AC 2009-1937: NOT SO FAST WITH THE DEMISE OF CIVIL ENGINEERING TECHNOLOGY--IT MAY BE JUST ABOUT TO BLOSSOM!

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Not So Fast with the Demise of Civil Engineering Technology, It May Be Just About to Blossom!!

Abstract

As recently as June 2008, the skies appeared to be growing ever darker for Civil Engineering Technology as an educational platform at four year institutions in the U.S. The National Council of Examiners of Engineers and Surveyors (NCEES) had in September 2006 adopted the ASCE Policy Statement 465 that applicants for Professional Engineer registration possess both a BSCE degree and 30 credits of post-graduate study, effective 2015. The demise of C.E. Technology was feared to be just around the corner because graduates from such programs would no longer have the opportunity to seek registration as Professional Engineers. Currently, graduates with civil engineering technology degrees from 4-year institutions can eventually become registered professional civil engineers in about 40 states. Many students in our local area choose the technology path in higher education because the instruction they receive is viewed as more practical and 'hands-on'. However, because there is only one professional level recognized for civil engineers, that of a registered Professional Engineer, CET programs would have a tough time attracting students if there were not ready opportunities to obtain professional credentials. But the role of the technologist in civil engineering is now being investigated by ASCE, and it may well be that the technologist will have a large role to play in civil engineering. Here at Wentworth Institute of Technology, we are holding off on elevating our successful CET program to be full civil engineering because we are seeing record freshmen enrollments and there seems to be renewed vigor in establishing professional recognition to the role of the technologist in civil engineering practice. The basis for our deliberations on this debate are explained in the paper, as well as our hopes and recommendations for future professional recognition of the civil engineering technologist.

Introduction

In a paper for last year's ASEE Annual Conference, I wrote about the a decision that Wentworth Institute of Technology was reluctantly making to elevate its thriving Civil Engineering Technology program to be a full Civil Engineering program[1]. That decision was in reaction to the adoption in 2006 by the National Council of Examiners of Engineers and Surveyors[2] (NCEES) of the essence of ASCE Policy Statement 465[3], which will "raise the bar" as to the qualifications in the future for becoming a registered professional Civil Engineer. The indications seemed clear that the position adopted in 2006 would have required the applicant for professional licensure to have achieved a Bachelor's Degree in Civil Engineering and attained post-graduate education (either a Master's degree or 30 credits of approved study). Even more worrisome was the initiation date of 2015 for the BSCE+30, which would have meant that the freshman class entering Wentworth in 2011 would no longer be eligible for professional licensure with the BS-CET degree that our institution confers. Our concern is that without the possibility of attaining licensure, few parents would be willing to allow their high school graduates to study four years in the Wentworth civil engineering technology program, let alone pay the $100,000+ in tuition and housing.

The demise of C.E. Technology appeared to be just around the corner, because graduates from such programs would no longer have the opportunity to seek registration as Professional Engineers. The ASCE "raise the bar" initiative has finally developed real forward momentum, and is still moving forward. However, several recent events have shown that there are other views in the civil engineering industry which also want to be heard. There has been less than positive reaction by some members of state boards of registration to the 2006 NCEES decision. A consequence has been the decision by NCEES in the August 2008 annual meeting to delay the formal adoption date of the BSCE+30 criteria to be 2020[4]. Furthermore, an initiative for further study was enacted by NCEES to address issues such as; whether the actual education of civil engineers has been lessened from decades ago (as argued by Galloway[5], for example), will the extra effort needed to achieve P.E. licensure reduce the future number of P.E.s when a shortage is already looming, and what alternative solutions might also be acceptable (such as professional experience) that might be acceptable in place of additional formal post-graduate education.

This is a very hopeful signal for the Wentworth CET program because it will likely include eventual adoption of "dual track" to licensure, which would add a second parallel track of BS+MSCE to the originally adopted BSCE+30. While the intent of this second track is to permit graduates from other scientific disciplines, such as biology, chemistry, geology, etc. to obtain professional licensure in Civil Engineering by obtaining a Master's degree in CE from a program based in a college or university having an ABET-EAC accredited civil engineering program, it is expected that this second track would also be open to graduates who have obtained a BS in CET. So if there is still an avenue for the motivated Civil Engineering Technology graduate to study for and earn an MSCE degree at an ABET-EAC school, then we can still promote our CET program at Wentworth as preparing the student to eventually become a registered professional engineer.

