Breakfast
9:00 a.m.	Travel Behavior
9:45 a.m.	Break
10:00 a.m.	Travel Behavior (continued)
10:45 a.m.	Breakout Session – Travel Behavior Pat Mokhtarian, ITS-Davis Hani Mahmassani, University of Texas at Austin
12:00 p.m.	Lunch Keynote Speaker: Dr. Hani Mahmassani, University of Texas at Austin
2:00 p.m.	Conference Adjourns

Using Technology to Make Policy
Session Agenda
9:00 a.m. to 12:00 p.m.
Monday, April 3, 2000

9:00 a.m. to 9:15 a.m.

Chris Lee: A Micro-Scale Simulation Model of Carbon Dioxide Emissions From Passenger Cars Using Classification and Regression Methods.

9:15 a.m. to 9:30 a.m.

Terence Lam: Estimating the Cost of Travel Using Survey and Loop Data.

9:30 a.m. to 9:45 a.m.

Arindam Ghosh: To Pay or Not to Pay: Commuters' Mode Choice Decisions Under Real Time Congestion Pricing.

9:45 a.m. to 10:00 a.m.

Sangjin Han: Efficient Solution Algorithm for Dynamic Deterministic User Equilibrium Assignment with Ideal Travel Time.

10:00 a.m. to 10:15 a.m.

Xiubin Wang: Solution Algorithm for Time Constrained Vehicle Routing and Scheduling.

10:15 a.m. to 10:30 a.m.

BREAK

10:30 a.m. to 10:45 a.m.

Jerry Shadewald: Uses of a GIS-TranPlan Interface for Modelers.

10:45 a.m. to 11:00 a.m.

Khaled Hamad: Enhancing the Regional Transportation Planning Process in the Developing Countries.

11:00 a.m. to 11:15 a.m.

Josias Zietsman: Using TRANSIMS and ITS Data to Quantify Aspects of Sustainable Transportation.

11:15 a.m. to 12:00 noon

Debate/Discussion: Do the benefits of using advanced technologies in data gathering and planning for transportation really outweigh the costs?
Joy Dahlgren of Partners for Advanced Transit and Highways (PATH), Berkeley and Scott Rutherford of the University of Washington, Seattle

Land Use and Transportation,
Survey Methods and Transportation Data
Session Agenda
1:30 p.m. to 5:30 p.m.
Monday, April 3, 2000

1:30 p.m. to 1:50 p.m.

Dan Chatman: The Influence of Workplace Characteristics on Non-Work Travel During the Work Day.

1:50 p.m. to 2:10 p.m.

Thirayoot Limanond: Effects of Household Structure, Neighborhood Setting, and Intra-Neighborhood Location on Shopping Travel Behavior of Residents in Well-Mixed Neighborhoods.

2:10 p.m. to 2:30 p.m.

Daniel Rodriguez: Behavioral Choice Modeling of a Proximate Commuting Program.

2:30 p.m. to 2:50 p.m.

Arnaud Banos: Enhancing Mobility Behaviour Analysis Using Spatial Interactive Tools and Computer Intensive Methods.

2:50 p.m. to 3:10 p.m.

BREAK

3:10 p.m. to 3:30 p.m.

Matt Sumpter: Transportation Needs of Northern California Welfare Recipients: Exploratory Survey and Results.

3:30 p.m. to 3:50 p.m.

Patricia Hendren: Closing the Gap Between State Transportation Plans and State DOT Budgets.

3:50 p.m. to 4:10 p.m.

Doug Ito: Air Quality Conformity Modeling: The Trip vs. Link Dilemma.

4:10 p.m. to 5:30 p.m.

Moderated Discussion: Tom Turrentine, Research Anthropologist, ITS-Davis. "Future Research Issues in Transportation and Land Use."

Travel Behavior Session Agenda
9:00 a.m. to 12:00 noon
Tuesday, April 4, 2000

9:00 a.m. to 9:15 a.m.

Seshasai Kanchi: Determining Relationships Between Highway Capacity and Induced Vehicle Travel Using Activity Durations and Travel Times.

9:15 a.m. to 9:30 a.m.

Jianyu Zhou: Analysis of Variability of Travel Behavior Within One-Week Period Based on GPS.

9:30 a.m. to 9:45 a.m.

Annika Norlund: Changing to Eco-friendly Travel: Possibilities and Problems for Households.

9:45 a.m. to 10:00 a.m.

BREAK

10:00 a.m. to 10:15 a.m.

Aoife Ahern: Providing Better Public Transport Alternatives: How do We Encourage People to Use Them?

10:15 a.m. to 10:30 a.m.

D. Gregg Doyle: The Persistent Sex-Segregation of Household-Serving Urban Trips.

10:30 a.m. to 10:45 a.m.

Krishnan Kasturirangan and Sachin Gangrade: A Preliminary Comparison of Activity Based Models between Two Geographic Contexts.

10:45 a.m. to 12:00 noon

Moderated Discussion: Major Findings and Issues in Paper Presentations, by Hani Mahmassani and Pat Mokhtarian.

IGERT 2003
June 26-27, 2003
Agenda
Thursday June 26, 2003

CHECK-IN & Continental Breakfast 7:30 a.m.
Lobby – Buehler Alumni Center

OPENING REMARKS 8:30 a.m.
Alpha Gamma Rho Room

Patricia Mokhtarian, Chair, UC Davis Transportation Technology & Policy Graduate Group
Dan Sperling, Director, UC Davis Institute of Transportation Studies

SESSION 1 – New Mobility Part I 9:00 a.m.
Alpha Gamma Rho Room

9:00 a.m. Combining High-Resolution Imagery and Ground-based Data for Improved AADT and VMT Estimates.
Zhuojun Jiang, Ohio State University

9:20 a.m. A Predicted and Consistent Information Supply Strategy for Variable Message Signs Under Non-recurrent Incident Congestion
Avinash Unnikrishnan, Vanderbilt University

9:40 a.m. Real-Time Visualization of Single-Loop-Based Traffic Information: Design and Implementation
Xiaoping Zhang, University of Washington

10:00 a.m. The Use of ITS Technologies to Develop Commercial Motor Vehicles Weight Distributions
Grant Schultz, Texas A&M University

REFRESHMENT BREAK Lobby 10:20 a.m.

10:40 a.m. Predicting Speeds on Urban Streets Using Real Time GPS Data
Rohini Bobba, University of Texas, Arlington

11:00 a.m. Estimation of Origin-Destination Matrices for Freeways
Yao Wu, University of Minnesota

11:20 a.m. Loop Detector Data Screening and Diagnostics Based on Conservation of Vehicles Approach
Lelitha Vanajakshi, Texas A & M University

11:40 a.m. Hydrogen Station Siting through the use of Geographical Information Systems
Michael Nicholas, University of California, Davis

LUNCH Library 12:00 p.m.

1:00 p.m. **Tour of UC Davis Campus Transportation Laboratories**

KEYNOTE SPEAKER 3:00 p.m.
Alpha Gamma Rho Room

Jeff Morales, Director, California Department of Transportation

Special Topics Speaker
Susan Shaheen, Innovative Mobility Research Program, University of California
Innovative Mobility: Opportunities for Enhancing Transportation Mgmt. and choice

Question and Answer

SESSION 2 – Social Aspects of Technology 3:50 p.m.
Alpha Gamma Rho Room

3:50 p.m. Modeling the interaction between internet communication and travel activities – evidence from the 2000 Bay Area Travel-Activity Survey
Sudhakar Athuru, Vanderbilt University

4:10 p.m. Understanding Access and Acquisition of Dynamic Travel Information
Felipe Targa, University of North Carolina

4:30 p.m. The Use and Role of Urban Models in Urban Policy Analysis
Michael Clay, University of California, Davis

REFRESHMENT BREAK Lobby 4:50 p.m.

5:20 p.m. Mass-Point Mixed Logit Models: Development and Application
Xiaojing Dong, Northwestern University

5:40 p.m. Idling Trucks: An Opportunity for Early Fuel Cells?
Nicholas Lutsey, University of California, Davis

KEYNOTE SPEAKER 6:00 p.m.
Alpha Gamma Rho Room

Thomas Gross, Senior Executive Member, Board of Directors, U.S. Department of Energy
Fueling our Transportation Future

Question and Answer

DINNER AND RECEPTION Moss Patio 6:30 p.m.

BREAKFAST 7:30 a.m.

KEYNOTE SPEAKER 8:30 a.m.
Alpha Gamma Rho Room

John Wallace, Former Director, Ford Motor Company's TH!NK Technologies Division
"May you Live in Interesting Times"
Question and Answer

ADVANCED PROPULSION AND FUELS 9:00 a.m.
Alpha Gamma Rho Room

9:00 a.m. Performance-based Technology Scanning for Intercity Passenger Rail Systems: The Incremental Maglev and Railroad Maglevication as An Option for Ultra High Speed Rail
Lexcie Lu, Massachusetts Institute of Technology

9:20 a.m. Direct Methanol Fuel Cells for Automotive Applications: Experimental Analysis of Transient Characteristics, Periodic Fuel Injection and Fuel Quality Requirements
Jeff Gonder, Pennsylvania State University

9:40 a.m. The First Cycles of Operation of the Diesel Linear Engine/Alternator at WVU
Csaba Toth-Nagy, West Virginia University

10:00 a.m. Hybrid Ultracapacitor/Battery Energy Storage for Electric and Hybrid-Electric Buses
Kandler Smith, Pennsylvania State University

REFRESHMENT BREAK Lobby 10:20 a.m.

10:40 a.m. On the Road Exhaust Emissions Predictions for a Class 8 Tractor using an Artificial Neural Network
Csaba Toth-Nagy, West Virginia University

11:00 a.m. Ignition Control in a Homogeneous Charge Compression Ignition Engine
Patrick Ferri and Maria Franco, California State Polytechnic University

11:20 a.m. Estimating the Impact of Freeway Speed Limits on Automobile Emissions
Tongbin Qu, Texas A&M University

11:40 a.m. Supervisory Control of Fuel Cell Vehicles and its Link to Overall System Efficiency and Low-Level Control Requirements
Gabriel Choi, Ohio State University

LUNCH Library 12:00 p.m.

12:40 p.m. **Tour of the California Fuel Cell Partnership**
West Sacramento, California
Transportation Provided

REFRESHMENT BREAK Lobby 2:50 p.m.

NEW MOBILITY PART II 3:00 p.m.
Alpha Gamma Rho Room

3:00 p.m. Hybrid Information Strategies for Improving Performance of Real-time Information Systems
Arun Krishnamurthy, Vanderbilt University

3:20 p.m. A Real-time Tracking and Scheduling Container pickup at Seaports to Reduce Truck Waiting Time Utilizing the Individual Container Tracking System 9ICTS) via the Internet
Saty Satyamurti, University of Texas, Arlington

3:40 p.m. Solving the "Last Mile" Problem for Suburban Job Centers
Steve Raney, Cities21.org

REFRESHMENT BREAK Lobby 4:00 p.m.

4:20 p.m. Do Salt Lake City's High-Occupancy-Vehicle Lanes Improve Mobility?
Peng Wu, University of Utah

4:40 p.m. A Vehicle-Centric Logic for Hybrid Route Guidance
Jennifer Farver, Massachusetts Institute of Technology

5:00 p.m. Modeling of the Intelligent Agents-Based Intersection Management
Xi Zou, University of Minnesota

CONFERENCE CLOSE

APPENDIX C

SUPPLEMENTAL EDUCATIONAL MATERIALS

Noteworthy Educational Highlights

Landscape Architecture Projects

Mark Francis, Professor of Landscape Architecture, notes that with supplemental funding, "The urban and community design and public space courses I teach are able to take transportation graduate students to participate in an interdisciplinary seminar, lecture and studio courses on advances in urban design, public space and transportation (together with students in landscape architecture, community development, sociology and horticulture). The courses expose students to leading practitioners in urban design and the students critique new urbanist projects from a transportation point of view. Transportation graduate students work with advanced landscape architecture students in a studio course. In the past, for example, they have designed a new neighborhood proposed on the UCD campus, and conducted pedestrian and bike planning for the University Arboretum. The funds also allowed students to visit the City of Portland, meet with local officials and tour innovative projects."

In a later communication, Prof. Francis notes, "I wanted to let you know about the large park project we did last quarter in my LDA 180/181M Urban and Community Design Studio - see http://lda.ucdavis.edu/newsevents/gold.html. Ted Buehler [a TTP student] was the TA. I think it actually has the possibility of happening given the people involved. I do not think we could have taken this on without your support. There was also a good group of TTP students in the lecture portion. We were also able to make a day field trip to Seattle in my LDA 201 graduate theory seminar which was a great experience."

The URL above provides more information about the park project. It is "a proposed 1000 acre park and new mixed use development adjacent to downtown Sacramento and the American and Sacramento Rivers… It would rival Central Park in New York City and Golden Gate Park in San Francisco in size and importance. … During the ten-week Winter quarter 2005, eighteen undergraduate landscape architecture students in [Francis'] Urban and Community Design Studio at UC Davis developed five alternative designs for the project. These include pastoral, contemporary and ecological park designs. The plans were presented to the Gold Rush Park Board and their major donors in Sacramento on March 16, 2005.

"As part of the project, the students developed case studies of 18 large urban parks of similar size and scope around the world. They included the American River Parkway, Sacramento, California; Amsterdamse Bos, Amsterdam, The Netherlands; Balboa Park, San Diego, California; Boston Common and Public Gardens, Boston, Massachusetts; Casa De Campo, Madrid, Spain; Chain of Lakes, Minneapolis, Minnesota; Central Park, New York, NY; Franklin Park, Boston, Massachusetts; Frogner Park, Oslo, Norway; Golden Gate Park, San Francisco, California; Hyde Park, London, England; Landschaftspark Duisburg-Nord, Duisburg, Germany; Luxembourg Gardens, Paris, France; The Mall, Washington, DC; Millennium Park, Chicago, Illinois; National Park of Tijuca, Rio de Janeiro, Brazil; Parc de la Villette, Paris, France; and Stanley Park, Vancouver, British Columbia, Canada. The students also conducted in teams site and urban design analysis including land use, transportation, open space, river ecology, and park programming."

The Gold Rush Park Foundation writes about this project, "Gold Rush Park would reclaim the industrial tract known as the Richards Boulevard corridor to provide Sacramento's 'Central Park.' The area encompasses hundreds of acres, bordering on two premier recreational assets –

Old Sacramento and the American River Parkway. The park would connect downtown Sacramento and West Sacramento to Cal Expo and [California State University, Sacramento] in a cultural and recreational corridor of world-class extent and content. It would encourage the riverfront development, helping revitalize West Sacramento and East Yolo."

Little Bang/Big Bang Business Plan Competitions
(Also see Appendix D for more details on the performance of specific teams in the first annual competition, 2004-05).

UC Davis has recently begun to more actively foster collaboration between the Graduate School of Management and other units on campus, particularly the College of Engineering. In 2004-05, the campus initiated the "Little Bang Business Plan Competition", organized in partnership with UC Davis CONNECT, the Sacramento Angels investment group, and the UC Davis GSM. Four student teams, three from ITS-Davis, submitted posters describing their transportation-related business ideas, then pitched their plans in short presentations to a panel of local venture capitalists and UC Davis judges. The $5,000 grand prize was donated by the Sacramento Angels and the Sacramento Area Regional Technology Alliance (SARTA), a local public-private partnership dedicated to entrepreneurial development. Two of the three teams of ITS-Davis students, each containing an IGERT fellow, took first and second prize for their transportation-related technology business plans in the inaugural Little Bang Business Plan Competition in March 2005. The first-place winner advanced to the semi-final round of the UC Davis Big Bang Business Plan Competition where they competed for an additional $10,000 grand prize. These competitions were enthusiastically received by all parties, and are expected to continue on an annual basis.

Business Development Certificate Program (2004-05)

IGERT fellows **Jonathan Weinert** and **Brett Williams** are among nine UC Davis students awarded fellowships to participate in a new business development certificate program offered by the Graduate School of Management (GSM) in collaboration with the Office of Research – Technology and Industry Alliances (OR-TIA).

The new program, designed specifically for science and engineering students, provides hands-on experience in developing new business ventures designed to commercialize research. GSM Professor Andrew Hargadon, an ITS-Davis faculty affiliate, launched the program this year to help students develop the range of skills necessary to commercialize research, whether in new venture start-ups or in corporate research and development settings. These skills are intended to prepare graduating scientists and engineers for careers in entrepreneurial firms as well as industrial research and development.

"I'm excited to collaborate with the GSM students and the other eight fellows this year," said Weinert, a Transportation Technology and Policy (TTP) Ph.D. student and this year's TTP student representative. "They're working on some really fascinating, important research; vastly different from my own field of study. It'll be interesting to see what business venture ideas come out of our group once we get thrown into the GSM student mix."

Williams adds that the GSM's Business Development Program is a natural extension of the progression of his hydrogen research. "As an interdisciplinary hydrogen-energy researcher, my focus has evolved over the years from examining the *potential* of these technologies — for example, to contribute to a healthier, more secure, and more sustainable society — into the issues surrounding the *realization* of that potential. I look forward to thinking through the innovation process with others on a wide variety of topics, including fuel cell vehicle commercialization."

Fall Quarter 1998:

Basic Principles of Transportation, Energy, and Environmental Systems

Instructor:
Timothy E. Lipman, PhD
Energy and Resources Group
University of California - Berkeley

Time: Wednesdays, 3:10 – 5:40pm
(may move to 1:10pm if no conflicts with ECI 254)

Location: 2028 Academic Surge, UC Davis

CRN#: TBA
2 units

Course Summary:
This weekly seminar course will focus on various technical topics of interest to the study of transportation, energy, and environmental systems. The goal of the course is to strengthen and broaden understanding of fundamental physical and engineering principles as they bear on these systems, and to improve students' problem solving skills. This course is particularly recommended for students studying research topics with technical aspects to them, or who are preparing for orals or other qualifying exams, who would like to refresh and enhance their technical understanding of topics of interest to them. The course is also recommended for students who would like to improve their ability to communicate with technical practitioners in the field. Anyone who wants to participate in the class and improve their environmental problem solving skills is welcome to attend.

Topics Include:
Basic principles of physics and chemistry; units and measures; problem solving skills; renewable energy systems based on solar, wind, and biomass; fuel cells; hydrogen as an energy carrier; the earth's radiation balance and climate change; the Laws of Thermodynamics; the Carnot cycle and theoretical efficiency limit; hybrid-electric vehicles; gas turbines; modeling the physical environment; nickel-metal hydride and lithium batteries; electricity and magnetism; atmospheric chemistry of the troposphere and stratosphere, Otto and diesel engine cycles; electric motors and generators.

Course texts (recommended, not required): Consider a Spherical Cow: A Course in Environmental Problem Solving by John Harte, University Science Books, 1988; Renewable Energy: Sources for Fuels and Electricity by Johansson et al., Island Press, 1992; and Six Easy Pieces: Essentials of Physics Explained by Its Most Brilliant Teacher, by Richard P. Feynman, Addison-Wesley, 1995.

Seminar: Processes and Materials in Polymer Electrolyte Fuel Cells

Department: Institute of Transportation Studies **Quarter:** Winter 99
Course: ECH 289D **CRN No.** *80979* **Units:** 2
Instructor: *Shimshon Gottesfeld*
Day(s): Monday, Wednesday, Friday
Times: 10-11:50am (1.5 -2 hours)
Location: Academic Surge 1113
Meeting: 4 weeks, starting Monday, February1 – Friday, February 26, 1999

Textbook:
Reference book to be reserved in library:
"Advances in Electrochemical Science and Engineering", Volume 5, Alkire, Gerischer, Kolb and Tobias, Eds., John Wiley-VCH, 1997 - this volume

Course Summary:
The course will provide detailed description of the physicochemical processes in fuel cells and how they determine merit performance parameters of such energy conversion devices. The polymer electrolyte fuel cell will be described from a physical electrochemistry perspective, highlighting the nature of electrode processes and transport processes in the polymeric membrane electrolyte. Structural materials requirements will be examined highlighting perspectives of electrochemical stability in addition to mechanical properties. Such fundamental examination of chemical & physical processes in the cell and relevant materials properties will be tied to the performance of the polymer electrolyte fuel cell including primarily energy conversion efficiency and power density.

Topical Outline:
(1) Introduction:
(a) Electrochemical cells - some basic principles
(b) Some key physicochemical processes and choice of materials determine efficiency, power density and reliability of fuel cells
(2) Electrocatalysis in Polymer Electrolyte Fuel Cells: Air cathode, hydrogen anode in presence of impurities, electrocatalysis in the direct methanol fuel cell.
(3) Practical Electrocatalysis : The membrane/electrode assembly
(4) Membrane Processes: The mechanisms of proton, water and coupled proton/water mobilities in ionomers and impacts on water management requirements in polymer electrolyte fuel cells
(5) Special membrane and electrocatalysis issues in direct methanol fuel cells
(6) Fuel processing on board the vehicle and resulting fuel cell performance challenges

Prerequisite: Instructors' consent.

Entry Level: Graduate Students Only

Grading: S/U
Grading will be based on a project paper which will include a critical review of selected literature in a specific area of fuel cell science & technology, followed by assessment of state-of-the-art in this area of technology, identification of barriers for further advancement and suggestion of possible ways to overcome such barriers.

The Full Social Cost of Transportation

Department: Institute of Transportation Studies **Quarter:** Winter 99
Course: **TTP 289-001** CRN No. **77615** Units: **2**
Instructor: Mark A. Delucchi
Day(s):Friday
Times: 10-12pm
Location: Academic Surge 2377
First Meeting: Friday, January 8th

Textbooks
-- Delucchi's UCD-ITS-RR-96-3 volume 1
-- D. L. Greene, D. Jones, and M. A. Delucchi, editors, Full Costs and Benefits of Transportation, Springer-Verlag, Berlin, Germany (1997).

Course description
Every year, Americans drivers spend hundreds of billions of dollars on highway transportation. They pay for vehicles, maintenance, repair, fuel, lubricants, tires, parts, insurance, parking, tolls, registration, fees, and other items. These expenditures buy Americans considerable personal mobility and economic productivity. But the use of motor vehicles costs society more than the hundreds of billions of dollars spent on explicitly priced motor-vehicle goods and services in the private sector. Some of the motor-vehicle goods and services provided in the private sector are not priced explicitly, but rather are bundled in the prices of non-transportation goods and services.

In this course, we will study:
What the social costs of transportation are why we care about them how we estimate them what we do with the estimates

Course Goals
To understand:
- what the social costs of transportation are
- why we care about them
- how we estimate them
- what we do with the estimates

Prerequisite
Microeconomics, resource economics, cost-benefit analysis, transportation planning and policy

Entry Level
Graduate Students Only

Grading
S/U

Data in Context: Reflexive Methods in Transportation Research

Department: Institute of Transportation Studies **Quarter:** Winter 99
Course: **TTP 289-002** CRN No. **77616** Units: **1**
Instructor: Tom Turrentine and Ken Kurani
Day(s): Wednesday
Times: 4-5:00 p.m.
Location: Conference Room 2028 Academic Surge
First Meeting: Thursday, January 7, 1999

Textbooks
Readings provided by instructors.

Course description
This will be an introduction to reflexive methods of data collection, and their relevance to transportation studies. Examples will be drawn primarily from studies of the introduction of new transportation and information technologies, and the role of those in facilitating and transforming lifestyle choice by households.

A central concept in social theorist Anthony Giddens' structuration approach is *reflexivity*. Giddens defines reflexivity

"...not merely as 'self consciousness' but as the monitored character of the ongoing flow of social life. To be a human being is to be a purposive agent, who both has reasons for his or her activities and is able, if asked, to elaborate discursively upon those reasons..."

Giddens argues that any study of lifestyle must be made with awareness of the increasing reflexive intrusion of knowledge into the conditions of social reproduction. As one example, not only has scientific knowledge become part of the reflexive structure of society, research methods have become common features of daily life. Increasingly, households are called upon by market research companies and social scientists to answer questions about their beliefs and behavior. Surveys come in the mail, pollsters call on the phone, interviewers stop businessmen in the airport or shoppers in the mall. The results appear later on the evening news.

Our choices of methodologies for observing behavior (i.e., collecting data) must be made then with an eye to this phenomenon. We require methods that allow us to position ourselves not merely as observers or interpreters, but as facilitators in settings in which researcher and subject explore options, reasons, and potential courses of action together.

We will examine how reflexivity is incorporated into three data collection methods in this course: focus groups, simulations structured as interactive gaming interviews, and dialogs. These examinations will be structured as three sets of lecture/discussion and lab exercise. For each research method we will conduct a one-hour lecture and discussion one week, followed the next week by a two to three hour lab in which we apply the methodology to particular transportation research problems. Students will have required readings prior to each lecture/discussion period, and must prepare some materials (e.g., outlines, questions, or protocols) for the next week's lab. We will then skip a week, before repeating the lecture/discussion and lab pattern for the next method.

