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America's Research-active, Geotechnical Faculty Members – a Snapshot of the Community 7 Years On

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ABSTRACT

This paper is an update of a 2010 snapshot in time of the personal backgrounds, educational training, and professional ranking of America's research-active geotechnical faculty members. 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, their professional standing, and to what extent these items have changed over the past seven years. The results of this paper raise several important insights as to the retention and progression of women and minorities in the ranks of the professorate. Collectively these show an uneven set of advancements for the geotechnical profession and offers some possible reasons for this.

INTRODUCTION

Originally motivated by the 2003 National Science Foundation workshop which sought to identify and address challenges facing American female faculty in geotechnical engineering, in 2010, the authors produced a factual snapshot of American geotechnical faculty in 2006. Now seven years on, the current study represents an updated survey tracking areas of change as well as areas which have not substantially changed and may still need improvement.

SCOPE OF STUDY

In order to offer a direct comparison to the 2010 study, this work used the original sample of 50 institutions: "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" (Laefer & McHale 2010). As seen in Table 1, the sample included 16 private and 34 public institutions across 25 states. All offer degrees beyond the baccalaureate.

Data for this study were collected in 2017, 7 years after the original snapshot was published and 11 years after the data for the original snapshot was collected. Tenured and tenure-track geotechnical faculty members were identified from departmental and school websites. Further information was then collected from personal websites, publicly available CVs, LinkedIn, and journal articles. Faculty were identified as geotechnical by departmental designation, classes

taught, or research conducted. Minorities were identified by surname origins, locations of baccalaureates, and other supporting information provided on personal and departmental websites.

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

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

For this study, the composition of the community and career trajectories of geotechnical faculty formed the focus of data collection and analysis. Preliminary data was also collected for productivity as demonstrated by publication rates, but the inconsistency in numbers of publications listed on individual CVs, Compendex (now Engineering Village), and Google Scholar strongly suggested that additional data collection, cleaning, and verification will be required before this data can be used to draw conclusions about the state of the community.

RESULTS

Across the 50 universities studied, there were 1,525 permanent, tenured or tenure-tracked civil engineering faculty members, of which 11% (168) were geotechnical. This is an increase of 9.8% over the 153 geotechnical faculty members identified in 2006 but a 1% decrease in the ratio of geotechnical to total civil engineering faculty. The number of universities with geotechnical faculty also increased from 42 to 45, even though the University of Washington at St. Louis has closed its civil engineering program entirely (theSource 2008). Amongst the four universities which, at present, offer geotechnical courses but do not have geotechnical faculty, adjunct staff, professors in practice, teaching professors, and part-time lecturers appear to be providing the required geotechnical expertise and instruction.

Personal Backgrounds. Continuing the trend observed in Laefer & McHale (2010), the percentage of female faculty members has increased, rising from 12% in 2006 to 18% (30) at current count. From Bhatia's (1989) finding that less than 3% of geotechnical faculty were women, through Laefer et al.'s (2007) finding that only 10% of geotechnical faculty were women in 2003, these numbers represent a clear upward trend in female participation in the community of geotechnical faculty (Fig. 1).

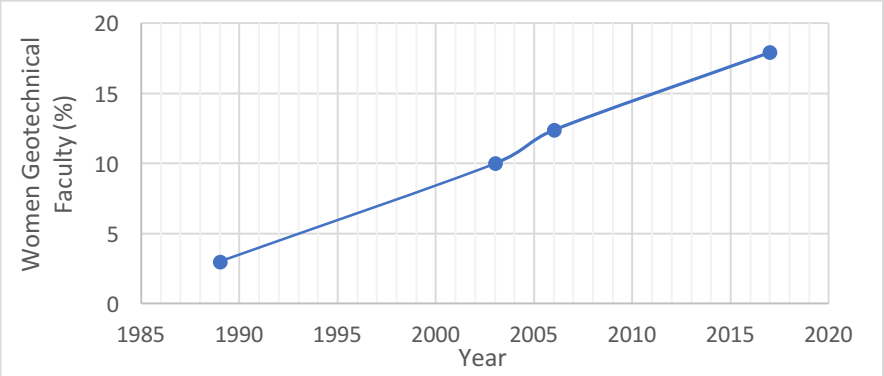

Figure 1. Percentage of women geotechnical faculty as per Bhatia (1989), Laefer et al. (2007), and Laefer & McHale (2010).