But why is this paper titled "… C.E.Technology is About to Blossom!!"? Certainly not because graduates with a technology degree will likely retain a possible path to professional licensure. That just maintains the status quo. The blossoming comes in the slowly growing awareness that there is real value in the civil engineering technologist. In the future, it may just be the civil engineering technologist who saves the C.E. practice in the U.S in the face of ever encroaching global competition. Although the C.E.Technology graduate may never become registered, by virtue of the under-graduate CET education received, the CET can productively undertake a career performing most of the analytical and design tasks that are done day in and day out throughout the civil engineering workplace. The CE Technologist will not be stamping drawings, but will work under the auspices of a registered Professional Engineer, who is in responsible charge of a project. The appropriate utilization of the CE Technologist in the civil engineering industry can help to correct what appears to be a poor utilization of labor that occurs when P.E.s are performing common analysis tasks such as slope stability or surface water run-off calculations for several days or weeks of the month. There is no need to have a P.E., or even to have passed the F.E exam, or to have had courses in Calculus III and a third science to properly draw a flow net, or to make bearing capacity calculations, or to size a reinforced concrete beam and select the proper reinforcement. Granted, in many offices such analyses are often done by entry level civil engineering graduates, or engineering interns who have passed the F.E. exam and are gaining the four years experience needed before taking the P.E. exam. How much quicker and reliably could some types of analyses be made by a C.E.Technologist with 8, 12 or 20 years of experience?

Civil Engineering Technology, What is it and How Does it Differ from Civil Enginering?

The Civil Engineering Technology at Wentworth has been a healthy educational program for decades, and its content has been evolving over the past several years both to keep pace with the changing needs of the civil engineering industry, and to provide the students a chance to specialize in different technical areas. There are similarities and differences between the 25 ABET-TAC accredited CET programs across the U.S., just as there are differences between the 250 or so full-fledged civil engineering programs. The intent here is to illustrate some similarities and differences in courses between our C.E.Technology program and the civil engineering programs at two nearby and well regarded New England state universities. This will be followed with a brief discussion of how our program fits the needs of the student base that we receive at Wentworth with each Fall's incoming freshman class.

The Civil Engineering Technology program at Wentworth Institute of Technology is summarized by semester in Table 1, along with the civil engineering programs at the Univ. of Massachusetts, Amherst campus[6], and that of Univ. of New Hampshire[7]. There are some notable differences. Much of the content in the Wentworth CET is driven by the requirements of ABET-TAC.[8] The CE programs at UMass and UNH must meet the recently revised ABET-EAC[9] requirements, which has among other changes added need for a third science. A foundational difference between programs is that civil engineering programs begin with calculus in freshman year and have two semesters of Physics (calculus based), but at Wentworth we begin with College Math and College Physics which better suits our incoming freshmen cohort. Another difference is the greater number of technical electives permitted at the engineering schools so a student can develop two or three specializations. However in the Wentworth curriculum the student will be broadly exposed to five disciplines C.E.designs, and then may take two or three specialized courses.

It is interesting to observe that junior and senior level design course names at Wentworth are, in a number of regards, fairly close to the current required upper level course names in the two listed civil engineering programs. Of course just because course titles are the same has no direct bearing on whether course contents are the same. There may well be more theoretical development in the courses listed for ABET-EAC schools than there is in CET courses. However, whether it is a fluid mechanics course, a soil mechanics course or reinforced concrete design course, the goal of undergraduate CE and CET has been to instill in the graduating senior the ability to enter the workplace with sufficiently full bag of civil engineering 'tools' so that the new graduate can productively undertake straightforward design assignments in that first month on the new job. At least that has been our goal for graduates from the Wentworth CET program. We also want the CET graduate to know how the tools work, although not necessarily be able to derive the basics equations from first basics of physics and intergral calculus.

