Title	America's research-active, geotechnical faculty members – a snapshot of the community
Authors(s)	Laefer, Debra F., McHale, C.
Publication date	2010-02
Publication information	Laefer, Debra F., and C. McHale. "America's Research-Active, Geotechnical Faculty Members – a Snapshot of the Community," 2010.
Conference details	Geo-Florida 2010: Advances in Analysis, Modeling, and Design. February 20-24, West Palm Beach, Florida
Item record/more information	http://hdl.handle.net/10197/2268
Publisher's version (DOI)	10.1061/41095(365)330

America's Research-active, Geotechnical Faculty Members – a Snapshot of the Community

D.F. Laefer[1], M.ASCE, Ph.D. and C. McHale[2]

[1]University College Dublin (UCD), School of Architecture, Landscape, and Civil Engineering (SALCE), Urban Modelling Group (UMG), Newstead, Belfield, Dublin 4, Ireland; PH(353-1-716-3226); email: debra.laefer@ucd.ie

[2]UCD, SALCE, UMG, Newstead, Belfield, Dublin 4, Ireland; PH(353-1-716-3226); email: tenure@ucd.ie

ABSTRACT

This paper is a snapshot in time of the personal backgrounds, educational training, professional ranking, and productivity levels of those individuals with respect to Compendex-listed journal paper. Important questions are raised not only as to issues of age, gender, and nationality, but as to where the professoriate in geotechnical engineering is coming from, what level of experience they are bringing to their positions, and their professional standing. The results of this paper raise several, possibly unexpected observations including the apparent role that small, private, undergraduate programs have in grooming future faculty members; the fact that most female faculty members come from only a handful of doctoral programs; the increasing productivity of junior faculty members; and the aging of the community with respect to succession planning. This document is intended to be a discussion document for succession planning for the wider community.

INTRODUCTION

In October 2003, the National Science Foundation sponsored a workshop to identify and address obstacles to success of American female faculty in Geotechnical Engineering. This paper is in part an outgrowth of issues, observations, and concerns that were raised at that time regarding the long-term future of Geotechnical Engineering in academics. As a follow on to the 2003 workshop, a more wide-scale effort was undertaken to begin to examine issues related to tenure. To achieve that in a comprehensive way, personal and professional information were sought for the approximately 1300 tenured or tenure-track academics working in Civil Engineering in the most research active schools across the United States. This paper is the first release of some of that data. As analysis of that extremely large data set is not yet complete, the intention of this paper is to be a discussion document, as opposed to an in depth analysis of data. As such, the information is presented in a factual as opposed to interpretive manner with only minimal comparisons made to other subgroups in the Civil Engineering community or other academic disciplines.

SCOPE OF STUDY

The scope of the study included a subjective selection of the most research-active programs in the United States, as informed by listings on Compendex, ISI Web of Knowledge, and ratings in U.S. News and World Report. Only institutions that offered degrees beyond the baccalaureate were considered. In total, 50 were selected as listed in Table 1. Of those 32% were private and 68% public. Of the public universities, most are their state's flagship school. In some cases there is no representation for a particular state.

The study began in the summer of 2006 and all data should be considered as reflective of the state of the community in December 2006. Initially, the web pages for the selected schools were used as the basis to identify faculty members who were either tenured or tenure-track, with the affiliated department. Information was collected from departmental and personal websites, as well as other professional listings. Missing personal data were solicited directly from the individual faculty members. Data related to research output was also collected. This included all journal papers that appeared in Compendex with a date of 2006 or earlier. Information on co-authors, the publication year, and the impact factor of the respective journal in 2006 was also collected. Additionally, information about any grants awarded from the National Science Foundation were also collated, including the type of program and the number of co-applicants on the grant. Although there are many other ways to measure research productivity, and one may always argue that these measures may not be appropriate for a certain subset of the geotechnical community, these were selected for their ability to provide a certain level of national parity when considering the data in its aggregate, as well as their availability being derived from open access, public repositories. The data presented in this paper will mainly focus on the composition of the community.

RESULTS

General Comments

Of the 50 universities examined, there were 1,261 permanent, tenured or tenure track faculty members. From this pool, a total of 12% (153) were geotechnical (as denoted either in a departmental designation or determined through an examination of publication titles and teaching responsibilities). Of the 50 schools studied, 16% (8) had no tenured or tenure-track geotechnical faculty members. In some cases this may have been due to a gap in hiring, but in many instances part-time external resources (e.g. adjunct staff) were being used on a long-term basis to deliver the geotechnical course material.