Despite the increasing percentage of women geotechnical faculty, non-Caucasian women are represented in a highly uneven manner. Of the 168 geotechnical faculty members, 33% (50) were non-Caucasian. Asian and South Asian faculty members represented 15% of faculty with women being 2%. Hispanic faculty members represented 9% of the pool with women also at 2%.

African American were most poorly represented at only 2% of the group and no women. Of the 67% Caucasian faculty members, 6.5% were Middle Eastern (Table 2). So although 20% (11) of these minority faculty members were female—a higher gender ratio than in the general population of geotechnical faculty—these women represented only 7% (11) of the entire community and no African American nor South Asian women faculty were represented. The continuing absence of African American faculty members continues to be worrisome.

Table 2. Racial distribution in geotechnical faculty

	Women		Men		Total		US
	Count	%	Count	%	Count	%	Census (%)
Asian (South Asian)	4	2	22(4)	13.1(2.4)	26(4)	13(2)	5
Hispanic	4	2	11	6.5	15	9	16
Black or African American	--	--	4	2.4	4	2	13
Middle Eastern	3	2	8	4.8	11	7	na
Total:	11	7	45	26.8	56	33	

As compared to the wider US population, the geotechnical community has a higher representation of Asian and South Asian individuals (15% vs. 5%) but a markedly lower representation of Hispanic individuals (9% vs. 16%) and an even more imbalanced ratio of Black or African American individuals (2% vs. 13%) [USA Census Bureau 2010].

Professional Training. The location of doctoral training was known for 99% (all but two) of the community members. As was found in Laefer & McHale (2010), UC Berkeley continues to dominate, producing 17% of faculty members, while Northwestern and Purdue have lost ground, and Georgia Tech has gained prominence (Table 3). As depicted in Table 3, the top 9 doctorate awarding institutions, represent 55% of all doctoral institutions for current faculty members. The ratio of US to international institutions remained relatively stable with 11% of doctoral degrees granted by international institutions in 2006 versus 10% at present count (Fig. 2).

The locations of undergraduate degree awarding institutions were available for 95% (159) of the community, of whom, 50% received their undergraduate degree from an international institution. Though overseas study is increasingly available for American students, affiliated demographic information suggests that the majority of those who studied at international institutions were born outside of the US. This is a significant increase over 2006 when only 40% of faculty received their undergraduate degrees outside of the US. This increase may suggest an increasing reliance on the international community to feed faculty roles in the US and/or increasing opportunities and motivation for foreign-born individuals to travel to the US for graduate education and subsequent employment.

In 2006 private institutions awarded a disproportionate 42% of the US undergraduate degrees earned by geotechnical faculty. In 2017 this drop to only 28%. While still not proportional to the total number of degrees produced annually at private and public institutions (2-3 dozen

versus greater than 200), this ratio suggests a shift towards public institutions. Notably, at the undergraduate level, both MIT and Rensselaer produced as many future faculty members (3) as UC Berkeley, despite UC Berkeley's far greater influence at the graduate level. Nonetheless, as seen in 2006, a mismatch between doctoral and baccalaureate institutions was still observed. Notably, the top 16 doctoral institutes which produced 69% of the doctoral degrees, produced only 17% of undergraduate degrees.

Table 3. Top 9 doctorate awarding institutions in 2017 with comparisons to 2006

	% of Faculty Awarded Doctorates	
	2006	**2017**
UC Berkeley	17	17
MIT	9	8
Georgia Tech	4	6
Northwestern	7	5
Stanford	4	4
Virginia Tech	4	4
UC Davis	--	4
Purdue	6	3
UIUC	4	3
Other US Institutions	34	36
International Institutions	11	10