A significant element in our educational model at Wentworth is the extensive use of 'experiential learning' through use of laboratory sessions in many fundamental and CE design courses, as noted on Table I with the (L) indication. These lab courses are either experimental or analytical or both depending on the course. All of our junior and senior level civil design courses include laboratory sessions, some for experimentation and others for design analysis application. In the same "practical experience" vein we also require our students to complete two mandatory semesters of co-op employment, as listed in Table 1. These two 4-month work experiences

provide most students a clear focus on their future, and the faculty notice real changes in student attitudes after each co-op period. Thus, after four years of study, we provide our students the tools and experience needed to function as well-trained entry level civil engineering technologists in the design and construction workplace, who can perform design tasks, and monitor and coordinate construction.

Wentworth Instit.of Technol.	***Univ.Mass. – Amherst[6]***	***Univ.New Hampshire[7]***
Freshman Year – Fall	**Freshman Year – Fall**	**Freshman Year – Fall**
Intro. to Des. & Constr. Prof.	Intro to Civil & Envir.Engineering	Intro to Civil Engineering
Chemistry I	Calculus 1	Fundamental of CAD
English I	Engineering Chemistry 1	Freshman English
College Mathematics I	College Writing	A&A of Functs (Math, if needed)
	Social World Elective	General Ed
Freshman Year – Spring	**Freshman Year – Spring**	**Freshman Year – Spring**
Construction Graphics (L)	CE Measurements	Surveying and Mapping
Fundam'ls of Constrc. (L)	Calculus 2	General Ed
English II	General Physics 1	Physics 1
Pre-Calculus	Engineering Chemistry 2	Calculus 1
College Physics I	Physics Lab	
Sophomore Year – Fall	**Sophomore Year – Fall**	**Sophomore Year – Fall**
Surveying I (L)	Systems Analysis and Economics	Engineering Communication
Structural Mechanics I (L)	Statics	Statics
Social Science Elective	Multivariate Calculus	Environ Pollution and Protection
Social Science Elective	General Physics 2 and Lab	Physics 2
Calculus I	Intro. to Microeconomics	Calculus 2
Sophomore Year – Spring	**Sophomore Year – Spring**	**Sophomore Year – Spring**
Dynamics	Probability and Statistics for CEE	Project Engineering
Structural Mechanics II (L)	Strength of Materials	Strength of Material
Matls, Testing and Q.C. (L)	Thermodynamics	General Chemistry
Technical Communications	Social World Electives	General Ed
Calculus II	Differential Equations	Diff. Eqns and Linear Algebra
Sophomore Year – Summer		
Recom'd Co-op Work Exper.		
Junior Year – Fall Semester	**Junior Year – Fall Semester**	**Junior Year – Fall Semester**
Structural Analysis (L)	Structural Analysis	Statistics for Engr & Science
Environ'al Issues in CET (L)	Transportation Systems	Basic Science
Applied Fluid Mechanics (L)	Elementary Fluid Mechanics	Fluid Mechanics
Soil Mechanics (L)	Environmental Engr.Principles	Engineering Materials
Appl.Calc. & Diff. Eqns.	Social World Elective	
Junior Year – Spring		
Mandatory Co-op Work Expr.	**Junior Year – Spring**	**Junior Year – Spring**
Junior Year – Summer	Des. of Concrete or Steel Structs	Structural Analysis
Structural Steel Design (L)	Soil Mechanics	Soil Mechanics
Hydraulic Design (L)	Water Wastewater Treatment	Fundamentals of Environ Engr
C.E. Technical Elective (L)	CEE laboratory	General Ed
Humanities or Soc.Sci. Elect.	Writing in Engineering	

Senior Year – Fall		
Mandatory Co-op Work Expr.		
Senior Year – Spring	**Senior Year – Fall**	**Senior Year – Fall**
Highway & Pavement Des.(L)	CEE Elective	
Reinforced Concrete Des. (L)	CEE Elective	Intro Proj. Planning & Design
C.E. Technical Elective (L)	Free Elective	Reinforced Concrete Design
Humanities or Soc. Sci. Elect.	Biological Sciences Elective	Foundation Design I
Water and Wastewater.Treat. (1)	Social World Elective	Design Elective
Senior Year – Summer	**Senior Year – Spring**	**Senior Year – Spring**
Professional Practice	CEE Design Project	Proj Plan & Design
Senior Design in C.E.T. (L)	CEE Elective	CIE/ENE Elective
C.E. Technical Elective (L)	CEE Elective	CIE/ENE Elective
Humanities or Soc. Sci. Elect.	Social World Elective	CIE/ENE Elective