Prerequisite
Instructors' consent.
Entry Level
Graduate Students Only
Grading
S/U

WORLD CLASS TRANSIT FOR THE BAY AREA

Department: Institute of Transportation Studies **Quarter: Spring 99**

Course: TTP 289-004 **CRN No. 66977** **Units: 2**
Instructor: John Holtzclaw, PhD, Sierra Club
Helping to Coordinate: Stuart Cohen, MPP, Exec. Dir., Bay Area Transp. Choices Forum

Days and Times: **Friday 9-11 a.m.**
Location: **Academic Surge 1113**
First Meeting: **Friday, April 9**

Textbooks
Readings to be determined at the start of class

Course description

This is a graduate seminar looking at public transportation in theory and in practice in the San Francisco Bay Area. The focus of the class will be on producing a report on the state of public transportation in the Bay Area which will identify cost-effective, sustainable means of improving transit facilities and increasing ridership. This will encompass analysis of transportation pricing, identifying weak links in transit connections, and the investigation of new technologies that can increase the reliability of transit, to name several topics.

Over the coming years, an enormous infusion of transportation investment will be targeted at the Bay Area. Unfortunately, there is still no coherent vision for the potential of a truly world class public transit system for the Bay Area. Instead, the region is characterized by 27 transit operators forming a poorly coordinated system. As new funding becomes available, the lack of vision becomes apparent: Low cost bus service is diminished in the urban core, while high cost rail projects are extended through the region's periphery. This seminar would culminate in a report that would provide the region with a vision of what is possible. It would integrate new infrastructure with the need for land use and pricing reforms, components in transit planning that are often absent. The report would be prepared and then published and distributed in coordination with staff at the Bay Area Transportation Choices Forum (a project of the Greenbelt Alliance). As one of the primary goals of the seminar is to broaden the scope of transit planning, the policy recommendations of the report, once published, would be pursued by The Bay Area Transportation and Land Use Coalition in the effort to expand the focus of transportation planning.

In this course, we will:

Research and write a paper on different aspects of public transportation in the Bay Area that will, as a whole, form the basis for a report on the present and potential future of public transit.

Prerequisite
Instructor's Consent

Entry Level
Graduate Students Only

Grading
S/U (If graded, grading will be based on the paper each individual produces.)

The Future of Mobility

Date: Tue, 12 Oct 1999 08:45:03 -0800
To: itsstudents@ucdavis.edu
From: access@foothill.net (ken kurani)
Subject: ITS-Davis Mobility workshop
Sender: owner-itsstudents@ucdavis.edu

Dear Transportation Students,

Professor Mokhtarian, Lorien Redmond, and I invite you to attend a one-day workshop on Saturday, October 30. The purpose of the workshop is to construct and discuss scenarios of future mobility, focused primarily on daily travel.

ITS-Davis will be hosting this workshop with Daimler-Chrysler. Daimler-Chrysler has indicated they would like to hold this workshop specifically for graduate students working in a variety of transportation related fields. That is where you all come in. I encourage all of you – whether your interests are in vehicle technology, travel behavior, transport economics, public policy, mobility, air quality, or any other aspect of transportation – to participate.

This workshop will be offered as a one-unit TTP course, with satisfactory/unsatisfactory grading. Requirements include participation in the workshop on the 30th and a brief written evaluation. You do not have to enroll in the course to participate in the workshop. But we thought that offering the course credit would be an appropriate recognition of your participation in an activity related to your education and professional training. The workshop/course will be limited to a total of twelve participants.

If you wish to enroll the CRN is 70275, and the course number is 289B-002. I apologize for the late notice, but you will need to enroll by this Friday, Oct 15.

I'll send another announcemnent with the precise date and time. For now, I've included a quick description of scenarios in general, and an outline of the tentative schedule for this Workshop on the 30th.

What are Scenario Workshops?

Scenario workshops can be thought of as "organized brainstorming." The usual purpose is not to pick a future, but to see if the conversation doesn't resolve itself into a few distinct possible futures based on a few key assumptions, beliefs, or trends. Each of the futures should be described by a consistent set of supporting ideas and beliefs. In general, identifying the key assumptions, beliefs and trends that lead to distinct scenarios is more important than the scenarios themselves.

For example, in the course of brainstorming, the participants might hypothesize that the application of information technology to transportation is one of the key processes shaping personal transport. Therefore, one possible scenario would rely on high levels of information technologies in transportation systems. You might then talk about which information technologies, where they would be applied, and their intended effects on travel. An alternative scenario could then be based on the counter-assumption that the trend toward more information

technologies will stall. Once the underlying assumptions are described, each scenario is filled in with details. In this example, the relevant details would include a discussion of how we imagine people travel in a world described by each scenario.

Please understand the above is only one possible description of how scenario workshops are organized, but it does convey the general idea.

What can you expect on October 30th?

We are still working with Daimler-Chrysler to develop the specific process for this workshop. We can tell you that you should count on spending the whole day working together on this. Tentatively, our schedule runs from 9:00 A.M. to 6:30 P.M. In fairly general terms, the outline for the day will be as follows.

9:00-10:45 AM General discussion of current personal transportation. What are the defining features, what are the processes, policies, technologies etc. that shape the current state? In scenario jargon, these are typically called "factors."

10:45-11:00 AM Break

11:00-12:30 PM Possible future trends, including possible continuation of factors from the first session as well as possible new factors.

1:15-2:30 PM Develop initial political/economic futures (scenarios).

2:30-2:45 PM Break

2:45-5:00 PM Divide into groups, each group developing the relationship between one of the scenarios and the factors, as well as a description of personal transport within their scenario. Each group organizes its own work time, including breaks.

5:00-6:30 PM Presentation by each group of their scenario, the important factors, and the description of personal transport.

We will provide food and beverages throughout the day, including lunch. If you are interested in attending, or have any further questions, please send me e-mail at: access@foothill.net.

I look forward to seeing you on October 30th.

Cheers,

Ken Kurani
Home office phone and fax: (916) 663-4332
email: access@foothill.net
Institute of Transportation Studies
University of California, Davis
One Shields Avenue
Davis, CA 95616 USA
Phone: (530) 752-6500
Fax: (530) 752-6572

ELECTRIC ENERGY STORAGE AND CONVERSION TECHNOLOGIES

Department: Institute of Transportation Studies **Quarter**: Winter 2000
Course: TTP 289A-005 **CRN No**.: 88652 **Units**: 3 **Grading**: Letter
Instructor: Dr. Andrew Burke
Days: Mondays, Wednesdays, Fridays
Times: To be Announced
Location: Academic Surge
First Meeting: Wednesday, January 5, 2000

Requirements: This is a 3 credit, letter grade graduate course. The requirements are an understanding of basic chemistry and thermodynamics. A previous course in electrochemistry or some experience with batteries and electric vehicles would be helpful, but not necessary.

Text: Handbook of Batteries (Second Edition)
David Linden, McGraw-Hill, 1995

Grading:

Final Exam:	40%
Project/Paper:	40%
Problem Assignments:	20%

References: Electrochemical Systems
J. Newman, Prentice Hall, 1991

Modern Battery Technology
C.D.S. Tuck, Ellis Horwood, 1991

Assorted papers from the Journals of the Electrochemical Society and Power Sources and the Proceedings of Symposia on Batteries and Ultracapacitors

Description: This course is intended to introduce the students to energy storage and conversion systems that are used in electric and hybrid vehicle powertrains including batteries, ultracapacitors, and fuel cells. The students will be familiarized with the basic science of these technologies and modeling and control of them as components in electric and hybrid vehicles. For each technology, the present state-of-the-art will be summarized and projections of likely future progress discussed. The course will also introduce the students to testing batteries, ultracapacitors, and fuel cells through a series of lab sessions in the UCD EV Power Systems Laboratory.

Department of Economics University of California, Davis	Christopher Knittel crknittel@ucdavis.edu 1125 SS&H Building

ECONOMICS 145
TRANSPORTATION ECONOMICS
WINTER QUARTER 2000
T-TH 10:30-11:50, HOAGLD 108

OVERVIEW

Purpose and Prerequisites

This course is designed to provide graduate students in the Transportation Technology and Policy (TTP) program a solid grounding in the economics of the transportation sector. In addition, the course is an excellent context in which advanced undergraduates can see the principles of economics applied to the analysis of a critical industry in the operation of the global economy. The instructor will not differentiate between undergraduate and graduate students: everyone will be graded on the same scale and all assignments will be expected of all students. Economics 145 will be more work that the average undergraduate upper-division course. You will also learn more.

Prerequisites for this course are Economics 100, Math 16A, B, and Statistics 13. These courses (or the consent of the instructor) are essential for this course.

Required Texts: Essays in Transportation Economics and Policy: A Handbook in Honor of John R. Meyer, by Gomez-Ibanez, Tye, and Winston, 1999, The Brookings Institution. This textbook will be heavily used throughout the course. In the syllabus, readings from this book will be denoted "**Essays**."

Economics at the Wheel: The Costs of Cars and Drivers, by Richard C. Porter, 1999, the Academic Press. This is an extremely useful and intuitive use of basic economic analysis in the context of the costs and benefits of automobile usage. In the syllabus, readings from this book will be denoted "**Porter**."

Additional "**Readings**" will be on reserve in the Economics dept., SSH room 1111. For the most part, these additional readings are *optional.*

Grading: Student evaluation will be done on the basis of a series of homework exercises, exams, and class participation. Homeworks will collectively account for 20% of the total grade. Students are welcome to work in small groups in completing the homeworks. Homeworks will be distributed during the course lectures and due in class one week after they are distributed. *Late homeworks will not be accepted except in cases of documented illness or family emergencies.* There will be an in-class midterm exam worth 30% of the grade. The final exam, to be given on the scheduled date, will count for 45%.

Class participation will count for 5%. Student attendance and participation in all lectures is expected.

Final Project: As an *alternative* to taking the final exam, each student may instead choose to complete a final project. This project should be a topic in transportation economics, with the following elements:

1) It must involve the collection and analysis of data, including a regression;
2) You must write a paper including the motivation for the topic; the sources of the data; and the results of the data analysis;
3) The paper should not be less than 10 pages (typed, double-spaced), not counting charts and figures;
4) The topic should be discussed with me before the work is done;
5) The topic and results should be presented in 10-15 minute talk during the last week;
6) The paper will be due on Thursday, June 13th (same day as the final).
7) This project must be done individually – students cannot work in groups.

Extra Goodies: Most lectures will make use of multimedia technology. The lecture slides and graphs can be downloaded from the class web site, available through http://my.ucdavis.edu . Please visit this class website often.

The course will include some classroom time in the Division of Social Sciences (DSS) Instructional Computing Lab, 233 Social Sciences Building. The hope is to schedule this during class hours to explain several homework assignments; however, we may have to come up with an alternative time(s). Students can use the computers in the DSS lab whenever they are not needed for other classes. A weekly schedule can be found at: http://dsslab.ucdavis.edu/

Spring Quarter 2000:

Basic Principles of
Transportation, Energy, and Environmental Systems

Instructor:
Timothy E. Lipman, PhD
Energy and Resources Group
University of California - Berkeley

Time: Wednesdays, 3:10 – 5:40pm
(may move to 1:10pm if no conflicts with ECI 254)

Location: 2028 Academic Surge, UC Davis

CRN#: TBA
3 units

Course Summary:
This weekly seminar course will focus on various technical topics of interest to the study of transportation, energy, and environmental systems. The goal of the course is to strengthen and broaden understanding of fundamental physical and engineering principles as they bear on these systems, and to improve students' problem solving skills. This course is particularly recommended for students studying research topics with technical aspects to them, or who are preparing for orals or other qualifying exams, who would like to refresh and enhance their technical understanding of topics of interest to them. The course is also recommended for students who would like to improve their ability to communicate with technical practitioners in the field. Anyone who wants to participate in the class and improve their environmental problem solving skills is welcome to attend.

Topics Include:
Basic principles of physics and chemistry; units and measures; problem solving skills; renewable energy systems based on solar, wind, and biomass; fuel cells; hydrogen as an energy carrier; the earth's radiation balance and climate change; the Laws of Thermodynamics; the Carnot cycle and theoretical efficiency limit; hybrid-electric vehicles; gas turbines; modeling the physical environment; nickel-metal hydride and lithium batteries; electricity and magnetism; atmospheric chemistry of the troposphere and stratosphere, Otto and diesel engine cycles; electric motors and generators.

Course texts (recommended, not required): Consider a Spherical Cow: A Course in Environmental Problem Solving by John Harte, University Science Books, 1988; Renewable Energy: Sources for Fuels and Electricity by Johansson et al., Island Press, 1992; and Six Easy Pieces: Essentials of Physics Explained by Its Most Brilliant Teacher, by Richard P. Feynman, Addison-Wesley, 1995.

SPACE, TIME, AND IDENTITY

Winter 2001; TTP 289A-002; CRN 89360
Beginning Jan. 4; every Thursday from 2:00-5:00 p.m.
Place to be announced
Instructors: Tom Turrentine and Ken Kurani
Units: 3
Grade: Letter grade

The course ties together theories of sociology and activity-based approaches to the study of travel behavior to explore identity and the organization of lifestyle across space and time. Notably, we examine how lifestyle choices are facilitated and mediated by transportation, media, and communication technologies, and how lifestyles affect what it is we regard as community. Much of the sociological theory will be based on Giddens' discussion of traditional space and time, the emptying of space and time in modernity, and the necessity to construct personal identity in modernity. The study of the physical expression given to lifestyles through activity-based approaches to travel behavior research will be linked to Giddens' to provide an understanding of why transportation researchers examine spatial and temporal organization of lifestyle at the level of individuals and households, and how in a practical sense that is accomplished. For example, why do we study household activity scheduling, and how do we do so? What problems do the spatial organization of lifestyle afforded by automobiles pose to policies that would require spatial or temporal re-organization?

Films will present much of the context and content for discussion. Film is an information rich medium that can depict—in a short period of time—lifestyle formation under conditions of modernity and the spatial and temporal organization of lifestyles. The class will examine these, as well as the facilitating and mediating effects of transportation and communication technology on lifestyle and identity, as these are represented in film. Both documentary and theatrical films will be used. Many films explore identity and community, and the effects arising from spatial organization (e.g., *Avalon, Home Economics: A Documentary of Suburbia, Metroland*), temporal organization (e.g., *The Time Machine, Run Lola Run, Go!*), automobiles and automobility (e.g., *The Magnificent Ambersons, Grapes of Wrath, Liberty Heights, American Graffitti, America on Wheels*), and communications technology (e.g., *Pleasantville, The Truman Show, The Matrix*).

Basis for Grades

Grading will be based on an initial project (15%), a mid-term exam (25%), and a final project (60%).

APPENDIX D

IGERT STUDENT ACTIVITIES, ACCOMPLISHMENTS, and TESTIMONIALS

The table below summarizes some of the important awards and activities of our IGERT fellows. Collectively, they have been awarded 13 prestigious and competitive national scholarships; participated in 15 internships with industry, government, and think-tanks, including four international ones; received three national awards for best dissertation, best presentation, and outstanding student, respectively; received two regional best student awards; and four ENO Transportation Foundation awards.

Brodrick, C.J.	US Department of Transportation (USDOT) Dwight D. Eisenhower Fellowship – 1998-2001 Society of Automotive Engineers Award for Excellence in Oral Presentation – 1999 Internship with Engine Fuel and Emissions Engineering – 1997-99 National Air & Waste Management Association Graduate Scholarship – 1998 Women's Transportation Seminar National Helene Overly Graduate Scholarship – 1998 Women's Transportation Seminar Regional Scholarship – 1997
Chen, Belinda	US Environmental Protection Agency STAR Fellowship – 2004 USDOT Eisenhower Fellowship (declined) – 2004
Clay, Michael	American Inst. of Certified Planners Outstanding Graduate Student – 2000-01 Midwest Transportation Consortium Transportation Scholar – 2001
Friedman, David	Internship with California Energy Commission – 1998 ENO Transportation Foundation Fellow – 1998
Gardiner, Monterey	Internship with Hydrogen Research Institute, Canada – 2003
Held, Anthony	USDOT Eisenhower Fellowship – 1998-2001 National Air and Waste Management Association Scholarship – 2001
Hendren, Patricia	Internship with Volpe National Transportation Systems Center – 2001 Internship with USDOT Federal Highway Administration – 1999 ENO Transportation Foundation Fellow – 1999 Women's Transportation Seminar Regional Scholarship – 1998
Herbert, Jesse	Internship with Los Alamos National Laboratory – 2000 Internship with French National Institute for Transport and Safety Research in Lyon, France – 1998 Internship with Exxon Research and Engineering – 1998 USDOT Eisenhower Fellowship – 1997
Kornbluth, Kurt	Internship with DEKA, New Hampshire – 2004
Leeman, Whitney	Superfund Traineeship – 1998-2000 Toxic Substances Research and Teaching Program Graduate Student Fellowship – 1998
Lipman, Tim	Wootan Award of the Council of University Transportation Centers, for the best US dissertation in transportation planning and policy – 1999
Lutsey, Nicholas	Internship with California Air Resources Board – 2003-04
Rodier, Caroline	University of California Transp. Center Student of the Year – 2000 USDOT Eisenhower Fellowship – 1997-1999 US EPA Science to Achieve Results (STAR) Fellowship (declined) – 1997
Salon, Deborah	USDOT Eisenhower Fellowship – 2002-2004 Robert Wood Johnson Foundation Active Living Policy and Environmental Studies Dissertation Fellowship – 2004 Internship with International Energy Agency, Paris – 2000
Sundaresan, Meena	Internship with DaimlerChrysler, Germany – 2002-03
Weinert, Jonathan	Internship with Ford Motor Company, California Fuel Cell Partnership – 2003 Internship with South Coast Air Quality Management District – 2004 ENO Transportation Foundation Fellow – 2004
Williams, Brett	ENO Transportation Foundation Fellow – 2000 Internship with Ford Motor Company, California Fuel Cell Partnership – 2003

On the initiative of students, the ITS-Davis Student Council in was formed in October 2004, to strengthen the ITS-Davis student community and make the academic program more rewarding. The first chair of the council was TTP student representative and IGERT fellow **Jonathan Weinert.** Committees/officers of the council include:

1. Social: Organize fun events that will bring ITS-Davis students together in a variety of environments.
2. Campus Ambassador: Represent ITS-Davis on campus and the TTP graduate group at the Graduate Student Association.
3. Recruitment: Improve how ITS-Davis/TTP draws in talented students from around the world.
4. Sports: Organize intramural sports for ITS-Davis students.
5. Class/Curriculum Quality: Provide a link between students and faculty to offer feedback on course and curriculum issues.

In its first year, members of the council put together several social events (ski trip, rafting trip), helped revamp the ITS-Davis website to make it more accessible to prospective students, and represented ITS-Davis at monthly GSA meetings.

David Grupp, Matthew Forrest, Pippin Mader, **C. J. Brodrick,** Marshall Miller and Harry Dwyer have been chosen to receive the 2004 SAE Vincent Bendix Automotive Electronics Engineering Award for their paper entitled, "Development of a Retrofit Fuel Cell Auxiliary Power Unit for Truck Idle Reduction" (SAE Paper Number 2004-01-2629). The award will be presented at the SAE World Congress in Detroit, in April.

Many of our IGERT fellows attended the California Hydrogen Highway Network launch on April 20, 2004. Hundreds of people from industry, government, academia, and nongovernmental organizations watched California Governor Arnold Schwarzenegger arrive at the university's new hydrogen fueling station at the Unitrans bus yard in one of ITS-Davis's two Toyota fuel cell vehicles, step out of the car, and begin refueling. Schwarzenegger flashed the thumbs-up sign and smiled at a wall of television cameras and still photographers, who captured the image and distributed it around the world.

(e-news #24, July 2005, http://www.its.ucdavis.edu/news/enews/issue24/)

Belinda Chen this summer begins a one-year student researcher position at the California Air Resources Board where she is studying the environmental and economic impact of motor-vehicle trends on low-income households. Chen is evaluating how new vehicle sales trends toward larger luxury cars trickle down to the used car market, typically affecting low-income peoples' mobility, purchase decisions, and factors such as their likelihood to hold on to older, more polluting cars longer.

Chris Congleton has a staff research position at the Traffic Safety Center at UC Berkeley. He is studying pedestrian safety on marked and unmarked crosswalks, and developing a standard measure of pedestrian safety for state use.

Matthew Caldwell, Jonathan Weinert, and others: Business Plan Competitions (2005)

Two teams of ITS-Davis students took first and second prize for their transportation-related technology business plans in the inaugural Little Bang Business Plan Competition in March.

The ITS-Davis competition, organized in partnership with UC Davis CONNECT, the Sacramento Angels investment group, and the UC Davis Graduate School of Management, seeks to strengthen the linkages between UC Davis and the venture capital community in the area of advanced transportation.

Four student teams, three from ITS-Davis, submitted posters describing their transportation-related business ideas, then pitched their plans in short presentations to a panel of local venture capitalists and UC Davis judges. The $5,000 grand prize was donated by the Sacramento Angels and the Sacramento Area Regional Technology Alliance (SARTA), a local public-private partnership dedicated to entrepreneurial development.

First prize went to Boegeskov Energy, led by ITS-Davis students Kenth Pedersen and **Matt Caldwell**, ITS-Davis alumnus Nico Bouwkamp, UC Davis management student Derek Larsen, chemistry student Daniel Scott, and law student Andrew Berk. Boegeskov is developing advanced fuel cell catalyst materials based on cutting edge polymer technology. The company hopes to compete against existing providers by offering products that improve fuel cell performance and power density relative to existing materials while reducing overall cost. In addition to the cash prize, Boegeskov Energy advanced to the semi-final round of the UC Davis Big Bang Business Plan Competition where they will compete for an additional $10,000 grand prize.

Second prize was awarded to Ridester, which is developing a dynamic ridesharing business. ITS-Davis students Kevin Eslinger, Darius Roberts, and **Jonathan Weinert** led the effort along with UC Davis undergraduate Ziv Lang. The Ridester team also advances to the semi-final round of the Big Bang Competition.

BIG BANG! COMPETITION: Two ITS-Davis Teams Make Big Splash

Two groups of ITS-Davis students were among the six teams of finalists in the fifth annual Big Bang! Business Plan Competition, designed by MBA students at the Graduate School of Management to promote entrepreneurship, innovation and hands-on learning.

Boegeskov Energy, led by ITS-Davis students Kenth Pedersen and **Matt Caldwell**, won the "People's Choice" award and $2,000. The company is developing a catalyst-enhancing material that it says will significantly reduce the cost and improve the overall efficiency of fuel cells for vehicles and other potential applications ranging from forklifts to cell phones. Additional team members are Daniel Scott, Derek Larsen, Andy Berk, Frank Parker, Richard Sklar, and Nico Bouwkamp.

RidePal is building a ridesharing program for commuters. The network enables users traveling the same route to easily find each other using cell phones and Internet technology. The RidePal team includes ITS-Davis students Kevin Eslinger, Darius Roberts, and **Jonathan Weinert**, with Rakesh Gupta and Jordan Rule. Eslinger, Roberts, and **Weinert** have decided to take the plunge and actually start the business with which they reached the finals of the UC Davis Big Bang! business plan competition. The three will work with several IT entrepreneurs to develop the software and Web site for their online ridesharing program.

Eggert, Friedman, and Lipman: Information Exchange in Kyoto (2004)
http://www.its.ucdavis.edu/news/enews/issue22/

In November 2004, ITS-Davis IGERT alum and Hydrogen Pathways research program associate director Anthony Eggert, alum and Hydrogen Pathways researcher Tim Lipman, and alum David Friedman, now working with the Union of Concerned Scientists, participated in the Frontiers in Engineering conference in Kyoto, Japan.

The invitation-only conference, jointly hosted by the National Academy of Engineering and Japan Science and Technology organization, is designed to foster information and knowledge transfer between scientists and engineers from the two countries. The topics of the conference were hydrogen energy, biotechnology, and information technology for the elderly.

While in Japan, Eggert also took the opportunity to meet and discuss recent Hydrogen Pathway research activities with program sponsors Nissan, Honda, Toyota, and Subaru. He also visited the Nippon Oil hydrogen fueling station in Yokahama.

David Grupp, who is putting the finishing touches on his dissertation, has accepted a senior engineer position with Sacramento's Altergy Systems, which makes small fuel cell systems. Grupp is designing the fuel cell system architecture and assisting with stack development, activities that he says are very similar to the hybrid systems design work he did at UC Davis. He looks forward to a continuing relationship with ITS-Davis. (e-news #24, July 2005, http://www.its.ucdavis.edu/news/enews/issue24/)

Monterey Gardiner: Six Months at Hydrogen Research Institute in Canada (2004)

This year IGERT allowed me to conduct research in Canada for six months in Trois-Rivieres (a small city between Montreal and Quebec City). While there I built a cryo adsorption system using densified carbon. This system contained 3.7 kgs of carbon which is more than any other system to date. The findings were helpful in determining that the AC provides a 5X slower boil-off rate than liquid hydrogen and the system is 2/3 smaller than compressed hydrogen at 5000 psi. The results are written up and will be presented at the 15th World Hydrogen Energy Conference in Yokohama Japan.