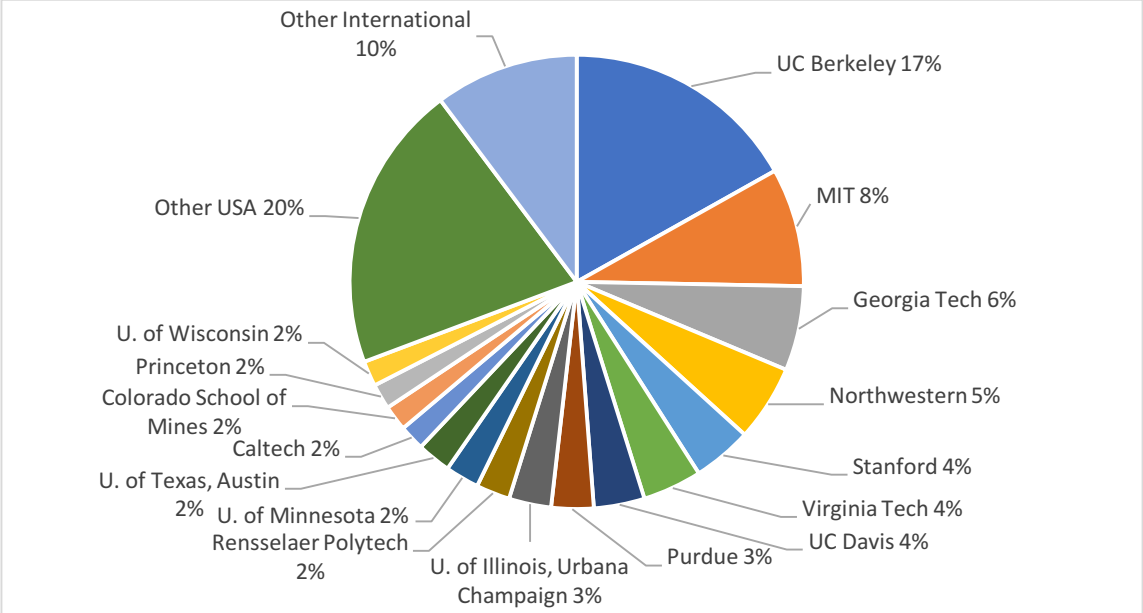

Figure 2. Doctoral degree awarding institution

Career paths. Full academic career profiles were available for 76% (127) of the individuals, of whom 41% went straight from their doctorate to a tenure track position. Another 19% had only one year between their doctorate and their first tenure track role (Fig. 3). Since 2006, there has been a slight decrease in direct transitions into tenure track positions (44% down to 41%) and a slight increase in those spending one year between doctorate and tenure-track (17% vs. 19%). More notably however, there has been an increase in the percentage of individuals who spend 2-3 years between finishing their doctorate and entering a tenure track role. Where in 2006, only 11% of individuals spent 2-3 years between doctorate and tenure-track, now 19% spend 2-3 years in non-tenure track roles following their doctorate. Though complete information could not be found as to how this time was spent, a mix of post-doctoral and industry roles were observed.

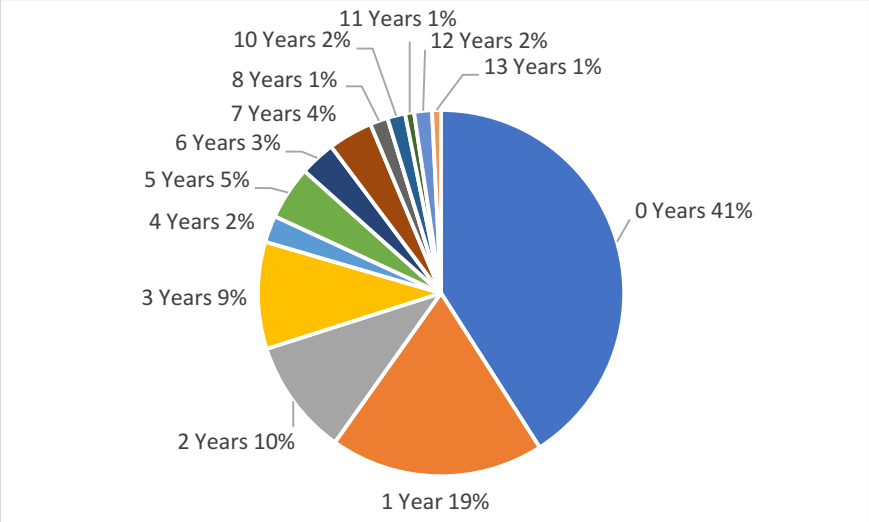

Figure 3. Years between doctorate and tenure track position

Of the 168 faculty members, 58% (97) were full, 21% (36) were associate, and 21% (35) were assistant professors. As compared to 2006, the community has further matured with an increasingly larger percentage of full professors (58% vs. 53%) but a thinning middle, with only 21% of the population at the associate level (cf. 30% in 2006). This likely represents an increase in hiring at the assistant level to address the gap identified by Laefer & McHale (2010).