Table 1. Comparison of Courses in Curriculum between Wentworth Civil Engineering Technology and Civil Engineering at Univ.Mass. Amherst and UNH

Many ask us why we simply do not change our program to be one of full-fledged civil engineering instruction. The answer lies both in the make-up of our incoming freshmen and their mathematics capabilities upon entry, and in our history of being strongly rooted in "hands-on" experiential learning. Wentworth holds itself out in part as a "college of opportunity" to many high school seniors, who are not as well trained in mathematics as they would need to be to enter a full engineering program at other universities. We find that the majority of freshmen coming into the CET program are not yet capable of taking Calculus I, and many, but not a majority, are not yet ready for Pre-Calculus. Therefore, our freshmen curriculum requirements for C.E.Technology in mathematics is College Math I followed by Pre-Calculus, as listed in Table I. With this basis in freshman year, and the need to also begin Physics in the freshman year, we simply have not found it practical to have the more rigorous freshmen curriculum necessary of an ABET-EAC engineering program that would require the higher level of mathematics, and calculus-based instruction in physics for freshmen.

We also make particular note of the "hands-on" experiential learning model of our Civil Engineering Technology curriculum. We find that our students are greatly aided by the experiential process in the CET program where weekly laboratory sessions are used to demonstrate principles or assist in understanding of applications of design processes and the related theory. It is also our desire to produce graduates who are well-versed across the spectrum of most CE disciplines. Therefore, our program provides introductory instruction in five design disciplines, albeit on a somewhat less theory-based course of study than in civil engineering programs. However, the analytical content of numerous upper level design courses is just as pervasive as is provided in many CE programs, if not more so, because we include numerous real project examples and problems that our experienced faculty and adjuncts bring to demonstrate their real world Civil Engineering design experiences. Furthermore, the two or three technical electives give the student the opportunity to gain more detailed design instruction in one of three discipline areas of study.

Capabilities and Successes of Wentworth CET Graduates

Our program at Wentworth has been successful over the past two decades. In the last few years, our graduating class has increased from 24 to 46, and that growth appears to be continuing with over 100 students entering last September in the freshman class, and 65 in the current sophomore class. Graduates usually obtain positions in the design or construction business, and more than half are typically employed on the day they graduate. Although most of our graduates obtain civil engineering positions in the New England region, a growing number venture to distant areas across the U.S. Employers who have just recently hired a civil engineering technology graduate often note pleasant surprise that their new employee is indeed well prepared technically to undertake a diverse spectrum of civil engineering tasks and challenges presented to them. We hear comments that in the practice of engineering design, our C.E.Technology graduates tend to be more focused on problem solving than graduates from ABET-EAC accredited Civil Engineering programs, who are sometimes noted by employers as being more interested in analyzing problems and performing parameter studies than in reaching design conclusions.

Although data are incomplete, we 'hear' that quite a few of our graduates eventually obtain registration as Professional Engineers (which currently is often a requirement for career advancement at many civil engineering design firms). In that regard, the CET curriculum at Wentworth actively incorporates 75 to 80% of the background that students need to know for the Fundamentals of Engineering exam. In the past three years, about one-third of each senior class has taken the F.E. exam prior to or in the fall after graduation, with between 2/3 to 3/4 passing rate. Our Junior and Senior level civil design courses also frequently incorporate material content that is prevalent on the Professional Engineers exam, so the graduate is also exposed to more than 65% of the P.E. exam content.

A further indication of the appropriateness of the depth of engineering for instructional background instilled in our CET graduates is their success in civil engineering graduate school. For each of the past three years, 10% to 15% of the graduating class has moved on to undertake advanced graduate studies to obtain a Master's Degree in a civil engineering discipline. Most of these graduates find Master's degree programs willing to accept them, although some universities place limitations on the amount of course load they can take in their first semester (to make sure the student can handle the greater intensity of course work required of graduate students). The lack of calculus-based physics and limited theoretical development in the presentation of civil engineering design methods in the CET coursework has not been noted as posing a major problem for the WIT graduates who go on to advanced degree studies. We would be remiss not to acknowledge that the Wentworth graduates who are seeking Master's degrees in civil engineering usually have been in the top one third of their class, but their instruction in the less than full calculus-based engineering basics has not shown to be a major hindrance. The other 2/3 of the class likely would never seek advanced degree in civil engineering, that is, under the existing circumstances of not needing the Master's degree to obtain professional registration. However, this could well change in the future when the BSCE+30 becomes the minimum level for admittance to take the PE exam. It is worthy of note that perhaps a quarter of our graduates do go on to obtain further education in construction management or business administration.