The Hydrogen Research Institute includes people from all over the world: Germany, people from several different countries in Africa, France, and post docs from Russia and China. I worked closely with several of these people while developing the storage prototype. In addition the primary language of the Quebec province is French. I worked with Richard Chahine, who is a well known researcher in the field of using activated carbon for hydrogen storage.

Monterey Gardiner: Advances in Hydrogen Storage Technology (2002)

Transportation will undergo a fundamental change in the next decade as vehicles begin to use fuel cells(FC) in place of internal combustion engines (ICE). A direct hydrogen FC vehicle provides for zero emissions at the vehicle, yet have a much longer range than a currently available battery electric vehicle. However, to reach a comparable range, a safe and compact hydrogen storage technology needs to be developed.

Hydrogen can be stored at high pressures, however, the storage volume is four to seven times larger than a conventional ICE vehicle fuel tank. There are also safety concerns of having 5000 psi or even 10,000 psi tanks on board a vehicle. Liquid hydrogen has been suggested, however, it takes nearly a third of the energy contained within the hydrogen to liquefy it. There are also problems with boil off losses. Metal hydrides are compact and safe, but they are relatively heavy.

Hydrogen storage in an advanced carbon based material provides for a compromise of the above challenges. The hydrogen is stored at low temperatures, however at a temperature much higher than that required by liquid hydrogen. The hydrogen is also stored at much lower pressures making it inherently safer. Cryogenically storing hydrogen in activated carbon is a relatively well known field, however, the use of new structures of carbon has the potential to solve many of the problems that face conventional storage technologies.

The IGERT grant has made further research in this area possible along with joint funding from, and a close working relationship with, the Nanomix corporation based in Emeryville, CA. This distinctive partnership between two graduate advisors (a professor of Chemical Engineering/ Materials Science and a PhD in Mechanical Engineering on ITS staff), the graduate student, and the company, is a good example of the diverse opportunities that IGERT makes available. When the PhD student is not constrained by traditional funding or a single department, (s)he is not compelled to work on a predetermined project of a single advisor. Creative new ideas and partnerships are supported and allowed to flourish.

Patricia Hendren: From English Major to Quantitative Policy Analyst (2001)

When I came to the University of California, Davis my goal was to address transportation problems by learning how to decrease people's dependency on automobiles. Currently, I am a PhD candidate in the Transportation Technology & Policy (TTP) Graduate Group. TTP is unique because it prepares students to directly address transportation problems from an interdisciplinary perspective. The TTP program exposed me to the behavioral and technological elements of transportation using statistical and other modeling techniques, policy analysis and economic theory. During my classes, I realized the importance of further developing my economics skills.

The 2001 IGERT fellowship has enabled me to pursue a Master's degree in Agricultural and Resource Economics at UC Davis. Through this additional degree, I have learned how economics can be used as a practical tool to clarify transportation issues and to effect transportation reform. For example, it is important to investigate how economic incentives (e.g., employee parking charges) and altering the price of traveling to reflect the true cost to society (e.g., air pollution) can change people's travel behavior.

In addition, the degree in Agricultural and Resource Economics has helped me in my dissertation research. Currently, I am analyzing the historical relationship between state-level resource allocation patterns and statewide performance measures. Recently passed federal legislation was designed to induce major transformations in transportation activities by changing the types of projects eligible for federal funding. The challenge to the states is to use the new funding opportunities to effectively develop an deficient multi-modal transportation system. In better under-

standing the link between resources and performance, states will be able to determine the impact of their investment decisions. A Master's degree has helped me with this research by introducing me to new methodologies used in the economics field.

The IGERT program has given me the necessary financial support to complete a Master's degree in Agricultural and Resource Economics and a PhD from Transportation Technology and Policy. The combination of these degrees will give me a powerful foundation for tackling current transportation problems. Through my PhD, I have obtained the wide perspective necessary for understanding today's transportation issues, but the work on the Master's degree has given me necessary depth in an area crucial to transportation change. Together the two degrees will enable me to transform my ideas into viable solutions.

Kurt Kornbluth: Building a Better World through Sustainable Development (e-news #24, July 2005, http://www.its.ucdavis.edu/news/enews/issue24/)

Kurt "Lorenzo" Kornbluth has been building a better world while conducting research for his dissertation.

Kornbluth completed his Ph.D. coursework a year and a half ago and went to work for inventor Dean Kamen's company, DEKA R&D, which developed the Segway personal transporter and the iBot stair-climbing wheelchair. At the same time he was invited to be a guest lecturer, then teach a year-long international develop MIT workshop class that takes students abroad on appropriate technology projects.

Besides being a car nut, Kornbluth's interest in personal mobility goes back more than a decade; before returning to grad school at ITS-Davis, he worked for Whirlwind Wheelchair International, which designs wheelchairs that can be built in developing countries from locally available materials. One of his proud accomplishments was the development of a simple, low-cost wheelchair design, plus the tools and manual. The chair is now being built in 25 shops across Africa and Latin America.

While much of his overseas work with MIT has comprised traditional international development projects such as water testing and treatment, and irrigation, Kornbluth also worked on small renewable energy projects. He recently returned from Bangladesh, where he installed prototype Stirling-cycle engines that burn biogas made from anaerobically digested cow dung to create electricity in two tiny remote villages with 50 – 70 families.

"This is a place that had never seen electricity, and now they have lighting," Kornbluth explains of the communities that are completely off the grid. "I worked with DEKA engineers to design and build all the equipment."

This particular experience is feeding Kornbluth's dissertation, which will focus on utilization of biogas in small engines. Mechanical Engineering Professor Paul Erickson is his advisor.

Not one to let moss grow under his feet, Kornbluth this summer is leading MIT, Harvard, and University of Zambia students on development projects in Zambia, Botswana, and Lesotho. This fall, he'll travel with students to Guatemala to work with an organization called Maya Pedal. Maya Pedal helps communities build low-cost devices such as blenders, washing machines, grain mills, water pumps, roof-tile makers, macadamia nut-hullers, and generators that are people-powered using bicycle parts.

Kornbluth travels with funding from MIT and DEKA, while still pursuing his Ph.D. from UC Davis. “The challenge will be to stand still long enough to synthesize it all.”

Nicholas Lutsey: Internship with State Air Quality Agency Making a Difference (2004)

The training and education provided by IGERT program within the ITS-Davis Transportation Technology and Policy (TTP) program allowed me to make fundamentally important contributions to the formation of the groundbreaking California vehicle greenhouse gas regulation. The internship has been, and continues to be, a fascinating, multidisciplinary experience with the California Air Resources Board (CARB) as they translate the 2002 Assembly Bill 1493 into the first major piece of regulation in the nation to address emissions that contribute to climate change.

My research with CARB has combined the disciplines of engineering, economics, and public policy, offering a perfect extension of my academic skill set. Along with providing a bridge between these typically isolated disciplines, my internship experience helped to provide a connection between the cutting edge of university research on vehicle technologies and the practical implementation of public policy that could bring these technologies to the fore in upcoming years. Without the diverse research experience and cross-disciplinary educational training, I would not have been able to participate in the CARB internship. Because of the IGERT program and my training in the TTP program, I have contributed greatly to a more rigorous, technically sound, and economically grounded vehicle regulation.

The training through the CARB internship has better prepared me for future research work. Having co-conducted aspects of the research involved with the new emission-reduction regulation, I better understand the data, assumptions, research conclusions, and practical limitations of translating academic research conclusions into real-world regulation. Interacting with the interest groups involved with environmental legislation, primarily environmental NGOs and representatives of the automotive industry, has prepared me to better understand the relationships between them, their viewpoints on various public policy issues, and how to work with them on various projects.

The same diverse educational tools that TTP prides itself in teaching its students – vehicle engineering, air pollution, technology feasibility, travel demand, economic and environmental analysis, and examination of policy alternatives – were applied often to make valuable contributions to the state initiative. For example:

- Vehicle simulation modeling- The vehicle simulation modeling learned in UC-Davis mechanical engineering classes, applied in my research on heavy-duty trucks, was invaluable in understanding and synthesizing the research that is to determine the maximum level of technologically feasible reduction of greenhouse gas emissions (CO2, N2O, CH4, HFCs).
- Economic analysis - My previous IGERT research and education in economic and travel statistics ably prepared me to analyze the effects of the new vehicle regulation on vehicle consumers, ensuring satisfaction of the requirements of the legislation to craft standards that are both cost-effective and economical to the vehicle owner-operator.

Michael Nicholas: Optimal Hydrogen Fuel Station Siting (2004)

As an example of new research collaborations, Michael Nicholas has been working with a new professor of urban planning, a new professor of energy policy, and a long-time professor in civil engineering/environmental policy, with input from a new civil engineering professor with expertise in operations research, to develop a methodology for determining optimal locations for hydrogen fuel stations within a metropolitan region. This project has produced insights into how extensive a hydrogen fuel station network will be needed to support the adoption of this new transportation technology. The research has been presented at three academic and professional conferences, and a paper on it is forthcoming in a peer-reviewed transportation journal. This work has helped to motivate Michael, originally an MS student, to stay on for his PhD and further refine the study for his dissertation. Other trainees in the fuel cell vehicle area have been jointly advised by chemical engineering and mechanical engineering faculty. Several have had enormously useful internships (with government agencies, an international research institute, and a global auto manufacturer) that have galvanized their research activities.

Caroline Rodier: Improving Regional Travel Demand Forecasting Models (2001)

The research that Prof. Robert A. Johnston is doing with Caroline Rodier uses econometric techniques to assist regional transportation planning by forecasting the demand for travel several decades into the future. They have adapted these models to be more realistic (using state of the art regional economic location theory) and to estimate the air quality impacts of various regional transportation strategies. One recent research presentation in particular was on the necessity of modeling and development changes due to freeway extensions. Their research is motivating several Metropolitan Planning Organization representatives to consider developing such models for their regions. Another aspect of their research relates to the uncertainty in regional travel modeling and how this affects the ability of a region to demonstrate conformity with federal and state air quality standards. The presentation of this work was of great interest to the US Environmental Protection Agency and Federal Highway Administration managers in attendance, and has resulted in EPA funding further research in this area.

Deborah Salon: Internship with International Energy Agency, Paris (2000)

From the beginning of September through mid-December 2000, I worked at the International Energy Agency in Paris doing some research on ways to predict business-as-usual greenhouse gas emissions from different parts of the transport sector. The work I did feeds into a larger body of work on baseline-setting for greenhouse gas emission reduction projects around the world. It is the first study to focus entirely on the transport sector.

The time I spent at IEA was incredible for me. Before I came to graduate school, I was working in the environmental advocacy world and felt like the work I did there was directly used in the policy process that was happening at that time. Being at IEA put me back in that setting again, and it was good to reconnect directly with the policy world.

Meena Sundaresan: International Internship with DaimlerChrysler, Germany (2004)

Meena Sundaresan spent one year in Germany working with DaimlerChrysler in the company's Fuel Cell Project. She assisted the project group with computer modeling activities related to direct hydrogen hybrid fuel cell vehicles. This experience not only grounded her dissertation research in real world data and engineering, it offered her a chance to interact with people from a different culture both professionally and socially. The benefits to Meena are research experience useful to the industry and a full-time employment offer from the company. The benefits to the university are continued opportunities for university-industry partnerships through internships and research projects and a record of successful job placement of its graduate students.

Jonathan Weinert: Launching a Pilot Research Project in China (e-news #24, July 2005, http://www.its.ucdavis.edu/news/enews/issue24/)

Jason Ni and Jonathan Weinert**,** both Transportation Technology and Policy students working on Ph.D.s, leave for China next month to begin work on research projects with Tongji University in Shanghai and Tsinghua University in Beijing. They are involved in an early pilot project of the proposed China Center for Energy and Transportation, a developing initiative that will link ITS-Davis with research universities and centers in China, and eventually, Europe and the U.S.

Weinert will focus on China's fueling infrastructure during his stay over the next 10 – 12 months.

"China is in a position to potentially leapfrog gasoline to cleaner fuels like hydrogen, much as it and other developing nations have done with cell phone technology," Weinert says. If successful, he notes, both China and the world will benefit from cleaner air, reduced greenhouse gas emissions, and a more secure energy supply.

Weinert and Ni will be working with professors Jianxin Ma and Jun Ma in the College of Automotive Studies at Tongji, and Minggao Ouyang at Tsinghua.

Jonathan Weinert: Second Place in Nationwide Hydrogen Station Design Contest (2004)

The biggest educational highlight for me this year has been my participation in the First Annual 2004 University Student Hydrogen Station Design Contest. In this contest, I led an interdisciplinary team of nine students, some from our TTP department, some undergrads from different departments including electrical engineering, art history, graphic design, and mechanical engineering. Together, we developed for our station a technical design; conducted necessary safety, economic, and environmental analyses; and outlined a marketing/education campaign to raise public support for hydrogen as a vehicle fuel. Fifteen teams from universities around North America competed in this landmark event. Our team came in 2nd place. This competition was by far the most rewarding experience of my graduate career to date. I learned so much about hydrogen technology, the hydrogen industry, project management, and leadership. My involvement in this project would not have been possible without the financial support of my IGERT fellowship.

APPENDIX E

TRANSPORTATION PROGRAM RECRUITMENT MATERIALS

Cover Letter to Mailing of Poster and Brochures

December 18, 1998

Dear Colleague:

We would like to introduce you to, or reacquaint you with, our graduate transportation programs at UC Davis. Our programs prepare students for the current and future demands of a modern career in transportation. We have developed a concept that allows students from many backgrounds to expand their intellectual scope and partake in a multidisciplinary approach to education and research. We not only offer courses from a wide variety of disciplines, but also employ faculty and researchers from varied disciplines. Our programs are flexible in that they allow students, with assistance from a faculty advisor, to customize their studies based on personal interests.

Our two largest graduate programs are the Transportation Technology & Policy program housed under the Institute of Transportation Studies, and the Transportation Engineering and Planning program housed within the Civil & Environmental Engineering Department. Both offer MS and PhD degrees. However, depending on specific interests, several other programs may also be appropriate for the student interested in pursuing a transportation focus, such as Ecology & Environmental Studies, Statistics, School of Management, Chemistry, Mechanical Engineering and others.

UC Davis was recently awarded a prestigious National Science Foundation grant to support its innovative, interdisciplinary graduate programs in transportation. ITS-Davis is one of only 17 recipients selected nationwide from 622 proposals, and the only recipient program focused on transportation. Also, in the past year the US Department of Energy designated the ITS-Davis Fuel Cell Vehicle Center and Hybrid Vehicle Drivetrain Program as National Centers of Excellence in advanced automotive technology.

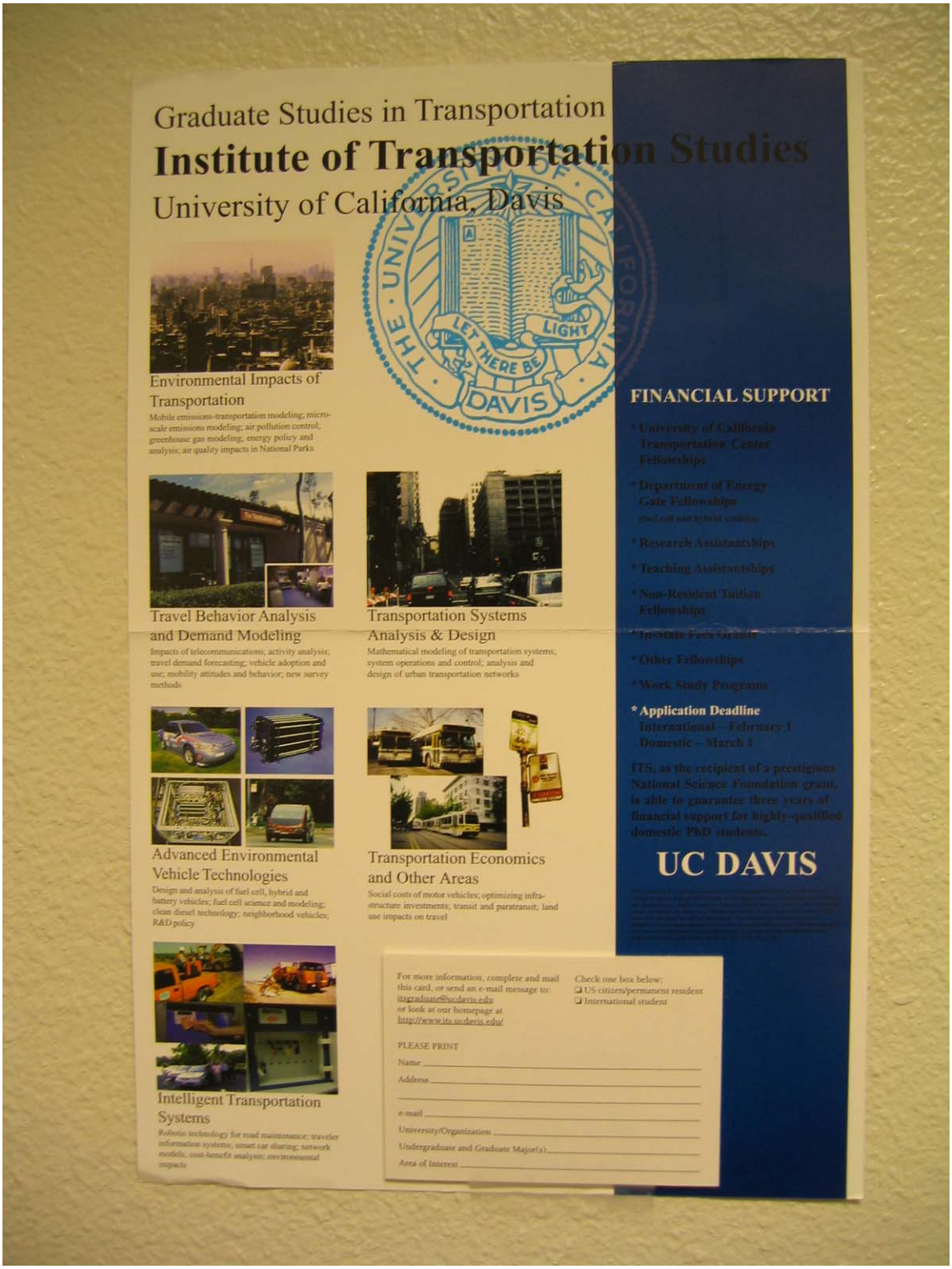
Enclosed you will find two copies of our brochure and a poster. The brochure contains information on all of these avenues to transportation studies at UC Davis. The poster portrays key areas of research conducted at ITS-Davis. We would be very grateful if you could display our poster in a prominent location and keep our brochures handy for students who inquire about our program. Please let us know if you would like more copies; we would be happy to send them. Thank you very much.

Best regards,

Patricia L. Mokhtarian, Ph.D.
Associate Professor,
Department of Civil and Environmental Engineering
and Chair,
Graduate Group in Transportation Technology and Policy

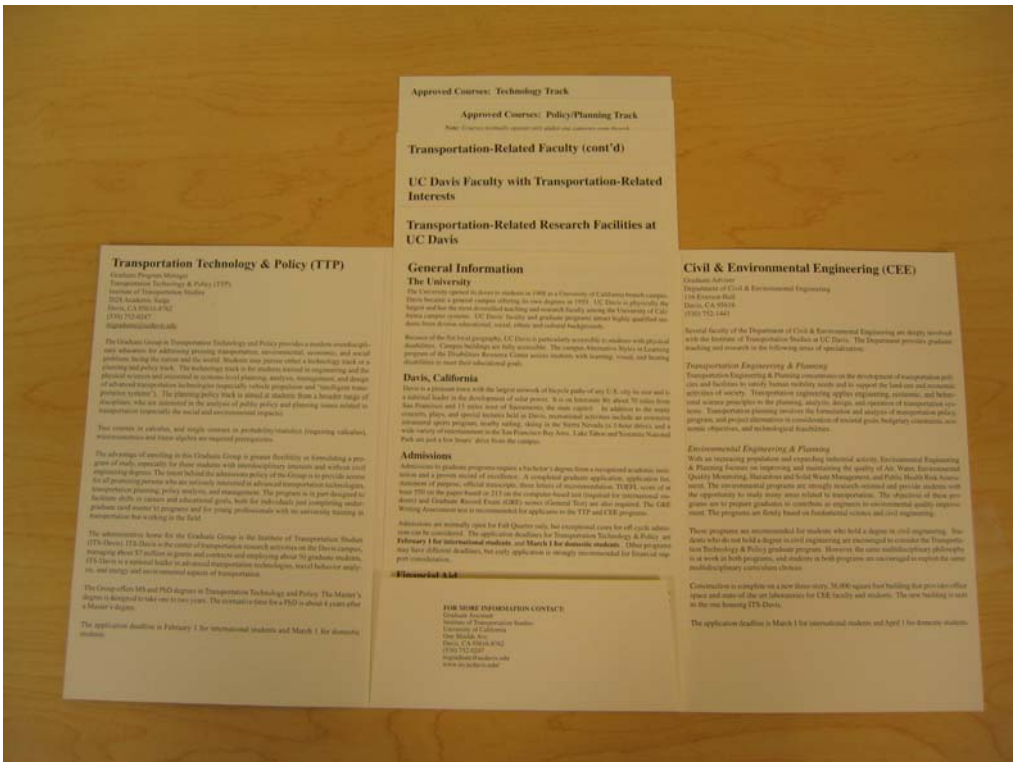
Enc

Recruitment Poster Promoting All Transportation Programs at UCD



First Brochure Promoting Transportation Programs at UC Davis (Front and Back)

First Brochure Promoting Transportation Programs at UC Davis (Inside)



Second Brochure Promoting All Transportation Programs at UC Davis (Front and Back)

Second Brochure Promoting All Transportation Programs at UC Davis (Inside)

Poster Publicizing Recruitment Talk

WHY SHOULD YOU GO TO GRADUATE SCHOOL?

(in transportation)

(at the UNIVERSITY OF CALIFORNIA, DAVIS)

Friday, November 3, 2000
12:00 – 1:00 p.m.
(place)

Dr. Patricia L. Mokhtarian, Professor of Civil and Environmental Engineering and Faculty of the Institute of Transportation Studies, describes the exciting, cutting-edge graduate education and research programs in transportation available at UC Davis. Come and get your questions answered – about graduate school in general, and UC Davis transportation studies in particular.

Can I afford it?

What careers does it make available?

Will I succeed there?

What is it like to be a woman in a male-dominated field?

…. Or a minority in an Anglo-dominated field?

UCDAVIS ITS

Recruitment Talk (Power Point presentation has video clips at slides 21, 27, and 28)

Why Should You Go to Grad School … in Transportation … at the University of California, Davis?

Prof. Patricia L. Mokhtarian
Dept. of Civil and Environmental Engineering
and Institute of Transportation Studies
pmokhtarian@ucdavis.edu
(530) 752-7062

Overview

- Why grad school?
  - MS
  - PhD
- Why
- Why UC Davis?
  - About Davis
  - About ITS
  - Transportation education at UCD
  - Transportation research at UCD
  - Financial aid
  - Other support

Why Grad School?

- Why an MS?
  - MS is now the entry-level degree
  - Having an MS counts as work experience
  - NOT having an MS slows your advancement
  - Obtain more training in your area of interest!
  - Opportunity for close interaction with faculty, fellow students, external professionals

Why Grad School?

- Why a PhD?
  - It's a challenge!
  - Obtain yet more training in your area of interest!
  - Even more opportunity for yet closer interaction with faculty, others
  - Make an original contribution to knowledge
  - Academia is a terrific career! (So is research alone)
  - Training in critical thinking

Why Transportation?

- Essential function of society
- Very big tent
  - pipelines, railways, harbors, airports, highways, vehicles, fuel, pavement, telecommunications
  - multidisciplinary: engineering, science, policy, behavior, economics, law, management, environment
  - from theoretical to practical
  - from individual to global scales
- Intellectually challenging
- There will always be work for us to do!

What Kinds of Careers Am I Looking At?

- Government
- Non-profits
- Consulting
- Industry
- Academia

Why the University of California, Davis?

UC D

Where the heck IS Davis, anyway??

What's So Great about Transportation at UCD?