The year of doctoral degree award was known for 89.29% (150) of the community. As in the previous study, the earliest doctorate was awarded in 1963 but the most recent is now 2017. The median has also shifted considerably from 1987 to 1996 with 50% of doctorates now having been awarded between 1985 and 2005 (Fig. 5), but ultimately this shift is not commensurate with the elapsed time. For example, if we presume an average graduation age of 30, the community now has an average age of 51 as compared to 49 in 2006. Though the proportion of assistant professors has increased, the continued aging and maturing of the community may still pose a risk for succession planning as increasing numbers of faculty reach retirement age with fewer younger colleagues to take their places. Of the 127 individuals for whom full career histories were known, 27% (34) were assistant professors, 20% (25) were associate professors, and 54%

(68) were full professors. The discrepancies between these ratios and the ratios seen in the population at large may be partially attributable to the probable ages of members of each rank. For example, assistant professors are more likely to be younger, digital natives who are more comfortable sharing personal data freely online. As changing institutions during the assistant phase is not uncommon, with 21% of the sample having done so, it may also represent assistant professors' efforts to enhance their career by eliciting employment opportunities from other institutions.

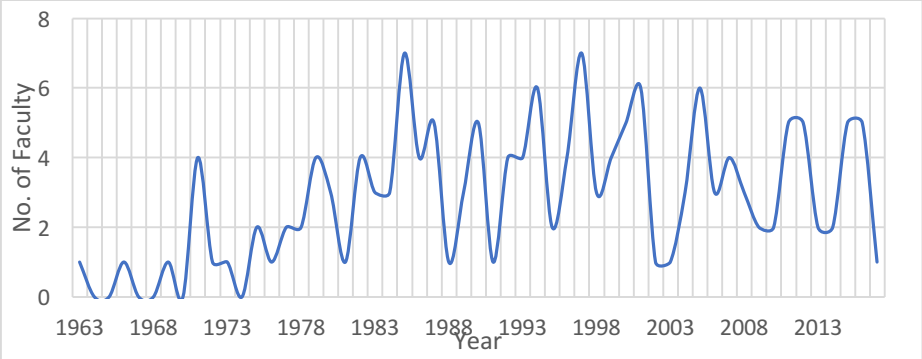

Figure 4. Number of geotechnical faculty members awarded doctorates by year

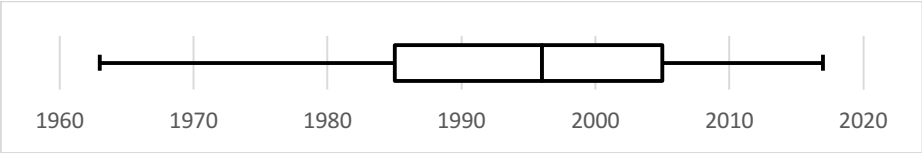

Figure 5. Rough statistical distribution within study group by year of granted doctorates

Of the 73% (93) that have attained associate or full professor status, 75% were promoted to associate professor within 5-7 years of their first tenure track role, while only 8% made the transition after 7 years. As was found in 2006, the likelihood of promotion is slim for those who miss on the first pass. In contrast to prior findings, however, the likelihood of early promotion has also fallen from 34% to 17%, suggesting a further codification of the tenure track promotion cycle and possible raising of expectations. This shift is also evident within the 2017 data itself. Full professors spent an average of 5.5 years as an assistant professor while those who are currently associate professors spent, on average, 6.6 years in an assistant role—much closer to the standard 7-year promotion cycle.

Though less clear than the pattern in promotion to associate professorship, for the 68 full professors for whom full career information was available, there was a clear peak in promotions at the 6-year mark. Overall, 20% of promotions occurred in the sixth year of employment as associate professor, and 47% of promotions happened within the 5-7 year period. Promotions within 1-2 years were very rare, while promotions beyond 10 years dropped off dramatically, with only 5 individuals (8%) receiving promotions after more than 10 years in an associate professor position.

Due to the limited sample size, drawing conclusions about the effect of gender on career trajectories is problematic, but some interesting trends are clearly visible. While 23 individuals in

the community were identified as holding distinguished or named professorships, only 2 of those distinguished professorships belonged to women. This tracks a general pattern whereby the percentage of women to senior roles lags behind their male colleagues. For example, only 10% of full professors were women, whereas 19% of associate professors, and a full 37% of assistant professors were women. While some of this trend may be attributable to the overall pipeline, promotion asymmetries must be considered.