Hopeful Signs for CET as a Consequence of the "Raise the Bar" Initiative

So why might we believe that the CET program is about to flourish? We feel it is not just because our CET program has been very similar to the full civil engineering curricula in ABET-EAC accredited schools. Rather it will be due to the impending and future changes in curricula of those ABET-EAC accredited schools that will have to occur as a consequence of the "raise the bar" initiative which ASCE and NSPE say is vitally necessary to both imbue global perspective and restore the technical ability of those seeking licensure as professional engineers. "Raise the bar" will affect the under-graduate side of education by broadening the educational background as noted by ASCE in BOK-2nd edition.[10, 11] But at the same time there will be somewhat of a reduced technical content of the BSCE degree. This is not yet reflected in curricula because the full scope of BOK-2 has not yet been incorporated into ABET-EAC requirements.

The ultimate goal of ASCE is to have a society of civil engineers who are not just number-crunching analysts, but who instead will be globally aware leaders and influential citizens of the U.S. and world society of tomorrow. International business relations in future years are expected to demand greater breadth of view and background. American infra-structure is barely passing with the most recent grade for 2009 from ASCE being a D[12]. My greatest fear is that politicians are like some students who view "D" as simply not great, but still a passing grade. However, funding for infra-structure renewal is a political issue, and civil engineers must become decision makers, instead of just being the 'hired help'.

As such, ASCE's expansion of the BOK to include 10 specific professional educational outcomes to increase background on ethics, business, global awareness, history and politics is laudable. The technical ability needed to begin practicing as a licensed P.E. will have to be gained in post-graduate studies to achieve +30 credits. But just where does that leave the civil engineering industry in its need for those number-crunching analysts? Here is the place for the Civil Engineering Technologist. If the goal of ASCE is to model civil engineering education along the lines of medical and legal professions, then would it not be wise to establish a full parallel structure right away in the initial stages of "raise the bar".

The pervassive reduction in undergraduate technical education for the BSCE student that has crept into curricula over the past several decades will, in the future under BS+30, be made up by the candidate for professional registration first having to obtain 30 additional credits of post-graduate education in technical civil engineering and related topics. ASCE has stated that the student who achieves a bachelor degree in civil engineering under the future criteria will essentially be acquiring a 'pre-engineering' level of knowledge similar to pre-law and pre-med. But what about the BSCE graduate who does not go on to earn the +30 credits. It just may be that the B.S. in civil engineering will not suffice for an entry-level position in civil design or construction firms, and that the new-normal for entry to a civil engineering practice will therefore have to be the Master's Degree. This is already the case in many structural design firms and geotechnical firms where new hires with only BSCE degrees are often utilized as technicians and junior grade analysists. How will this new-normal level affect the civil engineering industry in the U.S.? Will the lower half of each graduating class be able to go on to achieve the +30 added credits of advanced post graduate study?

As civil engineering education is broadened to be more of a pre-engineering course of study, then for a while (maybe a decade) employers of new bachelor degree graduates will have to adjust to the fact that the technical capability they expect will not yet have been bestowed on the 'new hire'. Here is the place where the CETechnology graduate can quite adequately fill what I forsee will develop to be a gap or void in the future CE workforce. The CET graduate will already have had grounding in much of the technical design topics that the future BSCE graduate may well be lacking. Thus it appears that CET education will not only have a place in the future civil engineering workforce, but will be a vital element.

