

## **Business Case for the Master's Degree: The Financial Side of the Equation**

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### **Introduction**

Civil engineers are compensated at lower rates than other leading professionals, which if nothing else implies that civil engineering adds less value than those professions. The following examination of the salaries and education levels of the leading professions reveals that increased educational requirements generally correspond to higher financial compensation in the U.S. economy. It also suggests that increasing educational requirements beyond the bachelor's degree, as recommended by the ASCE Task Committee (ASCE 2001), will result in higher rates of compensation for civil engineers—to say nothing of the increased prestige and control over managing professional concerns, the increased safety delivered to the public, and the increased value brought to clients and the public. As a leading employer of civil engineers, the Federal government serves as a significant test case for just how much the educational paradigm affects the professional standing and compensation of civil engineers.

### **Federal Government**

This analysis is based on, but does not rely solely upon, Federal government employment statistics for several reasons. With over 71,000 civil engineers employed by federal, state, and local government, at least 35% of all civil engineers are concentrated in the public sector—the largest number of any major branch of engineering (Grigg 2000). The Federal government employs approximately 18,500 of these civil and environmental engineers, while Federal government classifications and wage tables serve as the models for many states and municipalities. Moreover, civil engineers in public employment make, on average, less than their private counterparts. Whereas the median salary for all civil engineers is \$70,000, the median salary for federally employed civil engineers is \$54,000, or 23% lower (NSPE 2000; BOL 1999). Finally, the Federal government employs a substantial number of professions, all of which are paid according to a universal system of

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classification, allowing for the meaningful comparison of salary data across disciplines (OPM 1997).

### Federal General Schedule

Civil engineering, along with all other professions, is considered by the Federal government to be a white-collar occupation. White-collar positions are salaried according to a classification standard program known as the General Schedule (GS). Established in 1949, the GS divides Federal positions into occupational groups and series. Civil engineering jobs are subsumed under Series GS-0810 in the GS-0800 Engineering Group.

Most Federal positions are classified on a 15-grade scale from GS-1 to GS-15, with white-collar positions starting at grade GS-5. Within each grade, there are 10 stepped pay categories. Grades and steps are determined through classification standards developed by the Federal Office of Personnel Management to encourage uniformity and equity across disciplines and professions (OPM 1999). The GS system is designed so that applicants can qualify for positions through various combinations of requisite education and experience. A job is classified based on the requirements for that position, which are represented on a universal point scale. Table 1 presents the nine factors used to determine the GS grade for a position, along with their point equivalents. An applicant who meets the basic requirements is qualified for a position at the entry level, which for civil engineering is grade GS-5. For advancement to higher positions, additional education and experience requirements must be met. The requirements for civil engineering positions are presented in Table 2.

As employees acquire education and/or experience, their positions are periodically reviewed for reclassification, which can result in higher grades and salaries. Every series has a limit on promotion potential to higher grades, which for civil engineering is grade GS-14. A select few senior management positions are paid according to a special "Senior Pay Level" table, but less than one-half of a percent (0.5%) of civil engineers are classified at senior levels (OPM 1997).

Table 1. Factors Used to Determine Grades for White-Collar Federal Positions (Source: OPM 1999)

Name of factor (1)	Total possible points (2)	Percentage of total (%) (3)
<b>1. Knowledge Required by Position</b>	<b>1850</b>	<b>41.0</b>
2. Supervisory Controls	650	14.5
3. Guidelines	650	14.5
4. Complexity	450	10.0
5. Scope and Effect	450	10.0
6. Purpose of Contacts	220	5.0
7. Personal Contacts	110	2.5
8. Physical Demands	50	1.0
9. Work Environment	50	1.0
Total	4480	100.0

Table 2. Education and Experience Requirements for Civil Engineering Positions  
(Sources: OPM 1999; OPM 2001C)