Personal Backgrounds

Of the 153 geotechnical faculty members, the gender split was 12.4% (19) women and 87.6% men. This was up slightly from the more anecdotal percentages reported

Table 1. Schools included in the study by state and funding base

State	Public	Private
Alabama	- Auburn State Univ.	
Arizona	- Arizona State Univ.	
California	- Univ. of California (UC) Berkeley - UC Davis - UC Irvine - UC Los Angeles - UC San Diego	- California Institute of Technology (Caltech) - Stanford Univ.
Colorado	- Colorado School of Mines - Univ. of Colorado, Boulder	
Florida	- Univ. of Florida, Gainseville	
Georgia	- Georgia Institute of Technology (Georgia Tech)	
Illinois	- Univ. of Illinois at Urbana-Champaign	- Northwestern Univ.
Indiana	- Purdue	- Notre Dame Univ.
Iowas	- Univ. of Iowa	
Maryland	- Univ. of Maryland, College Park	- Johns Hopkins Univ.
Massachusetts	- Univ. of Massachusetts, Amherst	- Massachusetts Inst. of Tech. (MIT) - Tufts
Michigan	- Michigan State Univ. - Univ. of Michigan	
Minnesota	- Univ. of Minnesota	
Missouri		-Washington Univ. in St. Louis
New Jersey		- Princeton
New York	- Cornell University - SUNY Buffalo	- Columbia Univ. - Rensselaer Polytechnic Institute
North Carolina	- North Carolina State University	- Duke
Ohio	- Ohio State Univ. - Univ. of Ohio	
Oregon	- Oregon State Univ.	
Pennsylvania	- Pennsylvania State Univ.	- Carnegie Melon Univ. - Drexel Univ. - Lehigh Univ.
South Carolina	- Univ. of South Carolina - Clemson (Univ. South Carolina)	
Texas	- Texas A&M University - Univ. of Texas, Austin	- Rice Univ.
Virginia	- Virginia Institute of Technology (Virginia Tech) - University of Virginia	
Washington	- University of Washington	
Wisconsin	- University of Wisconsin, Madison	

previously of ten percent in 2003 (Gassman 2004, Laefer et al. 2007) and the figure of less than three percent reported in 1998 (Bhatia, 1989); note a slight change in the study pool as those two studies looked more broadly at all schools instead of focusing on research-oriented universities. Interestingly, 5 of the 19 women (26%) earned their doctorates at UC Berkeley, 2 at MIT, and 2 at Cambridge. The 2003, also saw a clumping of where women faculty members were earning their doctorates, with the University of Texas (UT) Austin and Northwestern being also well-represented (Laefer et al. 2007). Some of the other large programs [e.g. University of Illinois at Urbana-Champaign (UIUC), Purdue, Georgia Tech] were less well-represented, thus raising the question of culture and mentoring disparities across graduate education.

Professional Training

The location of the doctoral degree awarding institution was known for 96% (all but 6) of the community members (fig. 1). Of the 147 for whom this was known, a disproportionate number graduated from UC Berkeley, which produced 17.0% (25) of the faculty members (5 of whom were women), followed by MIT at 8.8% (13), then Northwestern with 6.8% (10), Purdue with 5.4% (8), and Stanford with 4.8% (7). An additional 4.1% each (6) graduated from UIUC and UT Austin. Another four schools produced four or more graduates, with the remaining coming from other institutions [10.5% from outside the United States (US) and 26.4% from within]. In summary 67% of all faculty members came from only 12 academic programs across the US.