- Thriving interdisciplinary research environment (Institute of Transportation Studies)
- Exemplary interdisciplinary approach to education
- World-class faculty
- Proximity to state capital

Institute of Transportation Studies (ITS)

- Officially founded 1991
  - 35 faculty and researchers
  - 50 graduate students
  - 10 staff
- Prestigious external Board of Advisors
  - 18 corporate, gov't, non-profit, academic leaders
- Important partnerships with private sector
  - Donate > $1.5M / year

ITS-Davis Marks of Excellence

- International reputation
  - Environmental focus: AQ analysis and policy, alt. fuel techno.
  - Travel behavior
  - Traffic flow theory
- Prestigious awards
  - 2 of 10 US Dept. of Energy centers of excellence are at UCD: Fuel Cell Vehicles and Hybrid Electric Vehicles
  - Nat'l Science Foundation IGERT Fellowship program ($2.6 M)
  - Two affiliated faculty (Niemeier, Zhang) have NSF Career Investigator awards

ITS Programs for Students

- Weekly seminar series
- Fellowships, including Summer undergrad programs
- Research assistantships
- Internships, including international
- Travel to conferences
- Local conferences, workshops (6-8 / year)

UCD Transportation's Multidisciplinary Philosophy of Research and Education

- Integrate
  - Engineering
  - Social sciences
  - Environmental studies
- Engage
  - Industry
  - Government
  - Non-profits
- Combine
  - Research
  - Education

Transportation Education at UCD

- Interdisciplinary Transportation Technology and Policy program
- Civil and Environmental Engineering program
- Other discipline-based programs:
  - Chemistry, chem engineering
  - Mechanical engineering
  - Economics
  - Environmental studies
  - Management

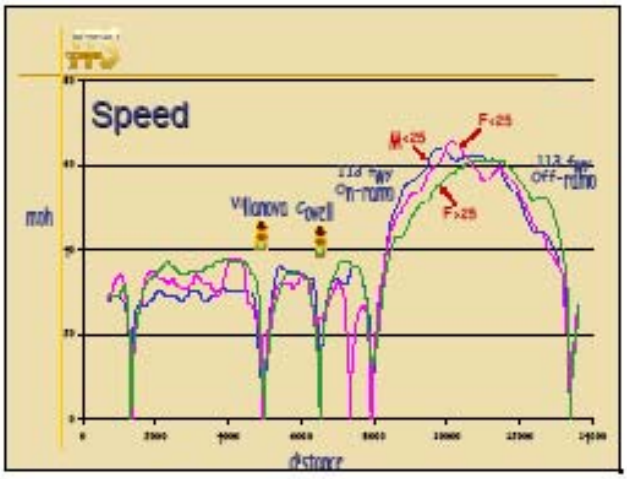
Our Current Students

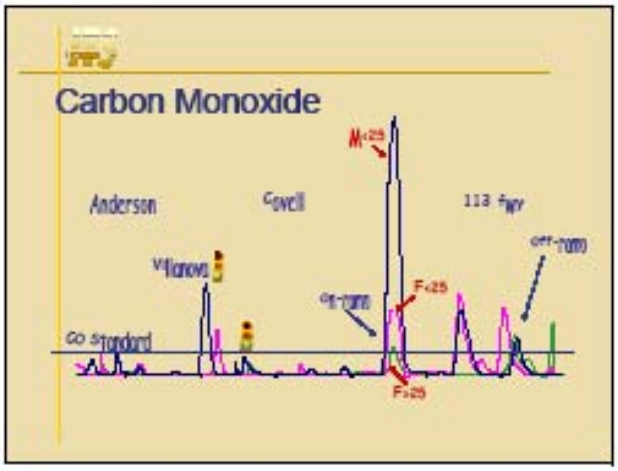
- 34 male, 15 female
- 9 MS, 40 PhD
- 21 TTP, 18 CEE, 10 other
- countries of origin:
  - Argentina
  - Brazil
  - China
  - Germany
  - India
  - Korea
- majors
  - engineering (civil, chem, mech, electrical, materials sci.)
  - city planning, geography
  - physics, chemistry, math
  - environmental studies
  - anthropology
  - geology, meteorology
  - history, philosophy
  - economics, business
  - English
  - law

What are Some of the Distinctive Research Specialties at UCD?

- Environmental impacts
- Alternative-fueled vehicles
- Traffic and Intelligent Transportation Systems (another ITS)
- Travel behavior
- Transportation economics

Air Quality Analysis





Alternative-Fueled Vehicles

- What if we didn't have to worry about emissions?
- UCD researchers leading the way to new zero- or very low-

That's Great for Air Quality, but What About Congestion?

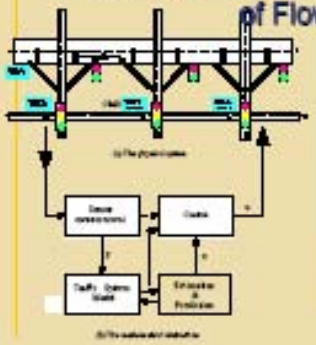
- Two main ways to reduce congestion:
  - Increase the (effective) *supply* of transportation capacity
  - Reduce or modify the *demand* for travel
- UCD internationally known for research on both aspects

Increasing the Supply

- Build more roads?
  - Heavy financial, environmental, social costs
- Public transportation?
  - Difficult to compete with private auto
  - Also has financial, environmental, social costs!
- Use existing capacity more efficiently
  - Manage traffic flows better (control technology)
  - Provide information to drivers (telecom

Traffic Analysis

Managing Traffic through the Control of Flow and Information



- Sensors
  - Loop detectors
  - Video cameras
- Flow control
  - Ramp meters
  - Traffic signals
  - Priority lanes
- Information control
  - Traffic conditions
  - Route guidance

Travel Behavior Research at UCD

- Modeling regional travel patterns
- Demand for electric vehicles
- Impacts of telecommunications on travel behavior
- "Smart" carsharing arrangements
- Attitudes toward travel

Carsharing – What's *that* about?

- Short term vehicle rental
- May eliminate the need for a (second) car
- Allows access to a "portfolio" of different vehicle types
- Payment by use

What is Your Ideal Commute Time?

- Not everyone hates commuting...
- Has important policy implications for pro-moting telecommuting and other commute reduction strategies

How Can I Afford Grad School?

- Research assistantships
- Fellowships:
  - IGERT (domestic PhD students)
  - University of California Transportation Center (US citizens, permanent residents)
  - US DOE GATE (US citizens)
- Teaching assistantships

How Long are We Talking about?

- MS
  - 1 year (if exam)
  - up to 2 years (if thesis)
- PhD
  - 3-4 years if prior related MS
  - 4-6 years for both MS/PhD combined if no prior MS
- And if you're having fun AND getting paid?!

What are the Admission Requirements?

Desirable:

- GPA > 3.0 (MS), 3.5 (PhD)
- GREs > 75th percentile (all three scores important)

BUT

- These are guidelines; exceptions are possible
- We look at the entire application, including

Will I Be Left to Sink or Swim?

- Our program is small enough to be personal
- 27 TTP faculty include 6 women, 1 African-American; 26 CEE faculty include 3 women, 1 African-American, 1 Hispanic
- White Anglos are in the minority in California!
- Numerous clubs and prof. societies offer support, networking:
  - Society of Women Engineers, Women in Engineering Program
  - Chicano and Latino Engineers and Scientists Society (affiliated with Soc. of Hispanic Professional Engineers, Soc. of Mexican American Engineers and Scientists, Center for the Advancement of Hispanics in Science and Engineering

Shouldn't YOU go to graduate school in transportation at UC Davis ?

UC DAVIS AGGIES

For more info and on-line apps, go to:

http://its.ucdavis.edu

$$$$ GET PAID TO GO TO GRADUATE SCHOOL ! $$$$

Fellowship funds available to qualified US citizens and permanent residents

for MS and PhD degrees in transportation at the

UNIVERSITY OF CALIFORNIA, DAVIS.

Support could include

- **in-state fees (~ $5000/yr),**
- **non-resident tuition (~ $10,000/yr), and**
- **a stipend up to $18,000 a year.**

Available programs:

- **Transportation Technology & Policy (interdisciplinary),**
- **Civil and Environmental Engineering,**
- **Mechanical Engineering,**
- **Chemical Engineering/Chemistry,**
- **Economics, and**
- **others.**

Students from all undergraduate majors are welcome – social sciences and liberal arts as well as science and engineering.

For more details, see our web site at www.its.ucdavis.edu or contact Joan Tolentino at the Institute of Transportation Studies, Univ. of California, Davis, One Shields Avenue, Davis, CA 95616; or jstolentino@ucdavis.edu; telephone: 530-752-0247

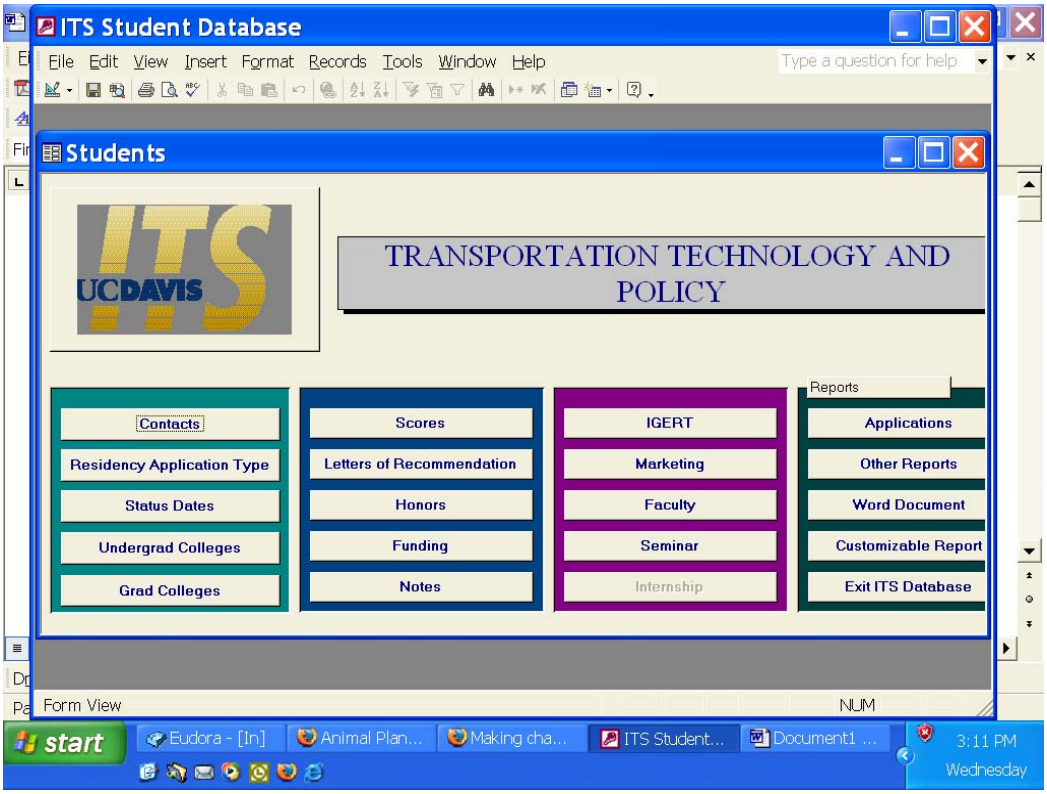
E-mail Message Sent to Several Environmental Newsletters

Get Paid While Earning an MS or PhD in Transportation!

Have you ever thought about going back to grad school, but didn't think you could afford it? Fellowships and research assistantships offering an $18,200 annual stipend (plus tuition and fees paid separately) are available for qualified individuals for graduate studies in transportation through the following available programs at the University of California, Davis: Transportation Technology & Policy (interdisciplinary), Civil and Environmental Engineering, Mechanical Engineering, Chemical Engineering/Chemistry, Economics, and others. Students from all undergraduate majors are welcome - social sciences and liberal arts as well as science and engineering. For more details, contact Graduate Assistant Joan Tolentino, jstolentino@ucdavis.edu, 530-752-0247, visit our web page at www.itsdavis.edu, or go directly to http://ttp.ucdavis.edu/gradschoolrecruitment.pdf for a presentation on why you should go to grad school, in transportation, at UC Davis!

APPENDIX F

DATABASE SCREENS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TRANSPORTATION TECHNOLOGY AND POLICY
Contacts
Residency Application Type
Status Dates
Undergrad Colleges
Grad Colleges
Scores
Letters of Recommendation
Honors
Funding
Notes
IGERT
Marketing
Faculty
Seminar
Internship
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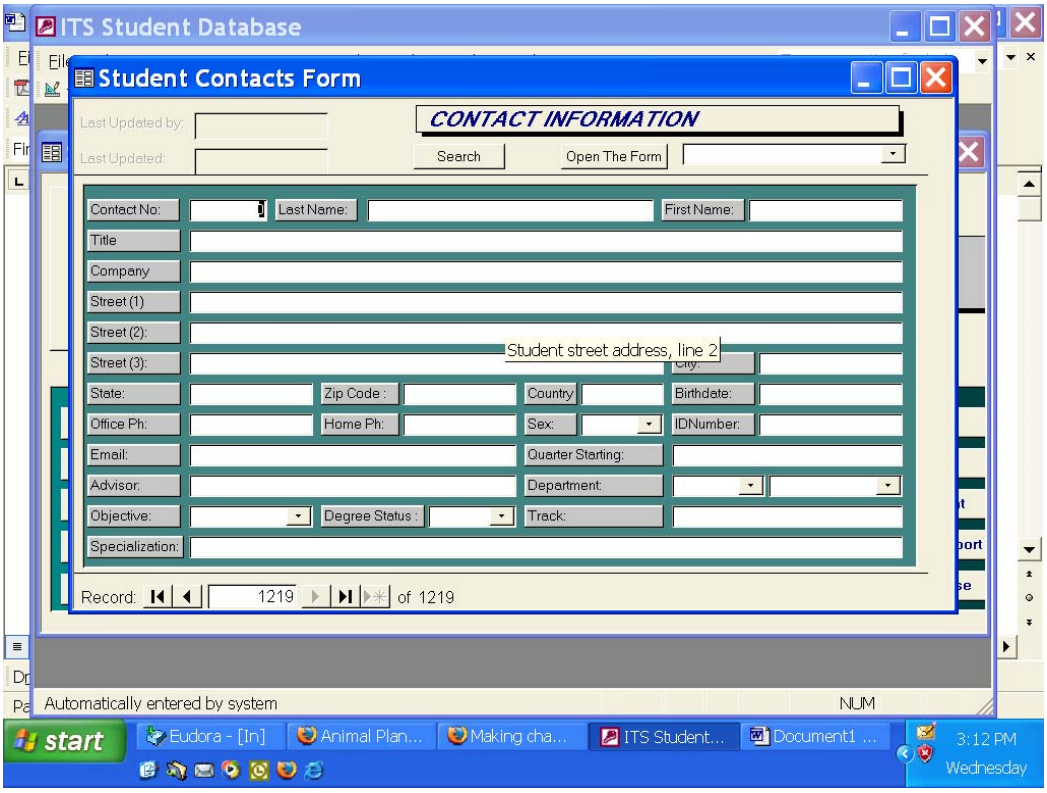
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First Name:
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Street (2):
Street (3):
Student street address, line 2
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Office Ph:
Home Ph:
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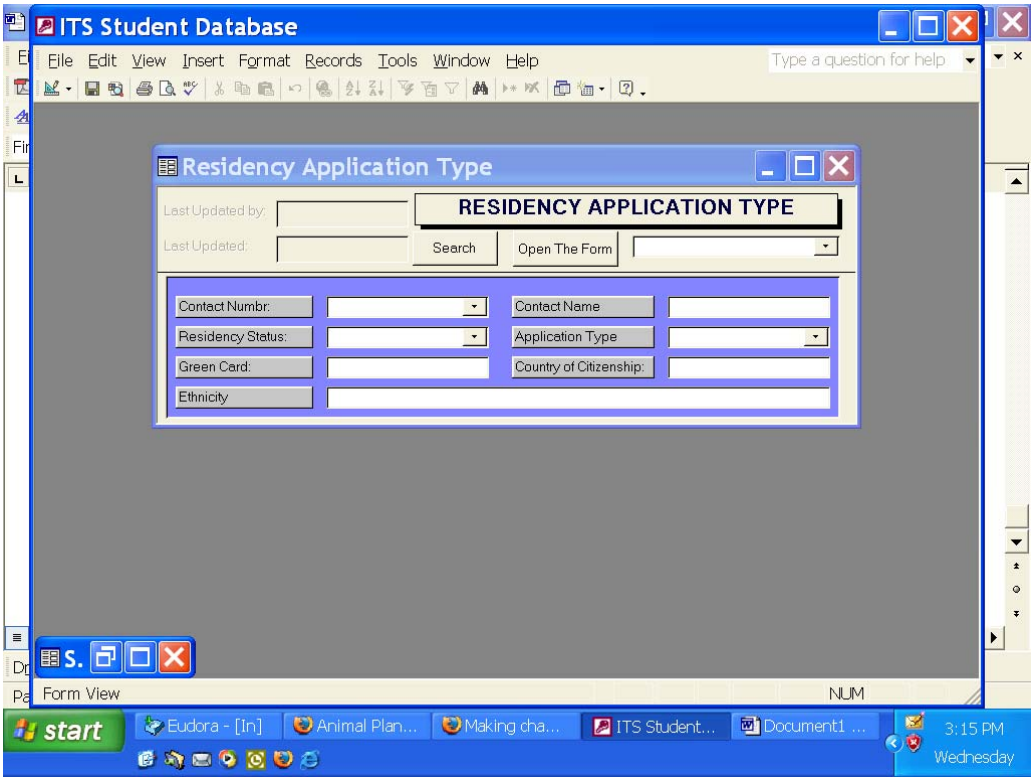
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Residency Status:
Application Type
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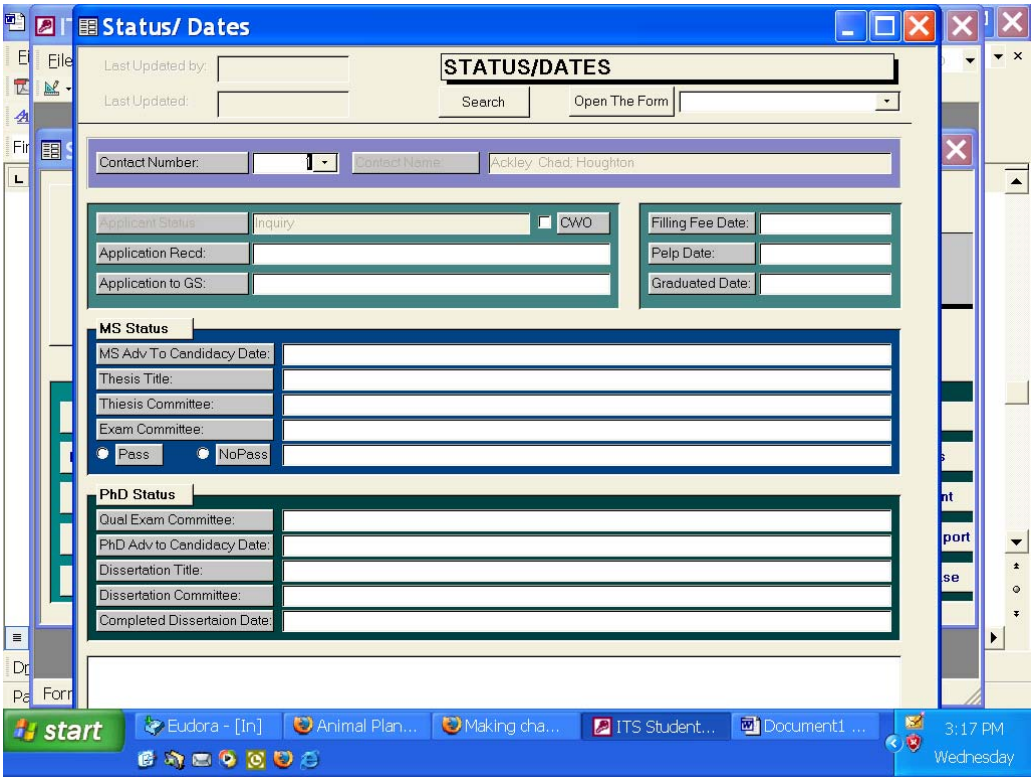
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Application Recd:
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Pelp Date:
Graduated Date:
MS Status
MS Adv To Candidacy Date:
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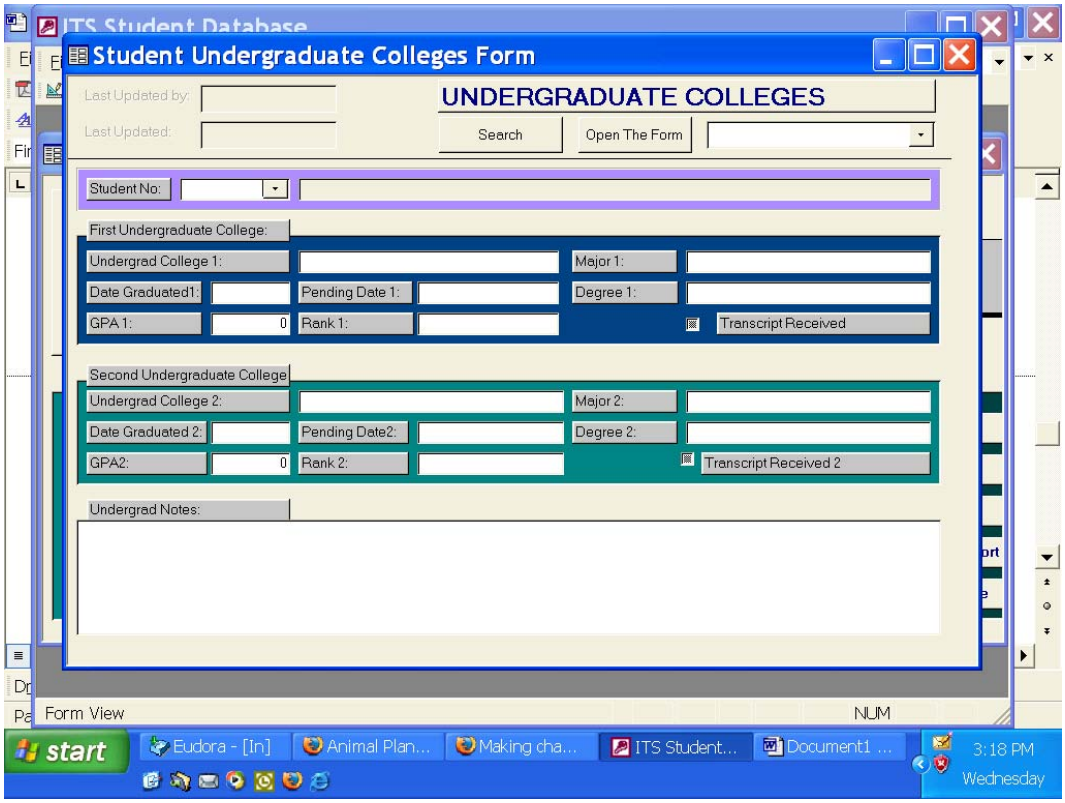
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Undergrad College 1:
Major 1:
Date Graduated1:
Pending Date 1:
Degree 1:
GPA 1:
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Rank 1:
Transcript Received
Second Undergraduate College
Undergrad College 2:
Major 2:
Date Graduated 2:
Pending Date2:
Degree 2:
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Rank 2:
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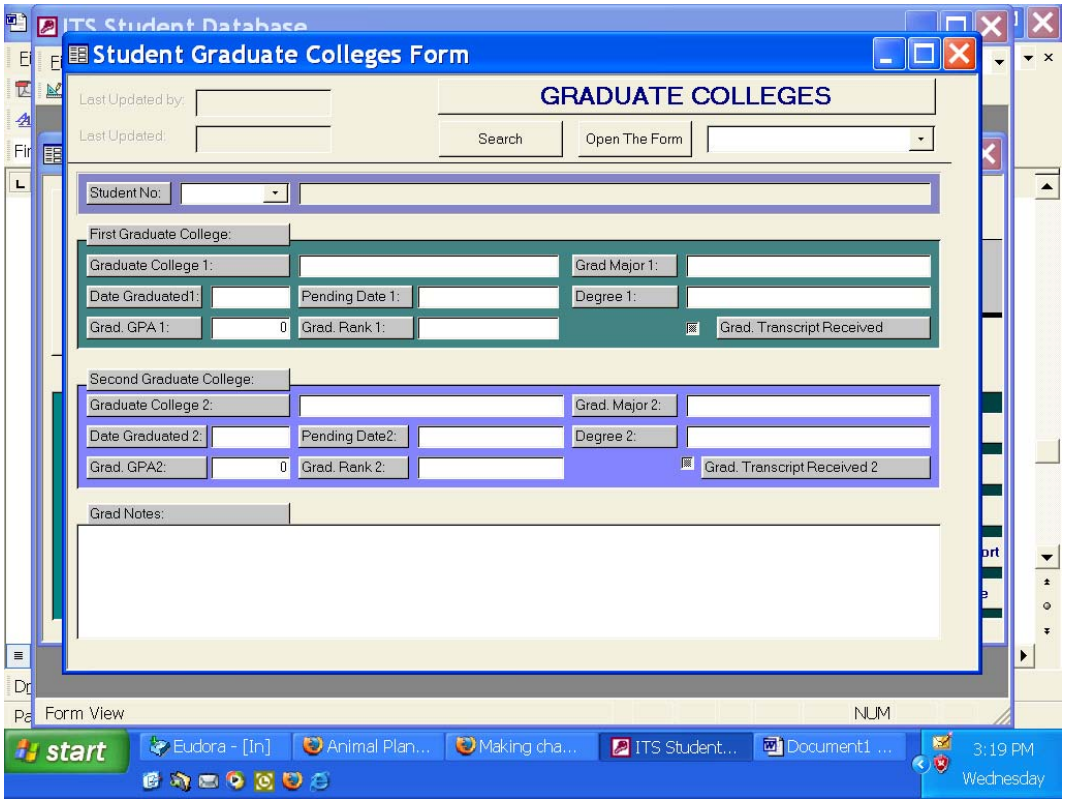
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Grad Major 1:
Date Graduated1:
Pending Date 1:
Degree 1:
Grad. GPA 1:
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Grad. Rank 1:
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Second Graduate College:
Graduate College 2:
Grad. Major 2:
Date Graduated 2:
Pending Date2:
Degree 2:
Grad. GPA2:
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Grad. Rank 2:
Grad. Transcript Received 2
Grad Notes:
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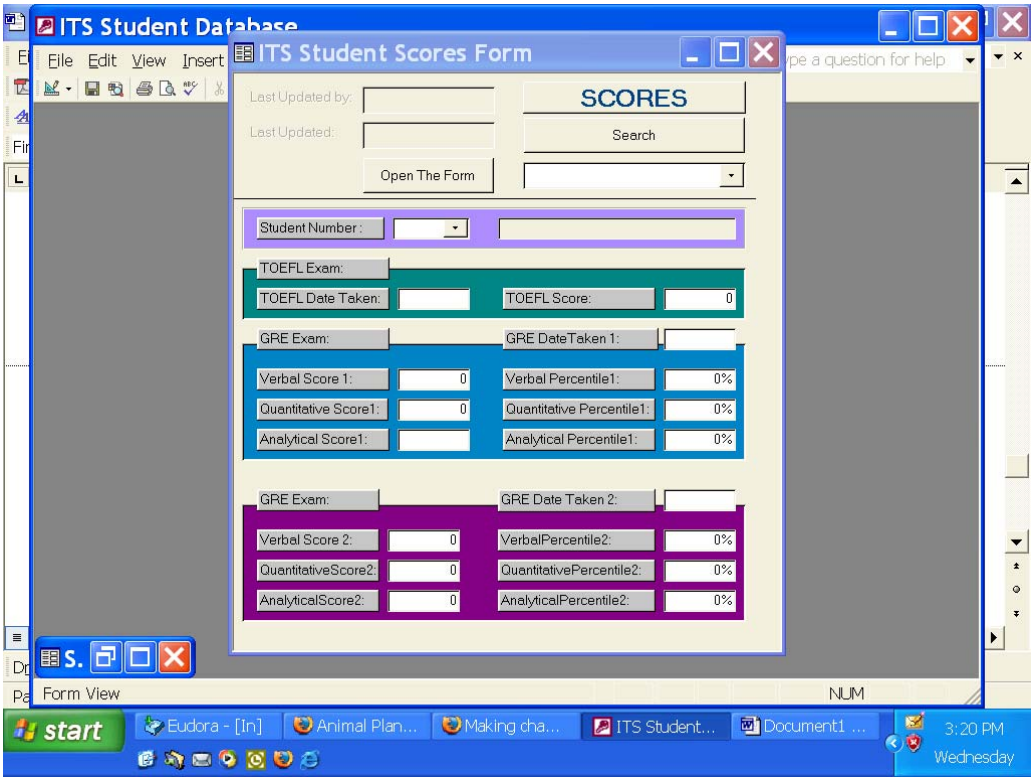
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Analytical Score1:
Analytical Percentile1:
GRE Exam:
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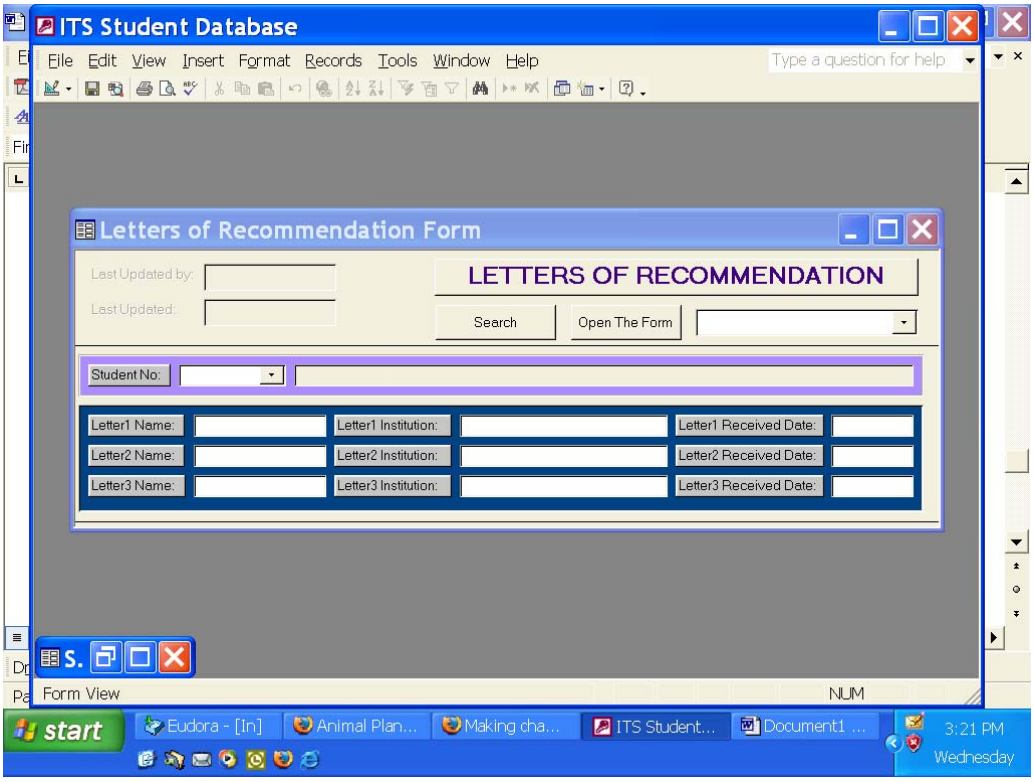
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Letters of Recommendation Form
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Student No:
Letter1 Name:
Letter1 Institution:
Letter1 Received Date:
Letter2 Name:
Letter2 Institution:
Letter2 Received Date:
Letter3 Name:
Letter3 Institution:
Letter3 Received Date:
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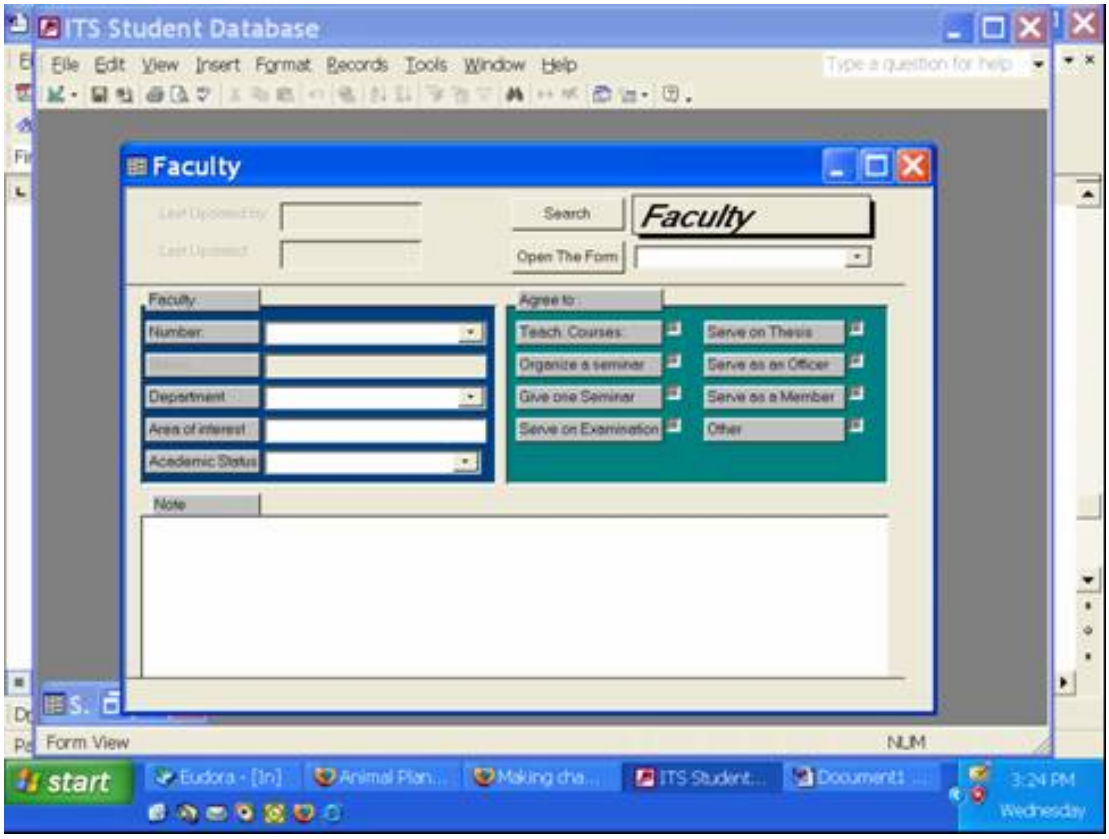
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Faculty
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Faculty
Number:
Department
Area of interest
Academic Status
Agree to:
Teach Courses
Organize a seminar
Give one Seminar
Serve on Examination
Serve on Thesis
Serve as an Officer
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APPENDIX G