Grade (1)	Total Point Range (2)	Total Points for Factor 1: "Knowledge Required by Position" (3)	Education and/or Experience Requirements (4)	Base One- Year Salary (\$) (5)
GS-5	855- 1100	750	BSCE or equivalent experience and knowledge, including 1) professional registration; 2) passing the Engineer-in-Training (EIT) examination; 3) at least 60 semester hours of courses in the physical, mathematical, and engineering sciences and in engineering; and 4) at least 1 year of professional engineering experience.	28,535
GS-7	1355- 1600	950	1 year of graduate-level education <i>or</i> superior academic achievement at the undergraduate level <i>or</i> 1 year equivalent experience to at least GS-5	35,339
GS-9	1855- 2100	1250	2 years of progressively higher level graduate education leading to a master's degree <i>or</i> master's or equivalent graduate degree <i>or</i> 1 year equivalent experience to at least GS-7	43,226
GS-11	2355 - 2750	1550	3 years of progressively higher level graduate education leading to a Ph.D. degree <i>or</i> Ph.D. or equivalent doctoral degree <i>or</i> 1 year equivalent experience to at least GS-9	45,600
GS-12 and above	2755 and up	1850	Ph.D. or equivalent doctoral degree <i>or</i> At least 1 year equivalent to at least next lower grade level	48,223

**Education is Key.** Factor 1, or the "Knowledge required by position," comprises the single most important criteria in determining the grade of any position (OPM 1999). For example, an entry-level position rated at the GS-5 level would have a total factor point range of 855 to 1100 (Table 2). Factor 1 points account for up to 750 or 88% of the total. Likewise, Factor 1 points account for up to 50% of the point total for every other grade, making it the overwhelming determinant for classification. The importance of knowledge requirements for Federal positions should be kept in mind throughout this analysis.

The specific educational requirements for civil engineering positions are listed in Column 4 of Table 2. Notice that to qualify for higher grades of employment, which command higher salaries, candidates must have increased education and/or experience. For an entry-level position (GS-5), a qualified candidate must have earned a BSCE or (1) be a registered Professional Engineer, (2) taken at least 60 hours of specific college courses, (3) possess a year of work experience, and (4) have

passed the Engineer-in-Training exam. Clearly the BSCE is the easier path to Federal employment, as professional registration alone would require several years of experience. Likewise, qualifications for higher grades are often easily satisfied through the completion of the requisite number of advanced years of education leading to advanced degrees.

A civil engineer hired straight out of a four-year BSCE program will generally be placed at the GS-5 grade. If that student demonstrates superior academic achievement at the baccalaureate level, however, he/she can qualify for GS-7 positions and earn almost \$7,000 more a year. Graduates of five-year programs with at least 160 credit hours also qualify for GS-7 positions. If a master's degree or equivalent experience is required for a position, that position starts at the GS-7 or GS-9 grade, with salaries \$6,700 to \$14,700 higher than GS-5 positions (OPM 2001C). Simply put, educational achievement means higher salaries for civil engineers in Federal employment.

### **Civil Engineering Compared to Other Professions**

Based on Federal government statistics, increased educational requirements in a profession generally correspond to higher starting grades of employment, higher average grades, and higher average salaries. Table 3 presents the required education, starting and average GS grades, and the average salaries of several leading professions. The average grade for the GS is a weighted average obtained by dividing the total number of employees in the GS and equivalent-to-GS pay systems (OPM 1979). The professions are ranked from the highest to the lowest average yearly salary. The average salary was obtained from the appropriate salary rate table (OPM 2001a; OPM 2001b; OPM 2001c).

Note that civil engineers begin at grade GS-5—the lowest starting level for a white-collar, professional occupation. Civil engineers start at the lowest level, and progress to an average GS grade below that of doctors, dentists, lawyers, optometrists, architects, and even the average of all white-collar occupations. Accordingly, civil engineers are compensated significantly less than those leading professions by up to tens of thousands of dollars per year (Table 3, Column 5).