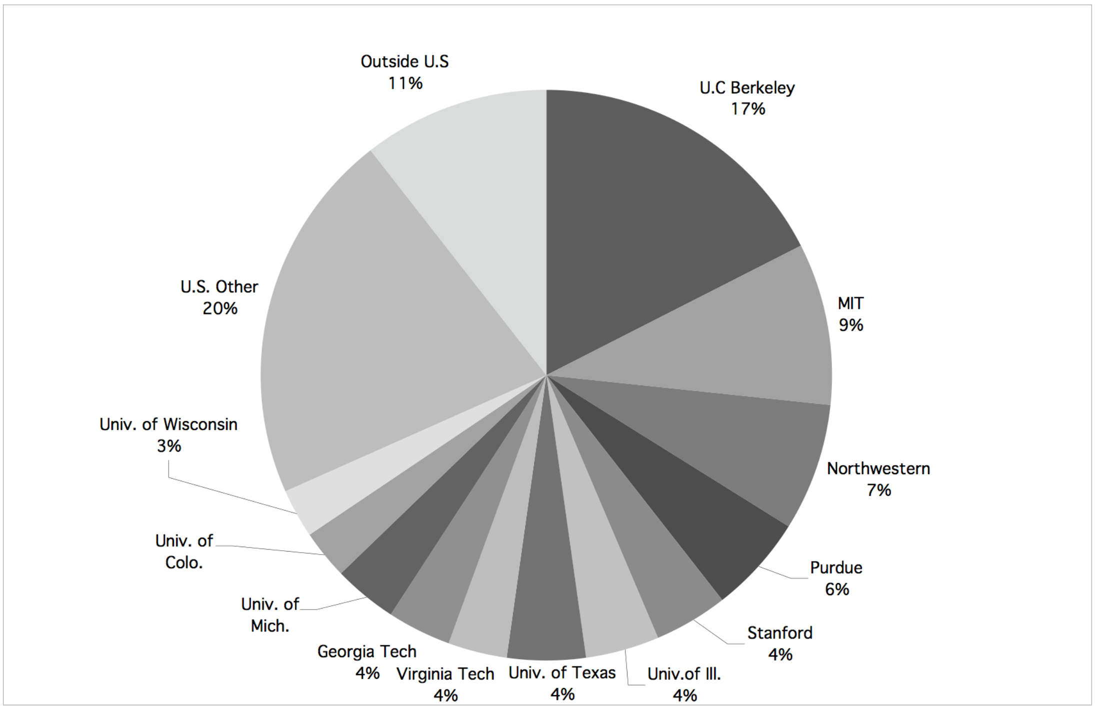

Fig. 1 Doctoral granting institutions for the geotechnical academic community by percent of contribution across 147 individuals

Information about location of undergraduate degrees was available for 94% (143) of the members of the study set. Of these, 57 (39.8%) took their bachelor’s degrees from foreign institutions. Thus, it can be assumed that nearly 40% of America’s geotechnical faculty is foreign born. Interestingly, over 42% of the non-foreign born individuals did their undergraduate training in small, private programs. Although the total number of graduates from those programs is not definitively known, the influence of such programs seems disproportionately high as they are in general only producing 2 to 3 dozen bachelor's degrees annually, compared to the large state schools that are producing the upward of 200 undergraduate students per year. In this respect, Princeton and Clarkson were very influential with three graduates, thereby rivaling the contribution of much larger institutions like the Univ. of Michigan and Oregon State Univ. both with three graduates and were more influential than Georgia Tech and the UT at Austin with only two each. UC Berkeley led at seven followed by UIUC with five. The only other notable contributors were the Universidad Nacional de Cordoba with four undergraduates and the National Cheng Kung University and Cairo University, each having produced three faculty members. All other institutions had no more than two. Of further interest is that the institutions that produced 67% of the doctorates produced barely 12% of the undergraduates, which may strongly speak to a discrepancy in the quality of undergraduate versus graduate education at most institutions.

Career Paths

For the 118 individuals (78%) for whom full academic career information was available with respect to hiring and promotion dates, 45% went straight from their doctorate to a tenured-track position and another 17% spent only a year between finishing their studies and teaching (fig. 2). This differs significantly from the life-science community where two, multi-year post-doctoral positions are considered typical prior to an assistant professorship. Also, there did not seem to be a specific cut-off date when candidates were no longer attractive either due to extensive post-doctoral positions, other non-tenure track posts, or industrial participation. As data were not collected as to how this time was spent, further analysis is not possible.