ALUMNI EVALUATION SURVEYS

COVER LETTER TO FIRST ALUMNI SURVEY

Dear _____, Date:_____

Congratulations on finishing your degree! You should rightfully be proud of yourself for successfully completing this challenging and important milestone in your life and we are proud of you.

The primary goal of our graduate transportation program at UC Davis is to help produce broadly-prepared graduates with the technical, professional, and personal skills essential to addressing the varied career demands of the future. Thus, it is important to us to assess how effective we are at helping you prepare for your career, and that is the purpose of the brief survey that is attached to this message as a Word document. Obviously your evaluation of our program may change with the passage of time, but this survey will give us your views while the program is still fresh in your mind. We don't intend to be surveying you forever, but we would like to contact you again in one year, to see what suggestions you might have for us after being out in the workforce for awhile.

This survey should take about 15 minutes to complete. You are welcome to answer it by typing your responses into the Word document and e-mailing it back to us. If you would respond more candidly by remaining anonymous (or at least as anonymous as possible), please feel free to print out your completed survey and mail it back to Joan Tolentino, ITS, UC Davis, One Shields Avenue, Davis, CA 95616.

We are collecting these data on an ongoing basis so your responses will be valuable at any time, but they will be most helpful to us if we receive them by [2 weeks from sending]. If for some reason you have trouble opening the attachment, please contact Joan at jstolentino@ucdavis.edu, and she will mail you a hard copy. And if you have any questions, please don't hesitate to contact me or Joan.

Thanks very much for your help!

Sincerely,
Pat Mokhtarian

PART A
YOUR UCD GRADUATE PROGRAM OF STUDY

Date:_____

1. How would you rate the following aspects of your UCD graduate program? Please feel free to comment on any or all aspects.

	Poor	*Fair*	*Good*	*Very good*	*Excellent*	*Comments*
a. overall quality of faculty with respect to classroom teaching	[ ]	[ ]	[ ]	[ ]	[ ]	_____
b. quality of the interaction with my faculty advisor	[ ]	[ ]	[ ]	[ ]	[ ]	_____
c. my research experience (check here if not applicable: [ ])	[ ]	[ ]	[ ]	[ ]	[ ]	_____
d. program advising/guidance	[ ]	[ ]	[ ]	[ ]	[ ]	_____
e. personal nature of the program	[ ]	[ ]	[ ]	[ ]	[ ]	_____
f. camaraderie with fellow students	[ ]	[ ]	[ ]	[ ]	[ ]	_____
g. availability of courses on desired topics	[ ]	[ ]	[ ]	[ ]	[ ]	_____
h. improving my public speaking skills	[ ]	[ ]	[ ]	[ ]	[ ]	_____
i. improving my technical writing skills	[ ]	[ ]	[ ]	[ ]	[ ]	_____
j. improving my critical thinking skills	[ ]	[ ]	[ ]	[ ]	[ ]	_____
k. giving me constructive teamwork experience	[ ]	[ ]	[ ]	[ ]	[ ]	_____
l. internship opportunities	[ ]	[ ]	[ ]	[ ]	[ ]	_____
m. the ITS seminar series	[ ]	[ ]	[ ]	[ ]	[ ]	_____
n. providing networking opportunities with other professionals	[ ]	[ ]	[ ]	[ ]	[ ]	_____

	Poor	*Fair*	*Good*	*Very good*	*Excellent*	*Comments*
o. assistance in finding employment	[ ]	[ ]	[ ]	[ ]	[ ]	_____
p. career preparation	[ ]	[ ]	[ ]	[ ]	[ ]	_____
q. treatment of ethics issues	[ ]	[ ]	[ ]	[ ]	[ ]	_____
r. other (please specify): _____	[ ]	[ ]	[ ]	[ ]	[ ]	_____

2. What other graduate schools did you consider at the time you applied to UC Davis? Please list each school on a separate line, and indicate for each school whether you applied, were accepted, and were offered funding. Feel free to add lines if needed.

Applied to	*Accepted by*	*Offered funding by*	*Name of school*
[ ]	[ ]	[ ]	_____
[ ]	[ ]	[ ]	_____
[ ]	[ ]	[ ]	_____
[ ]	[ ]	[ ]	_____
[ ]	[ ]	[ ]	_____

3. Compared to the alternatives you considered, what attracted you to your particular graduate program at UC Davis? (check all that apply)

[ ] a. specialization/content of the program
[ ] b. location
[ ] c. research interests of the faculty
[ ] d. reputation of the faculty/program/campus
[ ] e. recommendation of another person
[ ] f. availability of funding
[ ] g. other (please specify): _____

4. Which of those aspects was the single most important factor in your decision to come here? Please give the letter of the most important factor: _____

5. Did you participate in any internships while at UC Davis?

[ ] no (go to question 7)
[ ] yes

6. How would you evaluate your internship experience?

[ ] poor
[ ] fair
[ ] good
[ ] very good
[ ] excellent
Please explain any answer:

7. What did you like most about your graduate experience at UC Davis?

8. What did you like least about your graduate experience at UC Davis?

9. How well did the program meet your expectations?

[ ] much worse than expected
[ ] worse than expected
[ ] about what I expected
[ ] in some ways better, in some ways worse than expected
[ ] better than expected
[ ] much better than expected

Please explain any answer:

10. What suggestions do you have for enhancing the experience here for other students?

11. Do you have any other comments about UCD's graduate transportation programs that you'd like to share?

PART B
YOUR CURRENT STATUS

1. What is your current status? Please check the *single* most appropriate answer.

   [ ] Still a student, or expect to be within the next academic year *(please go to Part D)*
   [ ] Working at UC Davis while looking for an outside job
   [ ] Working at UC Davis and not currently looking for an outside job *(please go to Part C)*
   [ ] Not working, but actively looking for a job
   [ ] Not working and not actively looking for a job *(please go to Part D)*
   [ ] Working outside UC Davis

2. In this most recent job search, how long did you/have you been actively looking for a job?

   _____ months

3. To how many different organizations did you send (have you sent) a resume or expression of interest?

   [ ] 1-5 [ ] 6-10 [ ] 11-15 [ ] 16 or more

4. On how many web sites did you post (have you posted) your resume or expression of interest?

   [ ] 0 [ ] 1 [ ] 2 [ ] 3 or more

5. With how many different organizations did you have (have you had) a job interview?

   [ ] 1 [ ] 2 [ ] 3 [ ] 4 or more

If you are not currently working, please go to Part D.

PART C
YOUR CURRENT JOB

1. How many job offers did you receive, including the one you accepted? _____

2. Who is your current employer? _____

3. How would your employer be classified?

   [ ] education
   [ ] industry
   [ ] consulting
   [ ] government
   [ ] non-profit
   [ ] other (please specify): _____

4. What is your current position? _____

5. Would you consider this position to be a typical disciplinary-based position, or a multidisciplinary position?

   [ ] disciplinary
   [ ] multidisciplinary

   Please explain either answer: _____

6. Was the extent of your multidisciplinary preparation a factor in your getting this job?

   [ ] no
   [ ] not sure
   [ ] yes (please explain): _____

7. What was/is your official start date? _____

8. Had you worked for this employer before the position you have now? E.g. before you came to grad school, or in an internship?

   [ ] no
   [ ] yes (please explain): _____

9. How would you rate this job with respect to its *compatibility with your immediate career goals*?

[ ] It is exactly the kind of thing I had in mind.
[ ] It's not perfect, but it fits in some ways.
[ ] It's not a good fit, but it looked like my best choice for now.

10. What is your degree of satisfaction with the following aspects of your job?

	Very dissatisfied	*Dissatisfied*	*Neutral or mixed*	*Satisfied*	*Very satisfied*
a. Content of the work	[ ]	[ ]	[ ]	[ ]	[ ]
b. Supervisor	[ ]	[ ]	[ ]	[ ]	[ ]
c. Salary	[ ]	[ ]	[ ]	[ ]	[ ]
d. Fringe benefits	[ ]	[ ]	[ ]	[ ]	[ ]
e. Opportunity for professional development	[ ]	[ ]	[ ]	[ ]	[ ]
f. Overall	[ ]	[ ]	[ ]	[ ]	[ ]

11. In what range does your current job-based annual income fall, before taxes?

[ ] $30,000 or less
[ ] $30,001-40,000
[ ] $40,001-50,000
[ ] $50,001-60,000
[ ] $60,001-70,000
[ ] $70,001-80,000
[ ] more than $80,000

PART D
FINAL QUESTIONS

In case you choose to answer this survey anonymously, it will be important for us to know just a few general things about you, in order to put your answers in perspective.

1. Which graduate degree(s) *in a transportation-related field* did you obtain at UC Davis?

   [ ] MS only
   [ ] PhD only
   [ ] MS and PhD
   [ ] did not complete a transportation-related graduate degree at UC Davis

2. When did you receive your transportation-related graduate degree(s) from UC Davis?

   _____ _____
   quarter year

   _____ _____
   quarter year

3. From which program(s) did you obtain your transportation-related graduate degree(s) at UC Davis? Check all that are applicable if you obtained more than one relevant graduate degree.

   [ ] Transportation Technology and Policy
   [ ] Civil and Environmental Engineering
   [ ] Mechanical and Aeronautical Engineering
   [ ] Chemical Engineering
   [ ] Chemistry
   [ ] Ecology
   [ ] Agricultural Economics
   [ ] Economics
   [ ] Other (please specify): _____

4. Did you obtain any funding from IGERT during your graduate program?

   [ ] no
   [ ] not sure
   [ ] yes

Thank you very much for your time. Please feel free to offer any additional comments that you may have.

COVER LETTER TO SECOND ALUMNI SURVEY

Dear _____, Date:_____

I hope this letter finds you well and happy. We would certainly enjoy hearing how you are doing.

Soon after you finished your degree here at UCD, you completed a survey for us that provided some of your reactions to our program. I mentioned at that time that we would be contacting you one year later, to see what additional insights you might have about the program after being out in the workforce for awhile. It's now that time…

We've deleted a few questions, but most of this survey looks a lot like the first one. Don't worry about whether your answers are consistent or not! If you return the survey anonymously we won't even be able to match these responses with your previous ones, and even if we were, it would not be surprising if your impressions have changed somewhat over time. In fact, we are particularly interested in your telling us exactly that – how your impressions have changed over time – in your responses to the open-ended questions.

This survey should take less than 15 minutes to complete. You are welcome to answer it by typing your responses into the Word document and e-mailing it back to us. If you would respond more candidly by remaining anonymous (or at least as anonymous as possible), please feel free to print out your completed survey and mail it back to Joan Tolentino, ITS, UC Davis, One Shields Avenue, Davis, CA 95616.

We are collecting these data on an ongoing basis so your responses will be valuable at any time, but they will be most helpful to us if we receive them by [2 weeks from sending]. If for some reason you have trouble opening the attachment, please contact Joan at jstolentino@ucdavis.edu, and she will mail you a hard copy. And if you have any questions, don't hesitate to contact me or Joan.

Thanks very much for your help!

Sincerely,
Pat Mokhtarian

PART A
YOUR UCD GRADUATE PROGRAM OF STUDY

Date:_____

1. How would you rate the following aspects of your UCD graduate program? Please feel free to comment on any or all aspects.

	Poor	*Fair*	*Good*	*Very good*	*Excellent*	*Comments*
a. overall quality of faculty with respect to classroom teaching	[ ]	[ ]	[ ]	[ ]	[ ]	_____
b. quality of the interaction with my faculty advisor	[ ]	[ ]	[ ]	[ ]	[ ]	_____
c. my research experience (check here if not applicable: [ ])	[ ]	[ ]	[ ]	[ ]	[ ]	_____
d. program advising/guidance	[ ]	[ ]	[ ]	[ ]	[ ]	_____
e. personal nature of the program	[ ]	[ ]	[ ]	[ ]	[ ]	_____
f. camaraderie with fellow students	[ ]	[ ]	[ ]	[ ]	[ ]	_____
g. availability of courses on desired topics	[ ]	[ ]	[ ]	[ ]	[ ]	_____
h. improving my public speaking skills	[ ]	[ ]	[ ]	[ ]	[ ]	_____
i. improving my technical writing skills	[ ]	[ ]	[ ]	[ ]	[ ]	_____
j. improving my critical thinking skills	[ ]	[ ]	[ ]	[ ]	[ ]	_____
k. giving me constructive teamwork experience	[ ]	[ ]	[ ]	[ ]	[ ]	_____
l. internship opportunities	[ ]	[ ]	[ ]	[ ]	[ ]	_____
m. the ITS seminar series	[ ]	[ ]	[ ]	[ ]	[ ]	_____
n. providing networking opportunities with other professionals	[ ]	[ ]	[ ]	[ ]	[ ]	_____

	Poor	*Fair*	*Good*	*Very good*	*Excellent*	*Comments*
o. assistance in finding employment	[ ]	[ ]	[ ]	[ ]	[ ]	_____
p. career preparation	[ ]	[ ]	[ ]	[ ]	[ ]	_____
q. treatment of ethics issues	[ ]	[ ]	[ ]	[ ]	[ ]	_____
r. other (please specify): _____	[ ]	[ ]	[ ]	[ ]	[ ]	_____

2. Did you participate in any internships while at UC Davis?

[ ] no (go to question 7)
[ ] yes

3. How would you evaluate your internship experience?

[ ] poor
[ ] fair
[ ] good
[ ] very good
[ ] excellent

Please explain any answer:

4. What did you like most about your graduate experience at UC Davis?

5. What did you like least about your graduate experience at UC Davis?

6. How well did the program meet your expectations?

[ ] much worse than expected
[ ] worse than expected
[ ] about what I expected
[ ] in some ways better, in some ways worse than expected
[ ] better than expected
[ ] much better than expected

Please explain any answer:

7. What suggestions do you have for enhancing the experience here for other students?

8. Do you have any other comments about UCD's graduate transportation programs that you'd like to share?

PART B
YOUR CURRENT STATUS

1. What is your current status? Please check the *single* most appropriate answer.

   [ ] Still a student, or expect to be within the next academic year *(please go to Part D)*
   [ ] Working at UC Davis while looking for an outside job
   [ ] Working at UC Davis and not currently looking for an outside job *(please go to Part C)*
   [ ] Not working, but actively looking for a job
   [ ] Not working and not actively looking for a job *(please go to Part D)*
   [ ] Working outside UC Davis

2. In this most recent job search, how long did you/have you been actively looking for a job?

   _____ months

3. To how many different organizations did you send (have you sent) a resume or expression of interest?

   [ ] 1-5 [ ] 6-10 [ ] 11-15 [ ] 16 or more

4. On how many web sites did you post (have you posted) your resume or expression of interest?

   [ ] 0 [ ] 1 [ ] 2 [ ] 3 or more

5. With how many different organizations did you have (have you had) a job interview?

   [ ] 1 [ ] 2 [ ] 3 [ ] 4 or more

If you are not currently working, please go to Part D.