While the income disparity with architects and accountants may be insignificant, civil engineers earn slightly more than pharmacists and occupational therapists in the Federal sector. Nevertheless, the divide between the professions graded lower than civil engineering is decreasing, while the divide between the professions graded higher is increasing. Figure 1 presents the 1967 and 1997 median grades of the same professions listed in Table 3. Notice that every profession has witnessed an increase in its median grade over the 30-year period, except three—architecture, civil engineering, and medicine. At grade GS-15, medicine cannot rise beyond what is the highest level. Figure 2 helps explain this stasis by illustrating the historic rise in required education to at least 5 years for all the major professions, save one: civil engineering. While required years of education for professional practice is not the only factor for the static position of civil engineering grading, and thus compensation, it is nonetheless significant, especially considering that accountancy, occupational therapy, and pharmacy have each recently increased their educational requirements.

Table 3. Education, Starting and Average Grades, and Average Salaries of Select Federal Professionals  
(Source: OPM 1997; OPM 2001a; OPM 2001b; OPM 2001c)

Name of Professional (1)	Required Education (Years) (2)	Starting GS Grade (3)	Average GS Grade (4)	Average Salary (\$) (5)
Doctor	8	11	14.80	99,391
Dentist	8	11	14.61	79,060
Lawyer	7	9	13.85	72,641
Optometrist	8	9	13.63	66,906
Accountant	5*	5	11.91	50,964
All Professional Series	--	--	12.22	50,000
<b>Civil Engineer</b>	<b>4</b>	<b>5</b>	<b>12.13</b>	<b>49,839</b>
Architect	5	5	12.19	49,830
Pharmacist	5/6**	7	11.51	45,600
Occupational Therapist	5	6	11.20	41,577

\*Accountancy requires a total of 150 credit hours of college education, with at least 24 at the graduate level

\*\*Pharmacy is currently a 5-year degree, but by 2007 will be a 6-year degree

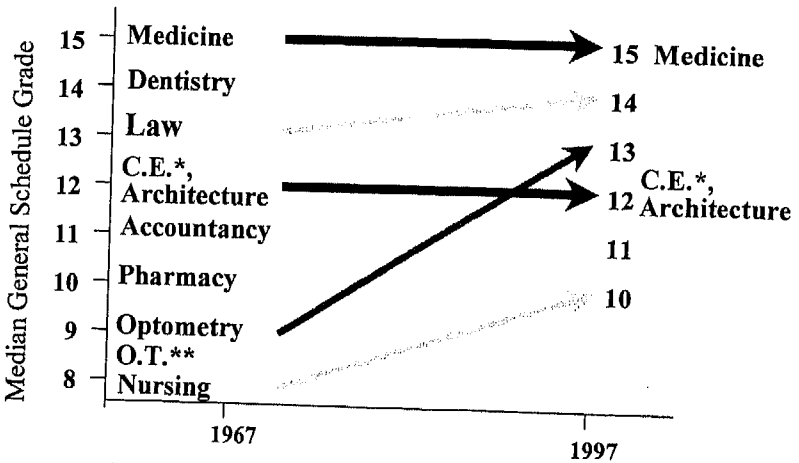
### Numbers Don't Lie

Since pharmacy is a profession that currently requires a five-year degree for practice, it would appear that pharmacy disproves the suggestion that more education requirements correspond to higher salaries. For this reason, our analysis encompasses more than just Federal government statistics. First of all, the Federal government is not a significant employer of pharmacists, with less than 5,000 of the 185,000 licensed pharmacists working for the government (BOL 2001; OPM 1997). Secondly, in the private sector, pharmacists earn median salaries greater than civil engineers' median salaries (BOL 1999). Most importantly, pharmacists have dramatically outpaced civil engineers in first-year earnings, as shown in Table 4. Table 4 also reveals that while accountants continue to make salaries comparable to those of civil engineers in both the public and private sectors, starting occupational therapists are offered salaries higher than starting civil engineers. In 1990, first-year civil engineers made approximately \$2,500 more than first-year occupational therapists, but \$8,000 less than pharmacists. In 2000, however, first-year occupational therapists earned on average \$3,500 more than civil engineers, while first-year pharmacists made almost \$30,000 more. These increases can be attributed to enhanced educational standards.