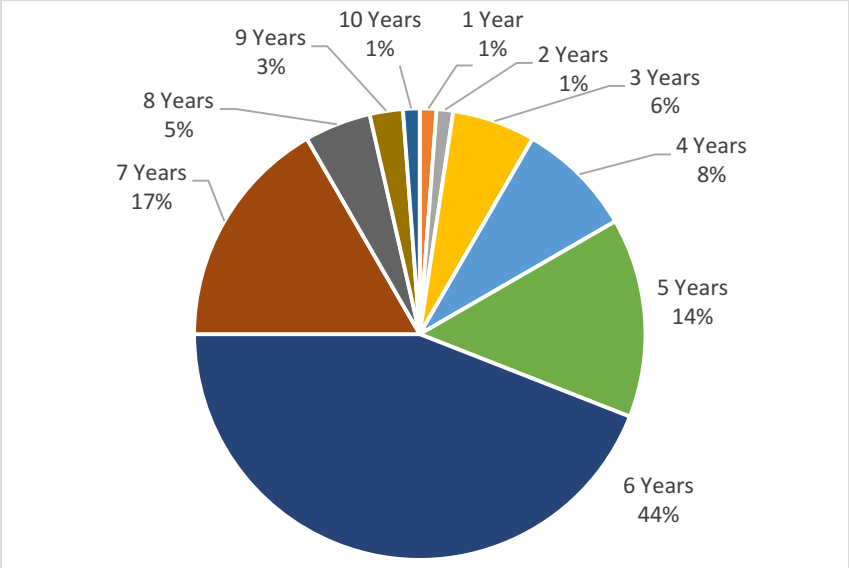

Figure 6. Years between first assistant professor position and promotion to associate professor

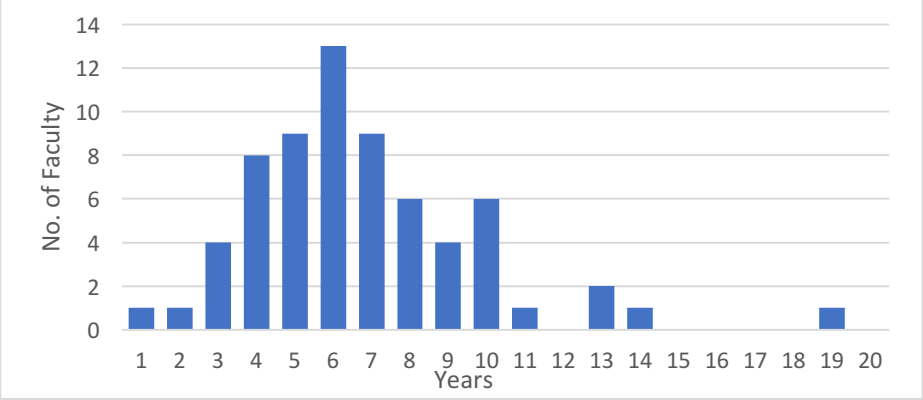

Figure 7. Years since first associate professorship at time of promotion to full professor

The collected data show women faculty spent an average of 0.45 years longer in an assistant professor role, but spent on average 1.3 years less before being promoted to full professorship. With such small samples (4 women in associate roles and 7 in full professorships) however, these differences may simply reflect a few exceptional cases, particularly since they do not align with the 2006 findings which found a delay for women reaching full professorship.

On the whole, promotion trajectories seem to follow very similar patterns for both genders (Figs. 8-10) with a peak at less than 1 year for entering a tenure track role and at 6 years for

promotion to an associate professorship. Promotion to full professorship follows a less obvious pattern and, for the very small sample of women, it is difficult to draw any conclusions. What the data also fails to capture is retention and whether or not women how have entered the system have remained. Thus, further individualized career tracking is needed.