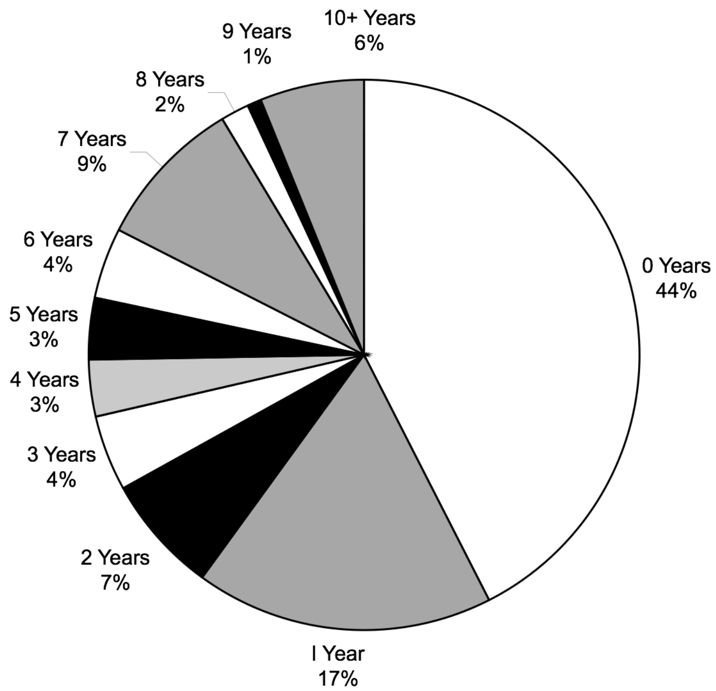

Fig. 2. Years between Ph.D. and tenure-track position

Academic rank was known for all but 3 (1%) of the faculty. The data showed a very senior community with 53.1% (80) as full professors, 29.8% (45) as associate professors, and only 16.5% (25) as assistant professors. If one were to assume an average Ph.D. graduation age of 30, a retirement age of 65, and a 7 year assistant professor period, then had there been a uniform level of hiring over the past decades, then one would expect the percentage of assistant professors in the community to be about 20% (or 7 years/35 year career), which is slightly more than currently exists. The statistical distribution is in part seen in fig. 3 for the 87% (133) of the study set for whom this information was known. Doctorates were earned as early as 1963 and as late as 2006, with 50% of them being awarded from 1980 to 1995 and the median being half way through 1987. Using the same estimate of the age 30 for the doctorate, this would have made average age of the community 49 in 2006 with 19 years of experience in a tenured/tenure-track position. This information does not predict the large gap that is in evidence in fig. 4, where there were relatively few hires in the period 1973-1981.

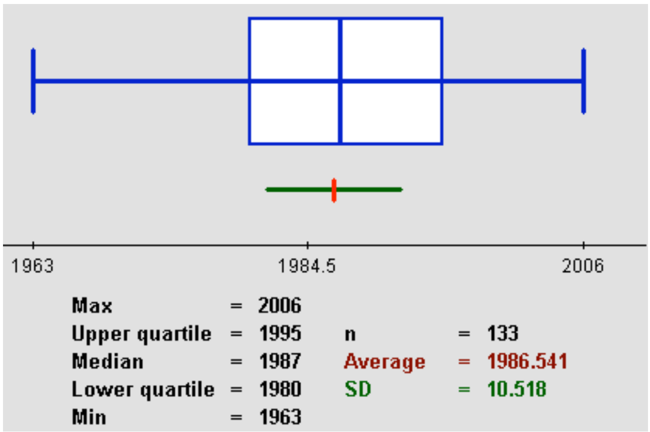

Figure 3. Rough statistical distribution within study group by year of granted doctorates

The relative paucity of current faculty members who received their doctorates from 1973-1981 may be attributable to at least 2 factors. The first was the hiring freeze that many US institutions had in the mid-1970s. The second was the early retirement packages offered by many universities in the late-1990s. Irrespective of the cause, the demographic distribution is potentially worrying in terms of succession planning for individual departments and the larger community both because of the gap and the subsequent peak of hiring of those with Ph.D.s granted in the period 1982-1985, as it is likely that this group will retire in large numbers in a short window possibly starting as early as 2012, but probably not until closer to 2017.

Out of the 118 faculty members for whom full promotion details were available, 92 have attained the level of associate professor or beyond (fig. 5). A total of 59% achieved the associate professor benchmark between 5 and 7 years. Only 8% achieved this beyond the 7-year mark. Taking into account the slightly longer tenure cycles at MIT and Carnegie Melon, the data would indicate extremely poor prospects of a first-tier research position for anyone who did not make it through tenure on the first pass. On the other side of the equation, there was a nearly 30% contingent who spent no or nearly no years as an assistant professor. Further analysis of the data is needed to know where these were individuals who came in from industry or from institutions with other promotion benchmarks (e.g. the United Kingdom or Germany) and then entered the US system at a more senior level.