PART C
YOUR CURRENT JOB

4. How many job offers did you receive, including the one you accepted? _____

5. Who is your current employer? _____

6. How would your employer be classified?

   [ ] education
   [ ] industry
   [ ] consulting
   [ ] government
   [ ] non-profit
   [ ] other (please specify): _____

4. What is your current position? _____

5. Would you consider this position to be a typical disciplinary-based position, or a multidisciplinary position?

   [ ] disciplinary
   [ ] multidisciplinary

   Please explain either answer: _____

6. Was the extent of your multidisciplinary preparation a factor in your getting this job?

   [ ] no
   [ ] not sure
   [ ] yes (please explain): _____

7. What was/is your official start date? _____

8. Had you worked for this employer before the position you have now? E.g. before you came to grad school, or in an internship?

   [ ] no
   [ ] yes (please explain): _____

9. How would you rate this job with respect to its *compatibility with your immediate career goals*?

[ ] It is exactly the kind of thing I had in mind.
[ ] It's not perfect, but it fits in some ways.
[ ] It's not a good fit, but it looked like my best choice for now.

11. What is your degree of satisfaction with the following aspects of your job?

	Very dissatisfied	*Dissatisfied*	*Neutral or mixed*	*Satisfied*	*Very satisfied*
b. Content of the work	[ ]	[ ]	[ ]	[ ]	[ ]
b. Supervisor	[ ]	[ ]	[ ]	[ ]	[ ]
c. Salary	[ ]	[ ]	[ ]	[ ]	[ ]
f. Fringe benefits	[ ]	[ ]	[ ]	[ ]	[ ]
g. Opportunity for professional development	[ ]	[ ]	[ ]	[ ]	[ ]
f. Overall	[ ]	[ ]	[ ]	[ ]	[ ]

11. In what range does your current job-based annual income fall, before taxes?

[ ] $30,000 or less
[ ] $30,001-40,000
[ ] $40,001-50,000
[ ] $50,001-60,000
[ ] $60,001-70,000
[ ] $70,001-80,000
[ ] more than $80,000

PART D
FINAL QUESTIONS

In case you choose to answer this survey anonymously, it will be important for us to know just a few general things about you, in order to put your answers in perspective.

1. Which graduate degree(s) *in a transportation-related field* did you obtain at UC Davis?

   [ ] MS only
   [ ] PhD only
   [ ] MS and PhD
   [ ] did not complete a transportation-related graduate degree at UC Davis

3. When did you receive your transportation-related graduate degree(s) from UC Davis?

   _____ _____
   quarter year

   _____ _____
   quarter year

3. From which program(s) did you obtain your transportation-related graduate degree(s) at UC Davis? Check all that are applicable if you obtained more than one relevant graduate degree.

   [ ] Transportation Technology and Policy
   [ ] Civil and Environmental Engineering
   [ ] Mechanical and Aeronautical Engineering
   [ ] Chemical Engineering
   [ ] Chemistry
   [ ] Ecology
   [ ] Agricultural Economics
   [ ] Economics
   [ ] Other (please specify): _____

4. Did you obtain any funding from IGERT during your graduate program?

   [ ] no
   [ ] not sure
   [ ] yes

Thank you very much for your time. Please feel free to offer any additional comments that you may have.

APPENDIX H

TTP AND CEE ANNUAL PROGRAM STATISTICS

TTP 1999-2000

1		#	%	V	%	Q	%	A	%
2	**Inquiries/Contacts**	46							
3	**Inquiries/Contacts+apps w/no prev. contact**	81							
4	**Completed Apps**								
5	# (%of Row 3-**Total**)	37	46%						
6	Average GREs			539	68%	728	84%	658	75%
7	# (% of Row 5-**Completed**) domestic	17	46%						
8	# (% of Row 5-**Completed**) international	20	54%						
9	# (% of Row 5-**Completed**) male	26	70%						
10	# (% of Row 5-**Completed**) female	11	30%						
11	# (% of Row 5-**Completed**) MS	14	38%						
12	# (% of Row 5-**Completed**) PhD	23	62%						
13	**Admitted Apps**								
14	# (% of Row 3-**Total**)	23	28%						
15	(% of Row 5-**Completed**)		62%						
16	Average GREs			530	66%	715	82%	657	74%
17	# (% of Row 14-**Admitted**) domestic	15	65%						
18	# (% of Row 14-**Admitted**) international	8	35%						
19	# (% of Row 14-**Admitted**) male	16	70%						
20	# (% of Row 14-**Admitted**) female	7	30%						
21	# (% of Row 14-**Admitted**) MS	11	48%						
22	# (% of Row 14-**Admitted**) PhD	12	52%						
23	**Offered Full Aid**								
24	# (% of Row 3-**Total**)	9	11%						
25	(% of Row 5-**Completed**)		24%						
26	(% of Row 14-**Admitted**)		39%						
27	Average GREs			540	68%	717	82%	660	75%
28	**Offered IGERT**								
29	# (% of Row 3-**Total**)	4	5%						
30	(% of Row 5-**Completed**)		11%						
31	(% of Row 14-**Admitted**)		17%						
32	Average GREs			508	59%	513	80%	660	73%
33	# (% of Row 29-**Offered IGERT**) male	2	50%						
34	# (% of Row 29-**Offered IGERT**) female	2	50%						
35	**Offered Partial Aid**								
36	# (% of Row 3-**Total**)	0	0%						
37	(% of Row 5-**Completed**)		0%						
38	(% of Row 14-**Admitted**)		0%						
39	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
40	**Own Funds**								
41	# (% of Row 3-**Total**)	2	2%						
42	(% of Row 5-**Completed**)		5%						
43	(% of Row 14-**Admitted**)		9%						
44	Average GREs			525	65%	595	57%	575	55%

45	**Enrolled Apps**								
46	# (% of Row 3-**Total**)	8	10%						
47	(% of Row 5-**Completed**)		22%						
48	(% of Row 14-**Admitted**)		35%						
49	Average GREs			523	64%	678	74%	619	64%
50	# (% of Row 46-**Enrolled**) domestic	7	88%						
51	# (% of Row 46-**Enrolled**) international	1	13%						
52	# (% of Row 46-**Enrolled**) male	5	63%						
53	# (% of Row 46-**Enrolled**) female	3	38%						
54	# (% of Row 46-**Enrolled**) MS	6	75%						
55	# (% of Row 46-**Enrolled**) PhD	2	25%						
56	**Enrolled Apps with Full Funding**								
57	# (% of Row 24-**Offered Full Aid**)	6	67%						
58	**Enrolled Apps with IGERT**								
59	# (% of Row 29-**Offered IGERT**)	3	75%						
60	Average GREs			483	55%	693	76%	650	69%
61	# (% of Row 5-**Completed**) male	2	67%						
62	# (% of Row 5-**Completed**) female	1	33%						
63	**Enrolled Apps with Partial Aid**								
64	# (% of Row 3-**Tota**l)	0	#####						
65	**Enrolled Apps with Own Funds**								
66	# (% of Row 41-**Own funds**)	2	100%						
67	**Enrolled Apps with Any Funds**								
68	# (% of Rows 24+36+41- **all w/ $**)	8	73%						
69	**Enrolled Apps with Full Aid or Own Funds**								
70	# (% of Rows 24+41-**Off. Full Aid +own funds**)	8	73%						

TTP 2000-2001

1		#	%	V	%	Q	%	A	%
2	**Inquiries/Contacts**	122							
3	**Inquiries/Contacts+apps (10) w/no prev. contact**	132							
4	**Completed Apps**								
5	# (%of Row 3-**Total**)	26	20%						
6	Average GREs			491	54%	728	85%	640	70%
7	# (% of Row 5-**Completed**) domestic	6	23%						
8	# (% of Row 5-**Completed**) international	20	77%						
9	# (% of Row 5-**Completed**) female	3	12%						
10	# (% of Row 5-**Completed**) male	23	88%						
11	# (% of Row 5-**Completed**) MS	6	23%						
12	# (% of Row 5-**Completed**) PhD	20	77%						
13	**Admitted Apps**								
14	# (% of Row 3-**Total**)	12	9%						
15	(% of Row 5-**Completed**)		46%						
16	Average GREs			570	74%	769	94%	727	89%
17	# (% of Row 14-**Admitted**) domestic	3	25%						
18	# (% of Row 14-**Admitted**) international	9	75%						
19	# (% of Row 14-**Admitted**) male	11	92%						
20	# (% of Row 14-**Admitted**) female	1	8%						
21	# (% of Row 14-**Admitted**) MS	1	8%						
22	# (% of Row 14-**Admitted**) PhD	11	92%						
23	**Offered Full Aid**								
24	# (% of Row 3-**Total**)	4	3%						
25	(% of Row 5-**Completed**)		15%						
26	(% of Row 14-**Admitted**)		33%						
27	Average GREs			557	71%	727	86%	703	87%
28	**Offered IGERT**								
29	# (% of Row 3-**Total**)	3	2%						
30	(% of Row 5-**Completed**)		12%						
31	(% of Row 14-**Admitted**)		25%						
32	Average GREs			595	81%	715	84%	685	85%
33	# (% of Row 29-**Offered IGERT**) male	3	100%						
34	# (% of Row 29-**Offered IGERT**) female	0	0%						
35	**Offered Partial Aid**								
36	# (% of Row 3-**Total**)	0	0%						
37	(% of Row 5-**Completed**)		0%						
38	(% of Row 14-**Admitted**)		0%						
39	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
40	**Own Funds**								
41	# (% of Row 3-**Total**)	0	0%						
42	(% of Row 5-**Completed**)		0%						
43	(% of Row 14-**Admitted**)		0%						
44	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A

45	**Enrolled Apps**								
46	# (% of Row 3-**Total**)	4	3%						
47	(% of Row 5-**Completed**)		15%						
48	(% of Row 14-**Admitted**)		33%						
49	Average GREs			557	71%	727	86%	703	87%
50	# (% of Row 46-**Enrolled**) domestic	3	75%						
51	# (% of Row 46-**Enrolled**) international	1	25%						
52	# (% of Row 46-**Enrolled**) male	4	100%						
53	# (% of Row 46-**Enrolled**) female	0	0%						
54	# (% of Row 46-**Enrolled**) MS	1	25%						
55	# (% of Row 46-**Enrolled**) PhD	3	75%						
56	**Enrolled Apps with Full Funding**								
57	# (% of Row 24-**Offered Full Aid**)	4	100%						
58	**Enrolled Apps with IGERT**								
59	# (% of Row 29-**Offered IGERT**)	3	100%						
60	Average GREs			595	81%	715	84%	685	85%
61	# (% of Row 5-**Completed**) male	3	100%						
62	# (% of Row 5-**Completed**) female	0	0%						
63	**Enrolled Apps with Partial Aid**								
64	# (% of Row 3-**Total**)	0	#####						
65	**Enrolled Apps with Own Funds**								
66	# (% of Row 41-**Own funds**)	0	#####						
67	**Enrolled Apps with Any Funds**								
68	# (% of Rows 24+36+41- **all w/ $**)	4	100%						
69	**Enrolled Apps with Full Aid or Own Funds**								
70	# (% of Rows 24+41-**Off. Full Aid +own funds**)	4	100%						

TTP 2001-2002

1		#	%	V	%	Q	%	A	%
2	**Inquiries/Contacts**	76							
3	**Inquiries/Contacts+ 13 apps w/no prev. contact**	89							
4	**Completed Apps**								
5	# (%of Row 3-**Total**)	27	30%						
6	Average GREs			554	72%	736	84%	655	75%
7	# (% of Row 5-**Completed**) domestic	9	33%						
8	# (% of Row 5-**Completed**) international	18	67%						
9	# (% of Row 5-**Completed**) male	18	67%						
10	# (% of Row 5-**Completed**) female	9	33%						
11	# (% of Row 5-**Completed**) MS	16	59%						
12	# (% of Row 5-**Completed**) PhD	11	41%						
13	**Admitted Apps**								
14	# (% of Row 3-**Total**)	23	26%						
15	(% of Row 5-**Completed**)		85%						
16	Average GREs			558	73%	740	85%	665	72%
17	# (% of Row 14-**Admitted**) domestic	7	30%						
18	# (% of Row 14-**Admitted**) international	16	70%						
19	# (% of Row 14-**Admitted**) male	11	48%						
20	# (% of Row 14-**Admitted**) female	12	52%						
21	# (% of Row 14-**Admitted**) MS	15	65%						
22	# (% of Row 14-**Admitted**) PhD	8	35%						
23	**Offered Full Aid**								
24	# (% of Row 3-**Total**)	6	7%						
25	(% of Row 5-**Completed**)		22%						
26	(% of Row 14-**Admitted**)		26%						
27	Average GREs			472	57%	693	73%	598	67%
28	**Offered IGERT**								
29	# (% of Row 3-**Total**)	2	2%						
30	(% of Row 5-**Completed**)		7%						
31	(% of Row 14-**Admitted**)		9%						
32	Average GREs			555	73%	675	71%	605	63%
33	# (% of Row 29-**Offered IGERT**) male	2	100%						
34	# (% of Row 29-**Offered IGERT**) female	0	0%						
35	**Offered Partial Aid**								
36	# (% of Row 3-**Total**)	2	2%						
37	(% of Row 5-**Completed**)		7%						
38	(% of Row 14-**Admitted**)		9%						
39	Average GREs			625	89%	700	76%	645	73%
40	**Own Funds**								
41	# (% of Row 3-**Total**)	2	2%						
42	(% of Row 5-**Completed**)		7%						
43	(% of Row 14-**Admitted**)		9%						
44	Average GREs			380	24%	800	98%	735	92%

45	**Enrolled Apps**								
46	# (% of Row 3-**Total**)	8	9%						
47	(% of Row 5-**Completed**)		30%						
48	(% of Row 14-**Admitted**)		35%						
49	Average GREs			510	66%	695	74%	610	68%
50	# (% of Row 46-**Enrolled**) domestic	6	75%						
51	# (% of Row 46-**Enrolled**) international	2	25%						
52	# (% of Row 46-**Enrolled**) male	7	88%						
53	# (% of Row 46-**Enrolled**) female	1	13%						
54	# (% of Row 46-**Enrolled**) MS	5	63%						
55	# (% of Row 46-**Enrolled**) PhD	3	38%						
56	**Enrolled Apps with Full Funding**								
57	# (% of Row 24-**Offered Full Aid**)	6	100%						
58	**Enrolled Apps with IGERT**								
59	# (% of Row 29-**Offered IGERT**)	2	100%						
60	Average GREs			555	73%	675	71%	605	63%
61	# (% of Row 5-**Completed**) male	2	100%						
62	# (% of Row 5-**Completed**) female	0	0%						
63	**Enrolled Apps with Partial Aid**								
64	# (% of Row 3-**Total**)	2	100%						
65	**Enrolled Apps with Own Funds**								
66	# (% of Row 41-**Own funds**)	0	0%						
67	**Enrolled Apps with Any Funds**								
68	# (% of Rows 57+64+66 - **all w/ $**)	8	100%						
69	**Enrolled Apps with Full Aid or Own Funds**								
70	# (% of Rows 57+66-**Off. Full Aid +own funds**)	6	100%						

TTP 2002-2003

1		#	%	V	%	Q	%	A	%
2	**Inquiries/Contacts**	125							
3	**Inquiries/Contacts+ 18 apps w/no prev. contact**	143							
4	**Completed Apps**								
5	# (%of Row 3-**Total**)	41	29%						
6	Average GREs			583	75	759	88	696	81
7	# (% of Row 5-**Completed**) domestic	17	41%						
8	# (% of Row 5-**Completed**) international	24	59%						
9	# (% of Row 5-**Completed**) male	29	71%						
10	# (% of Row 5-**Completed**) female	12	29%						
11	# (% of Row 5-**Completed**) MS	16	39%						
12	# (% of Row 5-**Completed**) PhD	25	61%						
13	**Admitted Apps**								
14	# (% of Row 3-**Total**)	33	23%						
15	(% of Row 5-**Completed**)		80%						
16	Average GREs			609	81	760	88	713	86
17	# (% of Row 14-**Admitted**) domestic	17	52%						
18	# (% of Row 14-**Admitted**) international	16	48%						
19	# (% of Row 14-**Admitted**) male	24	73%						
20	# (% of Row 14-**Admitted**) female	9	27%						
21	# (% of Row 14-**Admitted**) MS	12	36%						
22	# (% of Row 14-**Admitted**) PhD	21	64%						
23	**Offered Full Aid**								
24	# (% of Row 3-**Total**)	14	10%						
25	(% of Row 5-**Completed**)		34%						
26	(% of Row 14-**Admitted**)		42%						
27	Average GREs			573	73	746	85	721	85
28	**Offered IGERT**								
29	# (% of Row 3-**Total**)	6	4%						
30	(% of Row 5-**Completed**)		15%						
31	(% of Row 14-**Admitted**)		18%						
32	Average GREs			565	75	755	88	757	93
33	# (% of Row 29-**Offered IGERT**) male	4	67%						
34	# (% of Row 29-**Offered IGERT**) female	2	33%						
35	**Offered Partial Aid**								
36	# (% of Row 3-**Total**)	1	1%						
37	(% of Row 5-**Completed**)		2%						
38	(% of Row 14-**Admitted**)		3%						
39	Average GREs			620	88	690	72	800	98
40	**Own Funds**								
41	# (% of Row 3-**Total**)	2	1%						
42	(% of Row 5-**Completed**)		5%						
43	(% of Row 14-**Admitted**)		6%						
44	Average GREs			535	69	730	81	680	79

45	**Enrolled Apps**								
46	# (% of Row 3-**Total**)	14	10%						
47	(% of Row 5-**Completed**)		34%						
48	(% of Row 14-**Admitted**)		42%						
49	Average GREs			587	78	735	82	722	86
50	# (% of Row 46-**Enrolled**) domestic	12	86%						
51	# (% of Row 46-**Enrolled**) international	2	14%						
52	# (% of Row 46-**Enrolled**) male	11	79%						
53	# (% of Row 46-**Enrolled**) female	3	21%						
54	# (% of Row 46-**Enrolled**) MS	12	86%						
55	# (% of Row 46-**Enrolled**) PhD	2	14%						
56	**Enrolled Apps with Full Funding**								
57	# (% of Row 24-**Offered Full Aid**)	11	79%						
58	**Enrolled Apps with IGERT**								
59	# (% of Row 29-**Offered IGERT**)	5	83%						
60	Average GREs			525	64	750	86	737	90
61	# (% of Row 5-**Completed**) male	3	60%						
62	# (% of Row 5-**Completed**) female	2	40%						
63	**Enrolled Apps with Partial Aid**								
64	# (% of Row 3-**Total**)	1	100%						
65	**Enrolled Apps with Own Funds**								
66	# (% of Row 41-**Own funds**)	2	100%						
67	**Enrolled Apps with Any Funds**								
68	# (% of Rows 57+64+66 - **all w/ $**)	14	100%						
69	**Enrolled Apps with Full Aid or Own Funds**								
70	# (% of Rows 57+66-**Off. Full Aid +own funds**)	13	100%						

TTP 2003-2004

1		#	%	V	%	Q	%	A	%
2	**Inquiries/Contacts**	82							
3	**Inquiries/Contacts+ 37 apps w/no prev. contact**	119							
4	**Completed Apps**								
5	# (%of Row 3-**Total**)	49	41%						
6	Average GREs			583	76%	755	86%	721	83%
7	# (% of Row 5-**Completed**) domestic	17	35%						
8	# (% of Row 5-**Completed**) international	32	65%						
9	# (% of Row 5-**Completed**) male	35	71%						
10	# (% of Row 5-**Completed**) female	14	29%						
11	# (% of Row 5-**Completed**) MS	16	33%						
12	# (% of Row 5-**Completed**) PhD	33	67%						
13	**Admitted Apps**								
14	# (% of Row 3-**Total**)	29	24%						
15	(% of Row 5-**Completed**)		59%						
16	Average GREs			606	81%	768	88%	726	86%
17	# (% of Row 14-**Admitted**) domestic	15	52%						
18	# (% of Row 14-**Admitted**) international	14	48%						
19	# (% of Row 14-**Admitted**) male	22	76%						
20	# (% of Row 14-**Admitted**) female	7	24%						
21	# (% of Row 14-**Admitted**) MS	15	52%						
22	# (% of Row 14-**Admitted**) PhD	14	48%						
23	**Offered Full Aid**								
24	# (% of Row 3-**Total**)	13	11%						
25	(% of Row 5-**Completed**)		27%						
26	(% of Row 14-**Admitted**)		45%						
27	Average GREs			603	83%	732	80%	734	87%
28	**Offered IGERT**								
29	# (% of Row 3-**Total**)	0	0%						
30	(% of Row 5-**Completed**)		0%						
31	(% of Row 14-**Admitted**)		0%						
32	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
33	# (% of Row 29-**Offered IGERT**) male	0	#####						
34	# (% of Row 29-**Offered IGERT**) female	0	#####						
35	**Offered Partial Aid**								
36	# (% of Row 3-**Total**)	2	2%						
37	(% of Row 5-**Completed**)		4%						
38	(% of Row 14-**Admitted**)		7%						
39	Average GREs			475	49%	725	79%	660	74%
40	**Own Funds**								
41	# (% of Row 3-**Total**)	4	3%						
42	(% of Row 5-**Completed**)		8%						
43	(% of Row 14-**Admitted**)		14%						
44	Average GREs			600	81%	758	86%	630	66%

45	**Enrolled Apps**								
46	# (% of Row 3-**Total**)	8	7%						
47	(% of Row 5-**Completed**)		16%						
48	(% of Row 14-**Admitted**)		28%						
49	Average GREs			596	81%	736	81%	687	78%
50	# (% of Row 46-**Enrolled**) domestic	6	75%						
51	# (% of Row 46-**Enrolled**) international	2	25%						
52	# (% of Row 46-**Enrolled**) male	8	100%						
53	# (% of Row 46-**Enrolled**) female	0	0%						
54	# (% of Row 46-**Enrolled**) MS	5	63%						
55	# (% of Row 46-**Enrolled**) PhD	3	38%						
56	**Enrolled Apps with Full Funding**								
57	# (% of Row 24-**Offered Full Aid**)	5	38%						
58	**Enrolled Apps with IGERT**								
59	# (% of Row 29-**Offered IGERT**)	0	#####						
60	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
61	# (% of Row 5-**Completed**) male	0	#####						
62	# (% of Row 5-**Completed**) female	0	#####						
63	**Enrolled Apps with Partial Aid**								
64	# (% of Row 36-**Total**)	1	50%						
65	**Enrolled Apps with Own Funds**								
66	# (% of Row 41-**Own funds**)	2	50%						
67	**Enrolled Apps with Any Funds**								
68	# (% of Rows 57+64+66 - **all w/ $**)	8	100%						
69	**Enrolled Apps with Full Aid or Own Funds**								
70	# (% of Rows 57+66-**Off. Full Aid +own funds**)	7	100%						

TTP 2004-2005

1		#	%	V	%	Q	%	A	%
2	**Inquiries/Contacts**	48							
3	**Inquiries/Contacts+ 21 apps w/no prev. contact**	69							
4	**Completed Apps**								
5	# (%of Row 3-**Total**)	33	48%						
6	Average GREs			555	69%	742	78%	670	56%
7	# (% of Row 5-**Completed**) domestic	20	61%						
8	# (% of Row 5-**Completed**) international	13	39%						
9	# (% of Row 5-**Completed**) male	25	76%						
10	# (% of Row 5-**Completed**) female	8	24%						
11	# (% of Row 5-**Completed**) MS	22	67%						
12	# (% of Row 5-**Completed**) PhD	11	33%						
13	**Admitted Apps**								
14	# (% of Row 3-**Total**)	21	30%						
15	(% of Row 5-**Completed**)		64%						
17	# (% of Row 14-**Admitted**) domestic	14	67%	597	79%	746	81%	670	68%
18	# (% of Row 14-**Admitted**) international	7	33%						
19	# (% of Row 14-**Admitted**) male	15	71%						
20	# (% of Row 14-**Admitted**) female	6	29%						
21	# (% of Row 14-**Admitted**) MS	10	48%						
22	# (% of Row 14-**Admitted**) PhD	11	52%						
23	**Offered Full Aid**								
24	# (% of Row 3-**Total**)	7	10%						
25	(% of Row 5-**Completed**)		21%						
26	(% of Row 14-**Admitted**)		33%						
27	Average GREs			627	86%	721	76%	5.4	84%
28	**Offered IGERT**								
29	# (% of Row 3-**Total**)	0	0%						
30	(% of Row 5-**Completed**)		0%						
31	(% of Row 14-**Admitted**)		0%						
32	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
33	# (% of Row 29-**Offered IGERT**) male	0	#####						
34	# (% of Row 29-**Offered IGERT**) female	0	#####						
35	**Offered Partial Aid**								
36	# (% of Row 3-**Total**)	2	3%						
37	(% of Row 5-**Completed**)		6%						
38	(% of Row 14-**Admitted**)		10%						
39	Average GREs			580	80%	770	86%	790	96%
40	**Own Funds**								
41	# (% of Row 3-**Total**)	4	6%						
42	(% of Row 5-**Completed**)		12%						
43	(% of Row 14-**Admitted**)		19%						
44	Average GREs			636	87%	752	83%	4.8	58%