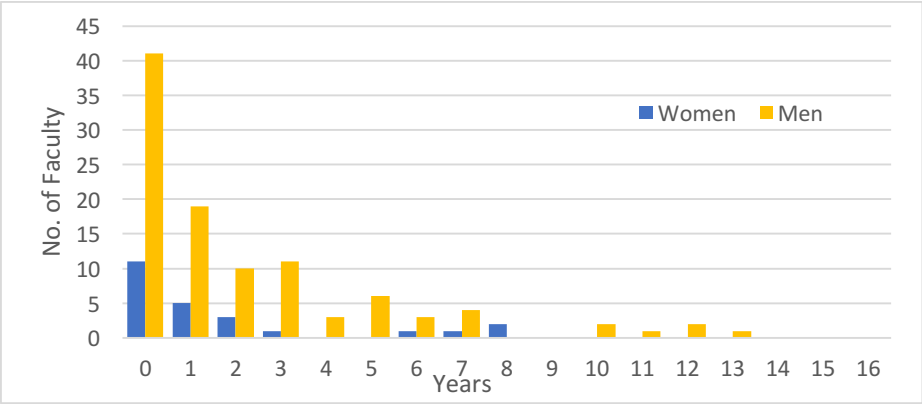

Figure 8. Years to first tenure track role by gender

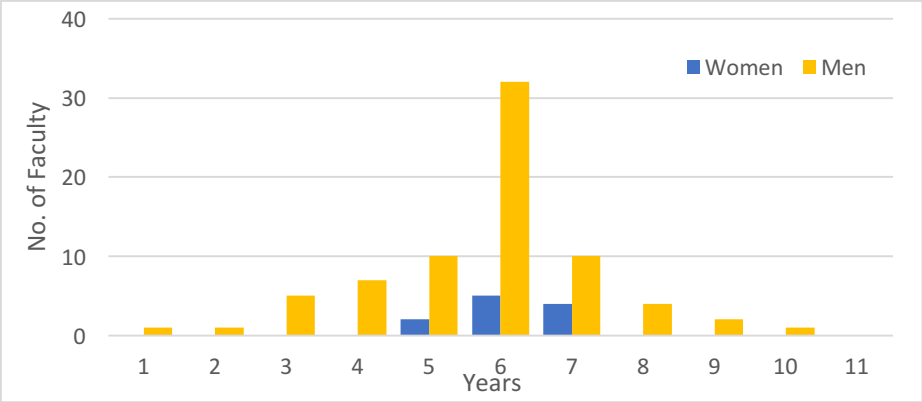

Figure 9. Years between first tenure track role and promotion to Associate

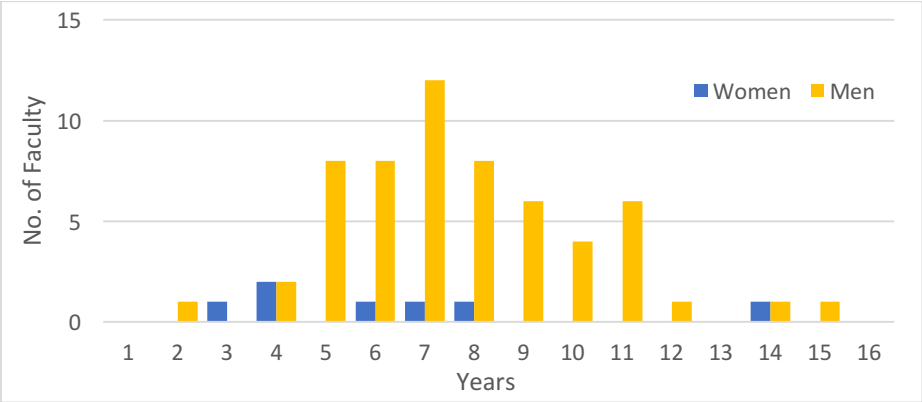

Figure 10. Years between promotion to associate and promotion to full professor

CONCLUSIONS

Seven years on from the first publication of this study, and 11 years after initial data collection, this brief snapshot elucidates several interesting trends within the geotechnical community. For instance, geotechnics seems to have gained some prominence. Specifically, the number of schools with no tenured or tenure-track geotechnical faculty has decreased from 16% to 10%. Since the 2010 study, one university has closed its geotechnical program and four others still rely on temporary and or part-time external staff to deliver their geotechnical courses. As noted in Laefer & McHale (2010) women continue to make steady progress entering the academic ranks, but are still a minority within the community, especially in the senior ranks were men comprise 89.7% of full professors. UC Berkeley remains the dominant feeder institution for American geotechnical faculty, but there appears to be a widening of the doctoral institutions from where new geotechnical faculty are being recruited. This may be driven in part by an increase in foreign born geotechnical faculty who now make up 50.3% of geotechnical faculty. Amongst those individuals who completed their undergraduate degree in the US there has also been a shift away from small private programs as seen in the 2006 data and towards public institutions. Lastly, the community continues to age with the median year of doctoral award at 1996, only 9 years later than the median found 11 years ago, in 2006, with an increasingly heavy ratio of full professors to assistant and associate professors. The ratio of assistant to associate professors has also shifted, implying an increased rate of hiring assistant professors as compared to promoting them, or perhaps suggesting a certain retention problem from the associate ranks. Future work would benefit by further exploring those faculty members who choose to leave academia, as well as developing richer profiles of those still in academia including productivity and public recognition.

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