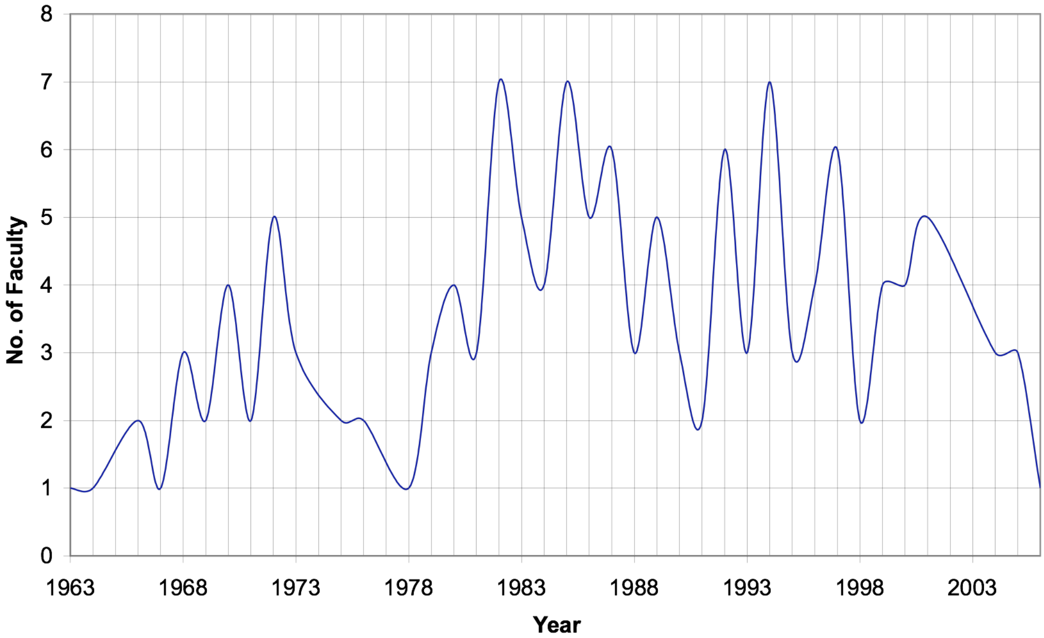

Figure 4. Number of geotechnical faculty members awarded doctorates by year

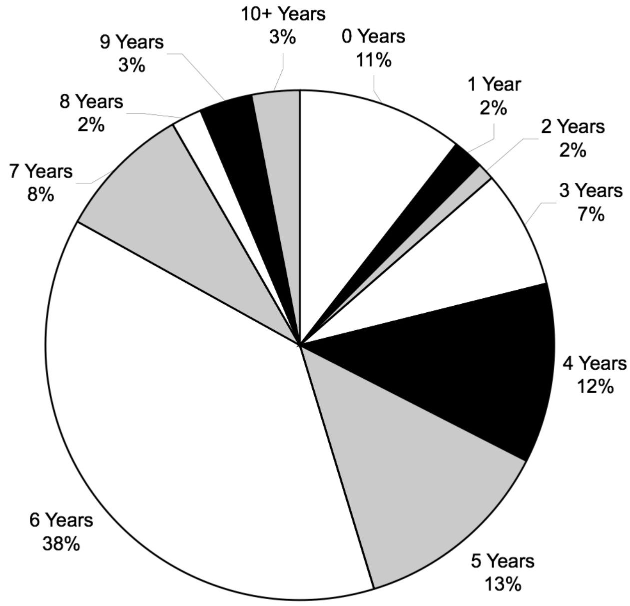

Figure 5. Years between first assistant professor position and promotion to associate professor

Out of the 78 full professors, promotion information was available for 60 (77%) of them, as shown in fig. 6. The trends in this data set are harder to discern. While just over two-thirds (68%) of individuals attained this final promotion in the period of 4 to 8 years, there was also a sizable cadre (14%) that did not achieve this for more than 10 years.

Further evaluating this group of full professors with respect to gender, it is seen that women obtained their first tenure-track position 1.17 years after the awarding of their doctorate compared to 2.36 for their male counterparts, but the women then spent 5.17 years attaining an associate professorship (versus 4.58 for men) and another 7.33 (versus 5.98 for men) until the rank of full professor was bestowed. Whether this was due to maternity leaves or other career breaks is unclear or was in fact slowed by not having a more lengthy post-doctoral or industrial positions is unknown. Further analysis is needed, especially with respect to publication and research funding levels, and other common benchmarks to see if bias possibly played a part. One critical aspect that is not charted in this research is an examinatin of those who left academics.