45	**Enrolled Apps**								
46	# (% of Row 3-**Total**)	10	14%						
47	(% of Row 5-**Completed**)		30%						
48	(% of Row 14-**Admitted**)		48%						
49	Average GREs			644	88%	739	80%	5.2	74%
50	# (% of Row 46-**Enrolled**) domestic	8	80%						
51	# (% of Row 46-**Enrolled**) international	2	20%						
52	# (% of Row 46-**Enrolled**) male	8	80%						
53	# (% of Row 46-**Enrolled**) female	2	20%						
54	# (% of Row 46-**Enrolled**) MS	9	90%						
55	# (% of Row 46-**Enrolled**) PhD	1	10%						
56	**Enrolled Apps with Full Funding**								
57	# (% of Row 24-**Offered Full Aid**)	4	57%						
58	**Enrolled Apps with IGERT**								
59	# (% of Row 29-**Offered IGERT**)	0	#####						
60	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
61	# (% of Row 5-**Completed**) male	0	#####						
62	# (% of Row 5-**Completed**) female	0	#####						
63	**Enrolled Apps with Partial Aid**								
64	# (% of Row 36-**Total**)	2	100%						
65	**Enrolled Apps with Own Funds**								
66	# (% of Row 41-**Own funds**)	4	100%						
67	**Enrolled Apps with Any Funds**								
68	# (% of Rows 57+64+66 - **all w/ $**)	10	100%						
69	**Enrolled Apps with Full Aid or Own Funds**								
70	# (% of Rows 57+66-**Off. Full Aid +own funds**)	8	100%						

CEE 1999-2000

1		#	%	V	%	Q	%	A	%
2	**Inquiries/Contacts**	0							
3	**Inquiries/Contacts+ 22 apps w/no prev. contact**	22							
4	**Completed Apps**								
5	# (%of Row 3-**Total**)	22	100%						
6	Average GREs			517	60%	769	93%	667	76%
7	# (% of Row 5-**Completed**) domestic	1	5%						
8	# (% of Row 5-**Completed**) international	21	95%						
9	# (% of Row 5-**Completed**) male	17	77%						
10	# (% of Row 5-**Completed**) female	5	23%						
11	# (% of Row 5-**Completed**) MS	16	73%						
12	# (% of Row 5-**Completed**) PhD	6	27%						
13	**Admitted Apps**								
14	# (% of Row 3-**Total**)	13	59%						
15	(% of Row 5-**Completed**)		59%						
16	Average GREs			550	70%	772	93%	688	81%
17	# (% of Row 14-**Admitted**) domestic	1	8%						
18	# (% of Row 14-**Admitted**) international	12	92%						
19	# (% of Row 14-**Admitted**) male	10	77%						
20	# (% of Row 14-**Admitted**) female	3	23%						
21	# (% of Row 14-**Admitted**) MS	3	23%						
22	# (% of Row 14-**Admitted**) PhD	10	77%						
23	**Offered Full Aid**								
24	# (% of Row 3-**Total**)	6	27%						
25	(% of Row 5-**Completed**)		27%						
26	(% of Row 14-**Admitted**)		46%						
27	Average GREs			508	58%	775	94%	628	69%
28	**Offered IGERT**								
29	# (% of Row 3-**Total**)	1	5%						
30	(% of Row 5-**Completed**)		5%						
31	(% of Row 14-**Admitted**)		8%						
32	Average GREs			520	65%	780	95%	660	78%
33	# (% of Row 29-**Offered IGERT**) male	1	100%						
34	# (% of Row 29-**Offered IGERT**) female	0	0%						
35	**Offered Partial Aid**								
36	# (% of Row 3-**Total**)	0	0%						
37	(% of Row 5-**Completed**)		0%						
38	(% of Row 14-**Admitted**)		0%						
39	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
40	**Own Funds**								
41	# (% of Row 3-**Total**)	1	5%						
42	(% of Row 5-**Completed**)		5%						
43	(% of Row 14-**Admitted**)		8%						
44	Average GREs			560	75%	770	93%	750	94%

45	**Enrolled Apps**								
46	# (% of Row 3-**Total**)	4	18%						
47	(% of Row 5-**Completed**)		18%						
48	(% of Row 14-**Admitted**)		31%						
49	Average GREs			540	66%	788	97%	625	68%
50	# (% of Row 46-**Enrolled**) domestic	0	0%						
51	# (% of Row 46-**Enrolled**) international	4	100%						
52	# (% of Row 46-**Enrolled**) male	4	100%						
53	# (% of Row 46-**Enrolled**) female	0	0%						
54	# (% of Row 46-**Enrolled**) MS	0	0%						
55	# (% of Row 46-**Enrolled**) PhD	4	100%						
56	**Enrolled Apps with Full Funding**								
57	# (% of Row 24-**Offered Full Aid**)	3	50%						
58	**Enrolled Apps with IGERT**								
59	# (% of Row 29-**Offered IGERT**)	0	0%						
60	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
61	# (% of Row 5-**Completed**) male	0	#####						
62	# (% of Row 5-**Completed**) female	0	#####						
63	**Enrolled Apps with Partial Aid**								
64	# (% of Row 3-**Total**)	0	#####						
65	**Enrolled Apps with Own Funds**								
66	# (% of Row 41-**Own funds**)	1	100%						
67	**Enrolled Apps with Any Funds**								
68	# (% of Rows 24+36+41- **all w/ $**)	4	57%						
69	**Enrolled Apps with Full Aid or Own Funds**								
70	# (% of Rows 24+41-**Off. Full Aid +own funds**)	4	57%						

CEE 2000-2001

1		#	%	V	%	Q	%	A	%
2	**Inquiries/Contacts**	37							
3	**Inquiries/Contacts+ 29 apps w/no prev. contact**	66							
4	**Completed Apps**								
5	# (%of Row 3-**Total**)	29	44%						
6	Average GREs			493	55%	771	93%	661	75%
7	# (% of Row 5-**Completed**) domestic	2	7%						
8	# (% of Row 5-**Completed**) international	27	93%						
9	# (% of Row 5-**Completed**) male	18	62%						
10	# (% of Row 5-**Completed**) female	11	38%						
11	# (% of Row 5-**Completed**) MS	12	41%						
12	# (% of Row 5-**Completed**) PhD	17	59%						
13	**Admitted Apps**								
14	# (% of Row 3-**Total**)	21	32%						
15	(% of Row 5-**Completed**)		72%						
16	Average GREs			518	62%	777	94%	707	85%
17	# (% of Row 14-**Admitted**) domestic	2	10%						
18	# (% of Row 14-**Admitted**) international	19	90%						
19	# (% of Row 14-**Admitted**) male	14	67%						
20	# (% of Row 14-**Admitted**) female	7	33%						
21	# (% of Row 14-**Admitted**) MS	7	33%						
22	# (% of Row 14-**Admitted**) PhD	14	67%						
23	**Offered Full Aid**								
24	# (% of Row 3-**Total**)	0	0%						
25	(% of Row 5-**Completed**)		0%						
26	(% of Row 14-**Admitted**)		0%						
27	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
28	**Offered IGERT**								
29	# (% of Row 3-**Total**)	1	2%						
30	(% of Row 5-**Completed**)		3%						
31	(% of Row 14-**Admitted**)		5%						
32	Average GREs			500	60%	680	74%	690	84%
33	# (% of Row 29-**Offered IGERT**) male	0	0%						
34	# (% of Row 29-**Offered IGERT**) female	1	100%						
35	**Offered Partial Aid**								
36	# (% of Row 3-**Total**)	2	3%						
37	(% of Row 5-**Completed**)		7%						
38	(% of Row 14-**Admitted**)		10%						
39	Average GREs			425	37%	740	87%	670	80%
40	**Own Funds**								
41	# (% of Row 3-**Total**)	2	3%						
42	(% of Row 5-**Completed**)		7%						
43	(% of Row 14-**Admitted**)		10%						
44	Average GREs			370	18%	780	95%	550	51%

45	**Enrolled Apps**								
46	# (% of Row 3-**Total**)	1	2%						
47	(% of Row 5-**Completed**)		3%						
48	(% of Row 14-**Admitted**)		5%						
49	Average GREs			389	23%	770	93%	360	9%
50	# (% of Row 46-**Enrolled**) domestic	0	0%						
51	# (% of Row 46-**Enrolled**) international	1	100%						
52	# (% of Row 46-**Enrolled**) male	1	100%						
53	# (% of Row 46-**Enrolled**) female	0	0%						
54	# (% of Row 46-**Enrolled**) MS	0	0%						
55	# (% of Row 46-**Enrolled**) PhD	1	100%						
56	**Enrolled Apps with Full Funding**								
57	# (% of Row 24-**Offered Full Aid**)	0	#####						
58	**Enrolled Apps with IGERT**								
59	# (% of Row 29-**Offered IGERT**)	0	0%						
60	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
61	# (% of Row 5-**Completed**) male	0	#####						
62	# (% of Row 5-**Completed**) female	0	#####						
63	**Enrolled Apps with Partial Aid**								
64	# (% of Row 3-**Tota**l)	0	0%						
65	**Enrolled Apps with Own Funds**								
66	# (% of Row 41-**Own funds**)	1	50%						
67	**Enrolled Apps with Any Funds**								
68	# (% of Rows 24+36+41- **all w/ $**)	1	25%						
69	**Enrolled Apps with Full Aid or Own Funds**								
70	# (% of Rows 24+41-**Off. Full Aid +own funds**)	1	50%						

CEE 2001-2002

1		#	%	V	%	Q	%	A	%
2	**Inquiries/Contacts**	82							
3	**Inquiries/Contacts+ 15 apps w/no prev. contact**	97							
4	**Completed Apps**								
5	# (%of Row 3-**Total**)	49	51%						
6	Average GREs			547	69%	774	93%	705	84%
7	# (% of Row 5-**Completed**) domestic	6	12%						
8	# (% of Row 5-**Completed**) international	43	88%						
9	# (% of Row 5-**Completed**) male	37	76%						
10	# (% of Row 5-**Completed**) female	12	24%						
11	# (% of Row 5-**Completed**) MS	24	49%						
12	# (% of Row 5-**Completed**) PhD	25	51%						
13	**Admitted Apps**								
14	# (% of Row 3-**Total**)	35	36%						
15	(% of Row 5-**Completed**)		71%						
16	Average GREs			578	75%	782	95%	717	87%
17	# (% of Row 14-**Admitted**) domestic	5	14%						
18	# (% of Row 14-**Admitted**) international	30	86%						
19	# (% of Row 14-**Admitted**) male	26	74%						
20	# (% of Row 14-**Admitted**) female	9	26%						
21	# (% of Row 14-**Admitted**) MS	16	46%						
22	# (% of Row 14-**Admitted**) PhD	19	54%						
23	**Offered Full Aid**								
24	# (% of Row 3-**Total**)	9	9%						
25	(% of Row 5-**Completed**)		18%						
26	(% of Row 14-**Admitted**)		26%						
27	Average GREs			583	75%	779	94%	754	94%
28	**Offered IGERT**								
29	# (% of Row 3-**Total**)	3	3%						
30	(% of Row 5-**Completed**)		6%						
31	(% of Row 14-**Admitted**)		9%						
32	Average GREs			520	69%	765	90%	750	94%
33	# (% of Row 29-**Offered IGERT**) male	1	33%						
34	# (% of Row 29-**Offered IGERT**) female	2	67%						
35	**Offered Partial Aid**								
36	# (% of Row 3-**Total**)	0	0%						
37	(% of Row 5-**Completed**)		0%						
38	(% of Row 14-**Admitted**)		0%						
39	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
40	**Own Funds**								
41	# (% of Row 3-**Total**)	4	4%						
42	(% of Row 5-**Completed**)		8%						
43	(% of Row 14-**Admitted**)		11%						
44	Average GREs			378	25%	765	92%	538	50%

45	**Enrolled Apps**								
46	# (% of Row 3-**Total**)	8	8%						
47	(% of Row 5-**Completed**)		16%						
48	(% of Row 14-**Admitted**)		23%						
49	Average GREs			495	53%	776	94%	649	72%
50	# (% of Row 46-**Enrolled**) domestic	0	0%						
51	# (% of Row 46-**Enrolled**) international	8	100%						
52	# (% of Row 46-**Enrolled**) male	7	88%						
53	# (% of Row 46-**Enrolled**) female	1	13%						
54	# (% of Row 46-**Enrolled**) MS	2	25%						
55	# (% of Row 46-**Enrolled**) PhD	6	75%						
56	**Enrolled Apps with Full Funding**								
57	# (% of Row 24-**Offered Full Aid**)	4	44%						
58	**Enrolled Apps with IGERT**								
59	# (% of Row 29-**Offered IGERT**)	0	0%						
60	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
61	# (% of Row 5-**Completed**) male	0	#####						
62	# (% of Row 5-**Completed**) female	0	#####						
63	**Enrolled Apps with Partial Aid**								
64	# (% of Row 3-**Total**)	0	#####						
65	**Enrolled Apps with Own Funds**								
66	# (% of Row 41-**Own funds**)	4	100%						
67	**Enrolled Apps with Any Funds**								
68	# (% of Rows 57+64+66- **all w/ $**)	8	100%						
69	**Enrolled Apps with Full Aid or Own Funds**								
70	# (% of Rows 57+66- Off. Full aid + own funds)	8	100%						

CEE 2002-2003

1		#	%	V	%	Q	%	A	%
2	**Inquiries/Contacts**	99							
3	**Inquiries/Contacts + 53 apps w/no prev. contact**	152							
4	**Completed Apps**								
5	# (%of Row 3-**Total**)	78	51%						
6	Average GREs			596	72%	788	93%	736	85%
7	# (% of Row 5-**Completed**) domestic	7	9%						
8	# (% of Row 5-**Completed**) international	71	91%						
9	# (% of Row 5-**Completed**) male	60	77%						
10	# (% of Row 5-**Completed**) female	18	23%						
11	# (% of Row 5-**Completed**) MS	48	62%						
12	# (% of Row 5-**Completed**) PhD	30	38%						
13	**Admitted Apps**								
14	# (% of Row 3-**Total**)	58	38%						
15	(% of Row 5-**Completed**)		74%						
16	Average GREs			596	79%	788	95%	736	89%
17	# (% of Row 14-**Admitted**) domestic	7	12%						
18	# (% of Row 14-**Admitted**) international	51	88%						
19	# (% of Row 14-**Admitted**) male	41	71%						
20	# (% of Row 14-**Admitted**) female	17	29%						
21	# (% of Row 14-**Admitted**) MS	36	62%						
22	# (% of Row 14-**Admitted**) PhD	22	38%						
23	**Offered Full Aid**								
24	# (% of Row 3-**Total**)	6	4%						
25	(% of Row 5-**Completed**)		8%						
26	(% of Row 14-**Admitted**)		10%						
27	Average GREs			565	74%	760	88%	680	68%
28	**Offered IGERT**								
29	# (% of Row 3-**Total**)	5	3%						
30	(% of Row 5-**Completed**)		6%						
31	(% of Row 14-**Admitted**)		9%						
32	Average GREs			535	69%	758	87%	680	74%
33	# (% of Row 29-**Offered IGERT**) male	4	80%						
34	# (% of Row 29-**Offered IGERT**) female	1	20%						
35	**Offered Partial Aid**								
36	# (% of Row 3-**Total**)	4	3%						
37	(% of Row 5-**Completed**)		5%						
38	(% of Row 14-**Admitted**)		7%						
39	Average GREs			505	59%	793	96%	725	90%
40	**Own Funds**								
41	# (% of Row 3-**Total**)	3	2%						
42	(% of Row 5-**Completed**)		4%						
43	(% of Row 14-**Admitted**)		5%						
44	Average GREs			520	68%	790	96%	690	84%

45	**Enrolled Apps**								
46	# (% of Row 3-**Total**)	10	7%						
47	(% of Row 5-**Completed**)		13%						
48	(% of Row 14-**Admitted**)		17%						
49	Average GREs			549	67%	786	96%	718	88%
50	# (% of Row 46-**Enrolled**) domestic	4	40%						
51	# (% of Row 46-**Enrolled**) international	6	60%						
52	# (% of Row 46-**Enrolled**) male	8	80%						
53	# (% of Row 46-**Enrolled**) female	2	20%						
54	# (% of Row 46-**Enrolled**) MS	5	50%						
55	# (% of Row 46-**Enrolled**) PhD	5	50%						
56	**Enrolled Apps with Full Funding**								
57	# (% of Row 24-**Offered Full Aid**)	4	67%						
58	**Enrolled Apps with IGERT**								
59	# (% of Row 29-**Offered IGERT**)	3	60%						
60	Average GREs			537	69%	707	90%	693	81%
61	# (% of Row 5-**Completed**) male	3	100%						
62	# (% of Row 5-**Completed**) female	0	0%						
63	**Enrolled Apps with Partial Aid**								
64	# (% of Row 3-**Total**)	4	100%						
65	**Enrolled Apps with Own Funds**								
66	# (% of Row 41-**Own funds**)	2	67%						
67	**Enrolled Apps with Any Funds**								
68	# (% of Rows 57+64+66 - **all w/ $**)	10	100%						
69	**Enrolled Apps with Full Aid or Own Funds**								
70	# (% of Rows 57+66-**Off. Full Aid +own funds**)	6	100%						

CEE 2003-2004

1		#	%	V	%	Q	%	A	%
2	**Inquiries/Contacts**	87							
3	**Inquiries/Contacts+ 56 apps w/no prev. contact**	143							
4	**Completed Apps**								
5	# (%of Row 3-**Total**)	64	45%						
6	Average GREs			582	74%	774	89%	714	79%
7	# (% of Row 5-**Completed**) domestic	9	14%						
8	# (% of Row 5-**Completed**) international	55	86%						
9	# (% of Row 5-**Completed**) male	15	23%						
10	# (% of Row 5-**Completed**) female	49	77%						
11	# (% of Row 5-**Completed**) MS	30	47%						
12	# (% of Row 5-**Completed**) PhD	34	53%						
13	**Admitted Apps**								
14	# (% of Row 3-**Total**)	37	26%						
15	(% of Row 5-**Completed**)		58%						
16	Average GREs			604	87%	784	92%	735	82%
17	# (% of Row 14-**Admitted**) domestic	6	16%						
18	# (% of Row 14-**Admitted**) international	31	84%						
19	# (% of Row 14-**Admitted**) male	30	81%						
20	# (% of Row 14-**Admitted**) female	7	19%						
21	# (% of Row 14-**Admitted**) MS	11	30%						
22	# (% of Row 14-**Admitted**) PhD	26	70%						
23	**Offered Full Aid**								
24	# (% of Row 3-**Total**)	0	0%						
25	(% of Row 5-**Completed**)		0%						
26	(% of Row 14-**Admitted**)		0%						
27	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
28	**Offered IGERT**								
29	# (% of Row 3-**Total**)	0	0%						
30	(% of Row 5-**Completed**)		0%						
31	(% of Row 14-**Admitted**)		0%						
32	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
33	# (% of Row 29-**Offered IGERT**) male	0	#####						
34	# (% of Row 29-**Offered IGERT**) female	0	#####						
35	**Offered Partial Aid**								
36	# (% of Row 3-**Total**)	1	1%						
37	(% of Row 5-**Completed**)		2%						
38	(% of Row 14-**Admitted**)		3%						
39	Average GREs			690	96%	800	97%	800	98%
40	**Own Funds**								
41	# (% of Row 3-**Total**)	6	4%						
42	(% of Row 5-**Completed**)		9%						
43	(% of Row 14-**Admitted**)		16%						
44	Average GREs			482	53%	737	81%	620	62%

45	**Enrolled Apps**								
46	# (% of Row 3-**Total**)	7	5%						
47	(% of Row 5-**Completed**)		11%						
48	(% of Row 14-**Admitted**)		19%						
49	Average GREs			511	59%	746	83%	665	66%
50	# (% of Row 46-**Enrolled**) domestic	1	14%						
51	# (% of Row 46-**Enrolled**) international	6	86%						
52	# (% of Row 46-**Enrolled**) male	7	100%						
53	# (% of Row 46-**Enrolled**) female	0	0%						
54	# (% of Row 46-**Enrolled**) MS	4	57%						
55	# (% of Row 46-**Enrolled**) PhD	3	43%						
56	**Enrolled Apps with Full Funding**								
57	# (% of Row 24-**Offered Full Aid**)	0	#####						
58	**Enrolled Apps with IGERT**								
59	# (% of Row 29-**Offered IGERT**)	0	#####						
60	Average GREs			N/A	N/A	N/A	N/A	N/A	N/A
61	# (% of Row 5-**Completed**) male	0	#####						
62	# (% of Row 5-**Completed**) female	0	#####						
63	**Enrolled Apps with Partial Aid**								
64	# (% of Row 36-**Total**)	1	100%						
65	**Enrolled Apps with Own Funds**								
66	# (% of Row 41-**Own funds**)	6	100%						
67	**Enrolled Apps with Any Funds**								
68	# (% of Rows 57+64+66 - **all w/ $**)	7	100%						
69	**Enrolled Apps with Full Aid or Own Funds**								
70	# (% of Rows 57+66-**Off. Full Aid +own funds**)	6	100%						

CEE 2004-2005

1		#	%	V	%	Q	%	A	%
2	**Inquiries/Contacts**	52							
3	**Inquiries/Contacts+55 apps w/no prev. contact**	107							
4	**Completed Apps**								
5	# (%of Row 3-**Total**)	71	66%						
6	Average GREs			525	64%	771	87%	728	60%
7	# (% of Row 5-**Completed**) domestic	18	25%						
8	# (% of Row 5-**Completed**) international	53	75%						
9	# (% of Row 5-**Completed**) male	46	65%						
10	# (% of Row 5-**Completed**) female	25	35%						
11	# (% of Row 5-**Completed**) MS	37	52%						
12	# (% of Row 5-**Completed**) PhD	34	48%						
13	**Admitted Apps**								
14	# (% of Row 3-**Total**)	53	50%						
15	(% of Row 5-**Completed**)		75%						
16	Average GREs			526	62%	767	86%	724	60%
17	# (% of Row 14-**Admitted**) domestic	17	32%						
18	# (% of Row 14-**Admitted**) international	36	68%						
19	# (% of Row 14-**Admitted**) male	32	60%						
20	# (% of Row 14-**Admitted**) female	21	40%						
21	# (% of Row 14-**Admitted**) MS	28	53%						
22	# (% of Row 14-**Admitted**) PhD	25	47%						
23	**Offered Full Aid**								
24	# (% of Row 3-**Total**)	7	7%						
25	(% of Row 5-**Completed**)		10%						
26	(% of Row 14-**Admitted**)		13%						
27	Average GREs			630	88%	762	83%	5	66%
28	**Offered IGERT**								
29	# (% of Row 3-**Total**)	0	0%						
30	(% of Row 5-**Completed**)		0%						
31	(% of Row 14-**Admitted**)		0%						
32	Average GREs			N/A					
33	# (% of Row 29-**Offered IGERT**) male	0	0%						
34	# (% of Row 29-**Offered IGERT**) female	0	0%						
35	**Offered Partial Aid**								
36	# (% of Row 3-**Total**)	3	3%						
37	(% of Row 5-**Completed**)		4%						
38	(% of Row 14-**Admitted**)		6%						
39	Average GREs			456	45%	756	83%	4.33	42%
40	**Own Funds**								
41	# (% of Row 3-**Total**)	4	4%						
42	(% of Row 5-**Completed**)		6%						
43	(% of Row 14-**Admitted**)		8%						
44	Average GREs			541	67%	756	93%	4.67	56%

45	**Enrolled Apps**								
46	# (% of Row 3-**Total**)	8	7%						
47	(% of Row 5-**Completed**)		11%						
48	(% of Row 14-**Admitted**)		15%						
49	Average GREs			583	76%	750	81%	513	71%
50	# (% of Row 46-**Enrolled**) domestic	3	38%						
51	# (% of Row 46-**Enrolled**) international	5	63%						
52	# (% of Row 46-**Enrolled**) male	2	25%						
53	# (% of Row 46-**Enrolled**) female	6	75%						
54	# (% of Row 46-**Enrolled**) MS	4	50%						
55	# (% of Row 46-**Enrolled**) PhD	4	50%						
56	**Enrolled Apps with Full Funding**								
57	# (% of Row 24-**Offered Full Aid**)	3	43%						
58	**Enrolled Apps with IGERT**								
59	# (% of Row 29-**Offered IGERT**)	0	0%						
60	Average GREs			N/A					
61	# (% of Row 5-**Completed**) male	0	0%						
62	# (% of Row 5-**Completed**) female	0	0%						
63	**Enrolled Apps with Partial Aid**								
64	# (% of Row 36-**Total**)	1	33%						
65	**Enrolled Apps with Own Funds**								
66	# (% of Row 41-**Own funds**)	4	100%						
67	**Enrolled Apps with Any Funds**								
68	# (% of Rows 57+64+66 - **all w/ $**)	8	100%						
69	**Enrolled Apps with Full Aid or Own Funds**								
70	# (% of Rows 57+66-**Off. Full Aid +own funds**)	7	100%						

APPENDIX I

LIST OF PAPERS AND RESEARCH REPORTS PRODUCED WITH IGERT FUNDING

Citations are sorted by faculty advisor, with IGERT recipient bolded. Where more than one faculty member was a co-author, citation only appears once.