Table 4. Average Yearly Salary Offered to Bachelor Degree Candidates (Men and Women)  
(Source: NACE 1990 and 2000)

Curriculum (1)	1990 (\$) (2)	2000 (\$) (3)	Change	
			\$ (4)	% Increase (5)
Civil Engineering	28,136	37,932	9,796	35
Accounting	26,391	36,710	10,319	39
Occupational Therapy	25,644	43,500	17,856	70
Pharmacy*	36,728	64,717	27,989	76

\* Pharmacy is a five-year degree program



\* Civil Engineering \*\* Occupational Therapy

Figure 1. Median General Schedule

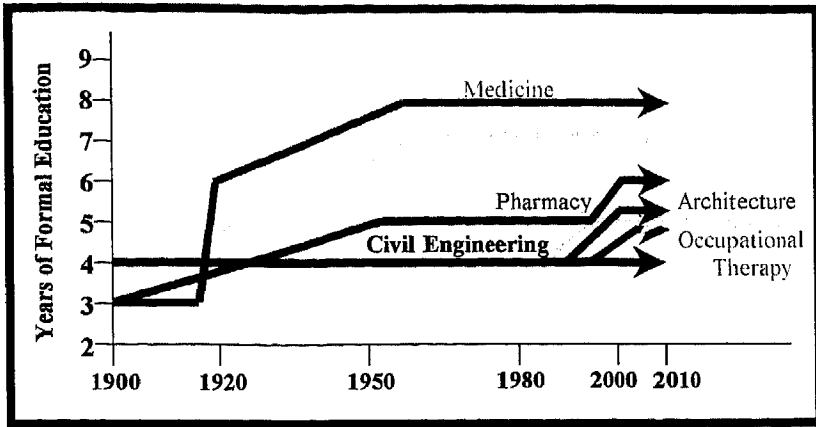


Figure 2. A Leader No Longer

**Accountancy.** As the authors have previously noted, accountancy is in the process of adopting a 150-hour educational requirement for accreditation as a public accountant (Russell et al., 2000). The previous standard had been the bachelor's degree. While first-year accounting salaries have so far remained equivalent to those of civil engineering, salaries have been shown to increase in states that have adopted new educational requirements. In Florida, for instance, a state that implemented the requirement starting in 1983, first-year salaries of graduates with 150-hour degrees have outranked the salaries of graduates from traditional four-year programs by an average of 8%-16% (Cumming and Rankin 1999).

**Occupational Therapy.** The occupational therapy (OT) profession recently made the master's degree the first degree for professional practice. In 1999, the American Occupational Therapy Association (AOTA) passed a resolution calling for the installation of a post-baccalaureate entry-level requirement for professional OT practice. The previous standard had been the bachelor's degree. Proponents of the new standards cite the perception that occupational therapists have been subordinated with respect to other professionals such as doctors, physical therapists, and social workers, and are thus penalized financially (Steib 1999). They also frequently mention an increasing emphasis on the need for professionalism, professional standards, and advanced training to cope with the increased knowledge about the body introduced by advances in biological and medical science (St. Ambrose 2001).

In a timeline established by the Accreditation Council for Occupational Therapy Education, programs have until January 1, 2007 to implement post-baccalaureate degree programs of at least five years, most culminating in the Master's of Occupational Therapy (AOTA 1999). The time lag from acceptance to full-compliance allows programs several years to meet the new requirements or phase out their existing programs. Since the master's will become an eligibility requirement to

sit for national certification, occupational therapy has effectively factored the new educational requirements into the licensing model of the profession (NBCOT 2001).