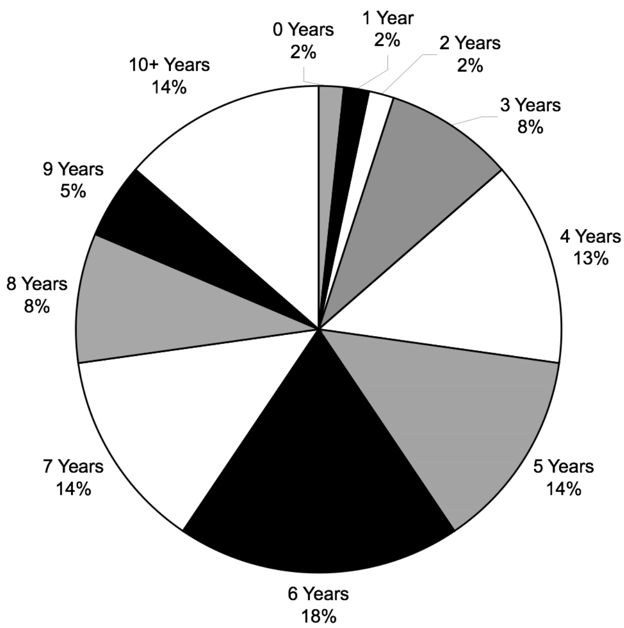

Figure 6. Years between associate professor appointment and promotion to full professor

PUBLICATIONS

A cursory look at publication rates is shown in Table 2. Although this data set is not fully usable until it is normalized by the total number of years of each of the individuals in each category or plotted by year of publication normalized by the total number of potential contributors in that year, it does provide a few initial insights. Given that the group of assistant professors studied had not completed the promotion process, whether there are increasing levels of output/expectations is not fully established, but certainly there is a trajectory that would indicate that the more junior ranks are publishing at ever greater levels. Of particular note is how much more the associate professors have published on an annual basis than their more senior colleagues. This observation is true both at the assistant professor level where today's associate professors published approximately 4.5 times that of the full professors (1.48 vs 0.38). Similarly, in their current rank the associate professors have been publishing at an annual rate of 2.11 journal articles per year, while the full professors have published at only 0.50 articles per year. This final figure only increases to 0.58/year for full professors in their current rank.

Without looking at the data on a year-by-year basis it is hard to know if the change in productivity levels represents a cultural change across the academic community, increased pressure to publish in more recent years, or some type of systemic bias in data availability prior to certain data. This last item would require checking collected data against individually provided publication lists, but given the relatively small increase in the publication rate of full professors in their current rank, a bias in data collection method is unlikely to fully explain this major difference in productivity.

Table 2. Journal Publication Rates by Rank

Rank	Average annual number of papers as an Asst. Prof.	Average annual number of papers while Assoc. Prof.	Average annual number of papers while Full Prof.	Total average years since Ph.D.	Total average years on faculty
Asst. Professors	1.53			6.20	3.58
Assoc. Professors	1.48	2.11		15.20	12.78
Full Professors	0.38	0.50	0.58	26.71	25.21

CONCLUSIONS

This cursory analysis of the tenured and tenure-track geotechnical faculty at 50 major universities highlights a number of interesting facts about the community. Firstly, 16% of these schools have no permanent members of staff in geotechnics. Secondly, women are making steady, albeit slow entry into the academic ranks but with a noticeable additional delay in promotion to full professor. Thirdly, two-thirds of tenure-track posts are being filled by graduates of only 12 American PhD programs. Fourthly, nearly 40% of the community are foreign born. Of those who are not, nearly 43% earned their undergraduate degrees in small, private programs. This number rivaled the contribution of the major, state-sponsored research programs, thereby showing a large disjunct between graduate and undergraduate education (or at least mentorship) at many of the US's top universities. Finally, the distribution within the geotechnical academic community is heavily weighted to the senior ranks, with the majority having received their doctorates prior to 1988. This combined with a hiring gap of those with doctorates earned in the mid- to late-1970s is an indicator for a potentially large band of upcoming retirements, which may cause succession difficulties in some programs.

REFERENCES

Bhatia, S.K. (1989). "Women in Geotechnical Engineering: Issues and Prospects," Final Report to the National Science Foundation – Solid and Geomechanics Programs, 32 pp.

Gassman, S.L. (2004). "Workshop to Foster Academic Development of Women in Geotechnical Engineering, Final Report for CMS 0334547 submitted to the National Science Foundation July, 19 pp.

Laefer, D., Gassman, S. & Luke, B. (2007). "Fostering Development of Women Faculty in Geotechnical Engineering." *Geo-Denver 2007: New Peaks in Geotechnics,* Feb. 18-21, Denver, CO, Educational Activities in Geotech. Eng. GSP 166, ASCE (ed. Griffiths, D.) 7 pp.