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APPENDIX J

OVERVIEWS OF SELECTED IGERT-SUPPORTED RESEARCH PROJECTS

The summaries below are loosely organized by theme. Many studies address more than one theme, but are somewhat arbitrarily assigned to one. Names of IGERT fellows are bolded.

Theme 1: Environmental Impacts of Transportation

What will be the consumer response to vehicle emission regulations? (Sperling, Bunch, Burke, Abeles, **Chen**, Kurani, Turrentine) This study was solicited by the California Air Resources Board (CARB), the state air quality regulatory agency. The purpose of the study was to research and analyze consumer response to CARB's creation of regulations to try to reduce emissions and greenhouse gasses in the transportation sector.

Chinese Rural Vehicles: An Explanatory Analysis of Technology, Economics, Industrial Organization, Energy Use, Emissions, and Policy (Sperling, Lin, **Hamilton**) Uncovered a motor vehicle industry in China that is invisible to the rest of the world, namely rural vehicles. These vehicle consume 25% of the diesel fuel in China and are large contributors to the greenhouse gas emissions and pollution. However, they also play a large role in the economic development of rural areas.

Markets for Fuel-Cell Auxiliary Power Units in Vehicles (**Lutsey**, **Brodrick**, Sperling, Dwyer) Found that an important initial application of fuel cells in vehicles would be as APUs in heavy duty trucks. Found that trucks consume a large portion of fuel while idling – surveyed truck drivers to find out how much idling affects consumption.

Testing Fuel Cells for Auxiliary Power in Trucks (Dwyer, **Brodrick,** Miller, Mader, Kulkarni, **Grupp,** others) For several years, a team of UC Davis researchers has been involved in a multi-million dollar research effort that seeks to determine if fuel cells could be installed in transport trucks to run auxiliary power units (APUs) and transport refrigeration units (TRUs) instead of diesel engines. APUs power accessories, heat, and air conditioning in the driver cab in lieu of engine idling during mandated rest periods. TRUs power the refrigeration unit in the cargo area where perishables are stored during transport.

Currently, most APUs are powered by the truck's engine, which emits pollution and consumes fuel while idling. TRUs almost always run on their own separate diesel engines, which typically use lower-grade off-road fuel and lack sophisticated emissions controls. Some TRUs can be plugged into electrical power. There is significant industry interest in developing and commercializing alternative technologies in order to meet new regulations that limit idling and off-road emissions in the near future.

Having focused on APU design and development the past few years, the UC Davis research team has now turned to studying TRUs. The research effort is led by Mechanical and Aeronautical Engineering Professor Harry A. Dwyer, Ph.D., and co-directed by assistant research engineer C.J. Brodrick, Ph.D., with substantial involvement and support from associate engineer Marshall Miller, Ph.D., and numerous students. They are currently involved in the second of a two-part study to measure existing in-use emissions on standard TRUs with diesel engines and compare them with a fuel cell unit they are designing and building to power similar TRUs.

To first characterize the emissions associated with traditional TRUs, researchers conducted multiple tests on more than 40 TRUs at a warehouse in Sacramento. Students Pippin Mader and Chintamani V. Kulkarni collected the field samples as part of Mader's master's thesis research.

Operation of TRUs is tremendously complex, Brodrick explains, because each is programmed to meet different "pull-down" and maintenance characteristics with various temperature needs and circulation requirements. Pull-down refers to the time it takes a given TRU to cool a trailer to a specified temperature. Some units are programmed for fast pull-down to protect perishables, others are programmed to accommodate other operating conditions, such as having the door shut all the time, or frequent opening and closing of the door, she notes.

"Thus, the size of TRUs, the size of the cargo compartments, and temperature requirements vary, and we see a corresponding emissions variation," Brodrick explains.

Preliminary findings have implications for the state's emissions inventory for newer in-use TRUs and will likely lead to suggestions on how the inventory may be improved by utilizing age-based emissions factors. The results could be a significant contribution to the state's effort to determine exactly how much pollution comes from this emission source.

"We're the first to do in-use emissions testing of newer TRUs in the field," Brodrick says. "Existing estimates are primarily based on lab measurements and modeling. And we know from vehicles that what happens in a lab is usually quite different from what happens in the field."

The next step in the project is under way in the UC Davis Fuel Cell Lab managed by Miller. Under Dwyer's direction, the team has developed a hybrid fuel cell/battery system using two small Ballard 1.2 kW PEM fuel cells combined with twenty-six 12-volt batteries to power a Carrier Supra 544 TRU. Student David Grupp designed power electronics for the system.

In designing a fuel cell-powered TRU, there are two challenges, Dwyer explains. Pull-down requires the most power, but once pull-down is achieved, the system typically needs considerably less energy. Because fuel cells are expensive and difficult to obtain, the researchers sought to minimize the cost by designing a system that could meet the rapid pull-down requirement without an over-sized fuel cell. "We decided to design this hybrid system with smaller fuel cells sized to work well for maintenance. The batteries provide the additional power needed for pull-down, and the fuel cells can re-charge the batteries efficiently," Dwyer explains.

The research team is conducting full system bench tests this spring. They hope to test the system with other components, such as lithium-ion batteries, later this spring. Over the summer, the team plans to acquire a trailer and install the unit for field-testing. Replacing the PEM fuel cells with solid-oxide fuel cells is another possible research direction.

The team's current work on TRUs follows several years of earlier design, development, and testing of fuel cells in APUs for the driver cab. At completion of the multi-phase project, they will have bench-tested three fuel cell systems and have analyzed costs and benefits of different fuel cell types in both APU and TRU configurations.

An Improved Model to Simulate Pollutant Dispersion from Roadways (**Held**, Chang, Niemeier) An improved dispersion model, UCD 2001, designed to estimate pollutant concentrations near roadways was developed and its performance evaluated. The model internally represents a highway link as a three-dimensional array of point sources that simulates a roadway mixing zone which extends 2.5m above a highway link. Dispersion from each point source is estimated with the Huang dispersion solution, which permits power law approximations of vertical profiles of wind speed and eddy diffusivity in the boundary layer.

The UCD 2001 model was calibrated with one-half of the General Motors (GM) SF6 tracer study data base and resulted in a selection of eddy diffusivity parameters that did not vary with ambient meteorology. The UCD 2001 model performance was evaluated and compared to the CALINE3 and CALINE4 dispersion models using the GM data base. UCD 2001 adequately simulates near parallel, low wind speed (less than 0.5 m/s) meteorological scenarios, whereas the CALINE models significantly overpredict most receptor concentrations for these conditions. The UCD 2001 model results in approximately 80-90 percent reduction in squared residual error when compared to the CALINE3 and CALINE4 models. In addition, the model exhibits better agreement in simulating the top forty observed concentrations than either CALINE model. Lastly, the UCD 2001 model requires less user input and modeler expertise than most roadway dispersion models, and should result in more consistent and robust near-field pollutant estimation.

Theme 2: Advanced Environmental Vehicles and Propulsion Systems

Hydrogen Storage Options: Technologies and Comparisons for Light-Duty Vehicle Applications (Burke, **Gardiner**) A vehicle-oriented summary from Gardiner's PhD dissertation – interpreted for hydrogen, light-duty fuel cell vehicles. Conclusion was that compressed hydrogen is the most developed technology in fuel cell vehicles to date. In the future, pressure will be increased and hybrids and carogenic carbon are possibilities.

Hydrogen Bus Technology Validation Program: Analysis and Update (Burnham, Burke, Collier, Forrest, **McCaffrey**, and Miller) McCaffrey's work was on the hydrogen bus, relating to CARB emissions requirements. He modeled fundamental processes occurring with hydrogen and natural gas in the engine. Looked at and tested a technology that could actually mean a car emission standard for having any engines and it could meet that. This was the first one that was demonstrated.

UC Davis ITS Narrow Vehicle Team (NVT) (**Kornbluth, Winston**, Burke, Sperling, Frank, Karnopp) As a possible solution to present-day roadway congestion and depleting fossil fuel reserves this project investigates the viability of a low emission, purpose-built narrow, commuter car. Along with ITS researcher Dr. Andrew Burke, IGERT fellow Kurt Kornbluth led a design team of undergraduate and graduate students in this project, which investigated the technical as well social viability of such a vehicle. Their work included aspects of the vehicle design such as drive train, component packaging, and safety. They also performed simulation analysis for efficiency and stability. Ergonomics and aesthetics also play a major role and to this end they have consulted with the Art Center School for design in Pasadena, CA. The NVT plans to collaborate with students there in the development of the final vehicle "styling".

Emily Winston (another IGERT fellow) researched the historical background of narrow vehicles, and developed possible policies that could make them more desirable to consumers. The study report includes a conceptual design as well as a discussion of strategies relating to how, when, and why to implement "Narrow vehicles". Kornbluth notes, "Although my major field of study is engineering, this project has allowed me to work in many disciplines. In addition, I have been mentored by ITS Mechanical Engineering faculty and have been able in turn to mentor the students on the team. The opportunity to work with creative people at the Arts Center has also been of great value."

Theme 3: Information/Communication Technologies and Travel

Modeling Joint Commute – Labor Engagement Decisions (**Ory**, Mokhtarian) Using socio-demographic, personality, and attitudinal data from 1,680 residents of the San Francisco Bay Area, we develop and estimate binary, multinomial, and nested logit models of the choice to work or not, whether or not to work at home, and whether to commute all of the time or some of the time (either by only working part time, or by working a compressed work week, or by telecommuting some of the time). To our knowledge, these are the first models of all these choices simultaneously. This work is relevant both to travel demand modeling, which usually bases trip or activity generation models on a given set of employment status inputs, and to labor force engagement modeling, which typically ignores the impact of travel-related variables. The model results indicate that the typical predictors of labor force engagement (gender, household income, and education) play an important role here, with family variables having an especially complex effect. Other interesting findings are that telecommuters tend to be adventure-seekers and home-based workers tend to be workaholics; those who like travel tend to commute five or more times per week; and mobility constraints are significant in the decisions to work part-time and to commute full-time.

Prospecting the Future For Hydrogen Fuel Cell Vehicle Markets (Kurani, Turrentine, Heffner, **Congleton**). We propose that the next supporting infrastructure built by modern societies will be a system that fully integrates automobility, electricity, and information. This will be accomplished, in part, by the transformation of automobiles from their current design and role as primarily mobility tools. In a technological sense, automobiles will become integrated information-mobility-electricity platforms; in a behavioral sense, they will become mobile activity locales. This is likely to lead to increases in energy use and associated emissions, due to (1) more energy-intensive lifestyles and work structures; (2) larger vehicles; and (3) more travel. Recognizing this, it is imperative (1) to increase our understanding of the new personal and social behaviors, including policy, likely to result from mobile electricity production and communications; and (2) to accelerate research and development programs on truly carbon-free energy paths.

Theme 4: Travel Behavior Analysis/Transportation Demand Modeling

Do people travel for its own sake? (**Ory**, Mokhtarian) Conventional wisdom in urban transportation planning holds that travel is purely a means to the end of participating in desired activities, and not desired for its own sake. Accordingly, transportation models and policies are formulated on the fundamental assumption that people minimize their travel times and costs. Civil engineering professor Patricia Mokhtarian and Israeli geographer Ilan Salomon have challenged this embedded assumption as a behavioral absolute. They have collected survey data to test various hypotheses about attitudes toward travel and their impacts on behavior, and have supervised a series of interdisciplinary papers and reports analyzing those data. The study conducted with IGERT fellow David Ory is a key element of the series. In this study they analyzed people's self-reported liking for various types of travel (by different modes and for different purposes), and identifed other variables that appear to influence travel liking. They found empirical support for most of the hypothesized reasons for liking travel, such as curiosity, adventure- or variety-seeking, independence, escape/ therapy, status, transition between different realms of life, exposure to the environment, scenery or other amenities, and synergy (the ability to conduct multiple activities while traveling). The concept that people can like travel for its own sake has profound implications for planning, policy, and modeling, and other scholars are beginning to build on these findings to increase our understanding of this issue.

The Price of Regulation (Sperling, Abeles, Bunch, Burke, **Chen**, Kurani, Turrentine) Regulations of vehicle technology and the regulatory process caused one-fifth to one-third of vehicle price increases between 1967 and 2001. However, the modest effect on markets is in part because rising and falling fuel prices, increasing competition from Japanese and European automakers, and shifting consumer desires are taken into account.

What is it about the built environment that influences the choice to walk? (**Winston**, Handy) The built environment has been identified as a culprit in the growing obesity epidemic in the U.S. because of its contribution to a decline in walking as a mode of transportation. However, the use of coarse measures of the built environment hindered researchers in their efforts to understand the role that the built environment plays in explaining levels of walking. This project has developed operational definitions and measurement protocols for subtle urban design qualities related to walkability: imageability, visual enclosure, human scale, transparency, and complexity. The project produced a field survey instrument that will enable other researchers to measure these qualities for the first time.

How do people manage their personal travel? (**Clay**, Mokhtarian) Policymakers have promulgated a number of strategies for reducing congestion (as well as energy consumption and emissions), trying to motivate people to shift away from automobile travel. Perhaps most often, however, those strategies do not have the desired effect – we believe because they fail to fully understand the motivations behind people's individual travel decisions. In this paper, we analyzed the adoption and consideration of 17 travel-related alternatives, by 1,282 commuters in the San Francisco Bay Area. We had expected that those who traveled a lot would be more likely to adopt/consider strategies to help them reduce their travel (such as telecommuting, modified work schedules, and shifting from drive alone to transit) – and we did – but we also found that those who traveled a lot were more likely to adopt/consider strategies that help them maintain their travel (such as getting a mobile phone or a nicer car, or changing their departure time). We suggest that if people travel a lot because they want to, they will choose strategies to support that desire and make their travel even more pleasant, and if they travel a lot because they have to, they will choose the same kinds of strategies so as to reduce the burden of the travel they must do. The first interpretation is supported by the additional finding that those who like to travel and want to do more, are less likely to consider travel-reducing strategies. We also found that women were more likely than men to have adopted/considered the more "costly" strategies such as changing from full-time to part-time, moving home or work, or quitting work altogether, which has equity implications.

APPENDIX K

CAMPUS-LEVEL DIVERSITY RECRUITMENT ACTIVITIES

University of California, Davis

AGEP

ALLIANCE FOR GRADUATE EDUCATION AND THE PROFESSORIATE

AGEP Scholars Program

The nine-week AGEP Scholars Program is set to start on July 11th and run through September 9th. In addition to a mentored research experience, students will attend seminars covering relevant topics for success in graduate school and research including research team dynamics, scientific/technical writing, effective oral presentations, efficient use of library resources and electronic citations, publishing papers and the peer review process, reading and critiquing research papers, and scientific integrity. Other activities will include faculty research presentations and informal graduate student round-table discussions, designed to create a dynamic, engaging environment for Scholars to meet faculty and current UC Davis graduate students, exchange research ideas, and share experiences. Mentors will also meet monthly for workshops on effective mentoring techniques and to share experiences.

AGEP Advantage Program

The year-long AGEP Advantage Program allows underrepresented students interested in academic careers to attend a variety of seminars to prepare them for faculty positions. The program also serves all graduate students interested in academic careers in minority serving institutions. Modeled on the successful Professors for the Future Program (PFTF), this program will specifically address issues of diversity in preparing for an academic career. Monthly seminars will focus on such topics as preparing for an academic career, balancing research, teaching, and service, working at predominantly white institutions versus a HBCU or HSI, and the challenges faced by underrepresented faculty and research institutions. The Advantage Program will include presentations by faculty from across campus and from other institutions. Student participants may also apply for funds to attend research or teaching conferences to present their research or learn effective teaching strategies.

Targeted recruiting to CSU/HBCU/HSI

The recruiting aspect of the AGEP program will enhance UC Davis' overall recruiting efforts and help to increase the number of underrepresented STEM students from the California State Universities (CSUs), Historically Black Colleges and Universities (HBCUs), and Hispanic Serving Institutions (HSIs). Potential graduate students will visit campus to attend faculty and graduate student workshops, campus and laboratory tours, and a faculty-hosted luncheon with topic tables to focus on student interests. Also, UC Davis faculty will form partnerships with CSU/HBCU/HSI faculty by visiting the campuses and offering seminars on their research.

Office of Graduate Studies
University of California, Davis

Graduate Outreach and Recruitment Activities in Support of Training Grant Programs

Graduate Outreach and Recruitment are vital elements of the overall effort to increase graduate enrollment at UC Davis. Through numerous coordinated activities, we seek to build and support an academically talented and diverse graduate student population. A particular focus of our activities is on supporting the goal of federal agencies (e.g. NSF and NIH) to increase the domestic talent pool of scientists and engineers by encouraging individuals from underrepresented and educationally disadvantaged backgrounds to pursue advanced degrees. Thus, we seek to increase the participation of these individuals in research training grant programs.

The Director of Outreach, Recruitment and Retention in the Office of Graduate Studies is responsible for a variety of programs that support training grants. The core of our outreach and recruitment efforts is based on attendance at regular graduate school information fairs at other colleges and universities. Beyond this basic effort, the primary components of these programs are: 1) National Recruitment of Undergraduate Students Currently Engaged in Research; 2) Campus Recruitment Visits from Undergraduate Students at Local Institutions with an emphasis on California State University campuses; and 3) Partnerships between UC Davis, Historically Black Colleges and Universities, and Hispanic Serving Institutions. The latter two activities are funded in part by a NSF Alliances for Graduate Education and the Professoriate (AGEP) grant at UC Davis.

1. National Recruitment of Undergraduate Students Currently Engaged in Research.

The purpose of these activities is to establish direct contacts between training grant faculty and underrepresented minority undergraduates who are actively engaged in research. One-to-one contact is critical to effective recruitment, and the opportunities for such contact are extremely rich at these conferences. Staff from Graduate Studies currently attend specific undergraduate conferences, and our office provides funding for a select group of faculty to accompany our staff. Training grant faculty represent a valuable augmentation to staff efforts, providing the ability to identify students whose research interests represent the best match for the grant. The training grant faculty also have a more in-depth understanding of the training grant itself, the graduate programs that are aligned with it, and the specific faculty interests to share with the student. Finally, these faculty could now serve as unique campus contacts for students identified as strong matches for the training grant's interests.

Targeted conferences include:

Society for the Advancement of Chicano and Native Americans in Science
(SACNAS at http://www.sacnas.org/)
Annual Biomedical Research Conference for Minority Students
(ABCRMS at http://www.abrcms.org)

California Forum for Diversity on Graduate Education
(One northern California and one southern California conference annually)
Minority Training Program in Cancer Control Research Summer Institute on Careers in Cancer Control Research
(MTPCCR at http://cc.ucsf.edu/mtpccr/)
McNair Scholars Conference
(Annually at UC Berkeley and in Wisconsin)
Hispanic Engineer National Achievement Awards Conference
(HENAAC at http://www.henaac.org/)
Louis Stokes Louisiana Alliance for Minority Participation Conference
(LS-LAMP at http://www.ls-lamp.org/)
American Indian Science and Engineering Society Conference
(AISES at http://www.aises.org)
Society of Hispanic Professional Engineers Conference
(SHPE at http://www.shpe.org/)
McNair Scholars UC Recruitment Day at UCLA
National Society for Black Engineers Conference
(NSBE at http://www.nsbe.org/)

2. Campus Recruitment Visits to and from Local Institutions

Our purpose is to institutionalize an aggressive recruitment strategy at regional universities and colleges having strong science programs, and undergraduate/graduate enrollments rich in students whose socioeconomic background has represented an impediment to their educational progression.

UC Davis is fortunate to have several such universities close at hand, a proximity which makes feasible the cultivation of a sustainable and productive relationship. We have established programs with these campuses that will ensure regular interactions between faculty and students in both locations. This includes UC Davis faculty visits to these campuses in which faculty can present research, engage students in discussions of graduate education and career progression in general, and address the specific areas of expertise in UC Davis training grants and graduate programs.

In turn, we will invite visits to UC Davis, from both faculty and students at these institutions, so that they gain familiarity with specific graduate programs, and the faculty and students that comprise them. The visiting days will include faculty and graduate student workshops, campus and lab tours, and a faculty-hosted luncheon with topic tables to focus on student interests. Such visits will address the immediate educational concerns of the students but also give them the opportunity to become familiar with the campus and community environment as well. The goal here is to raise the student/adviser knowledge of UC Davis' programs, their comfort level with the campus and community, and to initiate the formation of personal contacts.

Four campuses have been identified as a starting point: San Francisco State University; California State University, Sacramento; San Jose State University; and California State University, Chico.

3. Developing Partnerships with Institutions that Historically Serve Underrepresented Populations

To complement efforts aimed at regional Universities, we seek to develop partnerships with campuses that combine academic excellence with a history of serving minority populations. We will provide faculty and advisers from these institutions the opportunity to visit UC Davis, and learn about the campus, community, and specific programs. The desired endpoint would be to provide these faculty and advisers a knowledge and familiarity with UC Davis that gives them the assurance that our campus would be a good choice for their students, and to promote their recommendation of UC Davis to these students. Conversely, it is critical that UC Davis faculty develop a first-hand appreciation for the culture of these partner institutions, the strengths of their academic programs and the interests of their students.

To achieve these goals, we will bring representatives from each of several campuses to UC Davis for a one-day visit. Visiting faculty and advisers will meet with the leadership of the UC Davis training grants, the graduate programs aligned with them, and representatives of Graduate Studies to learn of specific programs, the general campus and community environment, and the resources available to their students. In exchange, faculty and representatives from Graduate Studies will travel to these same campuses for the same general purposes, as well as to provide their students with an opportunity to learn more about our academic programs. The initial group of institutions that are targeted as partners include Jackson State University, Howard University and the University of Texas-Austin and -San Antonio. This list will be expanded to include institutions such as Morehouse College, Spelman College, Texas Southern University, University of Texas-El Paso and New Mexico State University (Las Cruces).

APPENDIX L

CAMPUS-LEVEL
RESPONSIBLE CONDUCT OF RESEARCH (RCR)
ACTIVITIES

UCDAVIS

RCR

Responsible Conduct of Research

RCR Program '05

Session dates & locations are available online at www.research.ucdavis.edu/rcr

Building a Solid Foundation for Research Integrity

"RCR Program '05: Building a Solid Foundation for Research Integrity" is a year-long pilot project that includes five brown bag lecture-discussion sessions and two keynote guest symposia. The objective is to provide graduate students and postdoctoral scholars with information, training, and tools to address the increasingly complex issues that they will confront during their research careers. The topics will include:

1. Data acquisition, management, sharing, and ownership
2. Mentor/trainee responsibilities
3. Publication practices and responsible authorship
4. Research misconduct
5. Entrepreneurialism and intellectual property

The lecture-discussion sessions will take place over the course of the entire academic year and be offered at different campus locations. Sessions will be tailored to the needs of major academic and professional fields of study represented on the Davis and Sacramento campuses. Each session will be for 1.5-2.0 hours and take place during lunchtime. Two sessions will be offered during the Fall quarter and three during the Winter/Spring quarters. These sessions will be taught and facilitated by members of the faculty and administration with particular knowledge and expertise of the RCR topics. Two keynote symposia from guest lecturers will offer a broad perspective on research integrity.

RCR Training at UC Davis

The Office of Research and the Office of Graduate Studies are collaborating to provide a centralized, comprehensive RCR program for graduate students and postdoctoral scholars. This program may also be used to satisfy NIH and NSF training grant requirements for RCR training programs. RCR training provides necessary tools for building a solid foundation for research integrity. It can increase the morale within the research group, reduces stress, and increase the likelihood of successful research activities. Failure to provide such training through organized and informal dialog on campus jeopardizes the research environment and potentially leads to research misconduct, adversarial personnel issues, poor research results, and damage to the institution's reputation.

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