**Pharmacy.** Like accounting, civil engineering, and occupational therapy, pharmacy was once a four-year undergraduate program. Following a national study on pharmacy education, the American Association of Colleges of Pharmacy (AACP) promulgated in 1954 a five-year bachelor's degree consisting of two pre-professional and three professional years of education (Buckner et al., 1997). As demands on the profession increased, pharmacy again called for increased education. In 1992, the AACP endorsed the Doctor of Pharmacy (Pharm.D.) as the first professional degree for practice (Hitchens 1997).

The acceptance of the Pharm.D. as the first professional degree for pharmacy practice necessitated new accreditation standards. The American Council on Pharmaceutical Education adopted the new standards in June of 1997. The standards called for the discontinuation of the B.S. degree after June 30, 2000, with the last class of graduates leaving their programs in 2004 (Hitchens 1997). As with occupational therapy, the national accreditation body played a major role in enforcing the new standards, this time by discontinuing the accreditation of previous five-year programs. To date, the resolution "has not negatively impacted the number of students applying for admission into pharmacy professional degree programs" (Hitchens 1997).

### **Lessons Learned**

Clearly civil engineers are not alone in their belief that increased education for professionals is necessary in the 21<sup>st</sup> century. Recognizing this, accountancy, occupational therapy, and pharmacy have each moved forward with implementing augmented educational standards. Accordingly, all three professions have witnessed increases in starting salaries; in the case of the latter two, the results have been dramatic (Table 4).

The examples of occupational therapy and pharmacy also suggest the need for enforceable change, meaning there must be buy-in from accreditation and licensing organizations. With their new accreditation standards, the Accreditation Board for Engineering and Technology (ABET) appears receptive and able to support civil engineering in defining the master's as the FPD (Russell et al. 2000). Encouragingly, the National Society of Professional Engineers (NSPE) has recently revised its model law for licensing by outlining two paths to achieve the requirements: (1) with a BSCE and (2) with a MS or Ph.D. ("NSPE Proposes" 2000). These proposed changes to the model law suggest receptivity for the master's as a requirement for civil engineering. Furthermore, by providing a pathway for civil engineers to pursue licensing alongside other branches of engineering with four-year education requirements, the proposed changes should help avoid any problems of compatibility.

While ABET and NSPE appear receptive to supporting the FPD, the stance of the National Council of Examiners for Engineering and Surveying (NCEES) remains unclear. NCEES is in contact with state licensing boards and could help facilitate the transition to the new educational requirements. Nonetheless, it remains to be seen how NCEES will encourage the master's degree for civil engineering. As ASCE

develops its implementation plan, key representatives from NCEES, ABET, and NSPE should be consulted.

Table 5. Salary Comparison of Civil Engineering Bachelor's and Graduate Degrees  
(Sources: NACE 2000; BOL 1999; NSF 1997)

Salary (1)	Bachelor's Degree (\$) (2)	Master's Degree (\$) (3)	Doctorate (\$) (4)
Average Starting	36,100	42,300	58,600
Median	51,000	60,000	68,000

### Outcomes

Adopting increased education requirements for civil engineering will not guarantee that all Federal civil engineering positions will instantly be reclassified at a higher level, nor will it guarantee that private industry will increase civil engineering salaries. Yet both the government and private industry pay for increased education, as illustrated in Table 5. It is our contention that as the educational credentials of the profession are enhanced, so will the responsibilities of Federal jobs. Moreover, it is conceivable that the entire Federal Civil Engineering Series could be restructured to begin at the GS-7 level. This would be consistent with other professions that require education beyond the bachelor's degree for professional practice, as Column 3 in Table 3 makes clear.

Overall, the numbers support the master's for civil engineering. With increased value-adding knowledge and skills, young civil engineers will stand a better chance for advancement in public or private practice. In this way, more education will help civil engineers take control of their future.

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