Now the question becomes, will the CET graduate want to, and have the fortitude and capability to go on to achieve a MSCE degree? For that matter, how many of the BSCE graduates will want to go on and become registered P.E.s when they first must obtain the 30 additional credits of post-graduate coursework? This consequence of the "raise the bar" initiative can foster an entirely new category of civil engineering 'paraprofessional'. In the case of the CET graduate, this would be a person who is highly skilled in civil engineering technology and can readily carrying out analytical and design work tasks, but who does not want to invest the time and effort in obtaining the additional education needed to become eligible to take the P.E. exam. The future C.E.Technologist would be a person who would be quite satisfied to perform the design and analysis tasks in the civil engineering firm, and field engineering functions during construction, but for one reason or another they do not rise to the level of being the professional in responsible charge of the design project.

The Need in Civil Engineering for an Intermediate Level of Credentialing

At present, there is only one minimum competency standard in the civil engineering industry, that of registered "Professional Engineer". How many civil engineering graduates now achieve P.E. licensure, but never really or rarely utilize the P.E. responsibility? Perhaps quite a few. These individuals may hold positions that involve civil engineering design, but rarely supervise or direct others as part of their position duties. However, as part of their work position, or earlier path to advancement within their organization, these civil engineering graduates have needed to achieve the P.E. This has been a doable achievement by many because it 'only' required studying for and passing the FE and PE exams. Unfortunately, this requirement has been and still is too lax; I have known a number of individuals who have passed the P.E. exam, but who I sincerely hope never have a chance to be in responsible charge and actually stamp a drawing. But having attained the P.E. license many then continue to work as technologists and maybe that is the level to which they should have been credentialed in the first place.

As the "raise the bar" initiative becomes embedded in civil engineering practice with the formal adoption of BS+30 as the pre-requisite level of education for taking the PE exam, it may very well be that fewer will be able to 'leap' to this higher level. Certainly, there will be a greater effort needed to achieve the 30 credits of post-graduate education. While this will achieve the ultimate desired result of a better educated civil engineer, I foresee that a "gap" will likely emerge in the civil engineering work force between those with the PE and those without. Currently, there is no alternative credential that is recognized across the civil engineering industry in the U.S. for those who do not really need the P.E. license, but who have to attain it initially for reasons of work place requirement. This issue has been studied in 2008 by the ASCE Paraprofessional Exploratory Task Committee (PETC),[13] on which the author of this

paper served and contributed to the report writing, some of which forms the basis of thoughts presented in the following paragraphs of this section. A further ASCE task committee will carry out the next steps of study recommended by the PETC, with the further study continuing through the next two years.

The Professional Engineer title has served the CE industry well for the past 60 years. There was a time in the 19th and early 20th century when just about anyone could pass themselves off as a civil engineer. In response, states enacted licensing laws that set minimum standards to be met before being able to say one was a licensed professional civil engineer. Eventually this included passing the one, and then the two exams we have today. The PE currently remains the only formally credentialed "professional" recognized throughout civil engineering practice. This P.E. is recognized as having legal power to undertake and authorize designs of structures and facilities as being properly designed and constructed, and safe for public use. Most organizations and businesses recognize the attainment of the P.E. as an individual's having had the individual initiative to study for and pass the two examinations necessary to achieve P.E. license. Attaining the P.E. is often a job requirement.

However, as mentioned above, a registered engineer may never actually use his/her P.E. authority to stamp drawings, communicate formal recommendations to a client, and may only rarely assume responsible charge on a project. Furthermore, day to day work tasks that the P.E. often undertakes may not involve "responsible charge" decisions. Because licensure would not therefore be required to accomplish many of this P.E.'s work tasks, much of the work could be completed by a highly skilled Civil Engineering Technologist. The question is then, how much of a P.E.'s workday time is actually spent doing civil engineering analysis and design tasks that could just as well be done by a civil engineering technologist?

Will the civil engineering industry be willing to undertake the creation of a category of positions that have different prerequisites and career paths from those of the Professional Engineer? To create such a position would at a minimum require there be established formalizing of credentials for the Technologist, complete with educational requirements, examination requirements to verify minimum capabilities and then a continuing education requirement to verify maintaining of continued competency. Development of such an industry-wide position should not, however, be seen as adding to the civil engineering workforce, Rather it would be a formalizing of a different position within the civil engineering industry for a role that already exists and which has great importance for the future of civil engineering design in the U.S. This would provide a level of credentialing and career path to individuals who do not really 'need' to leap over the "raised P.E. bar" of the future.

Hopeful Signs that CE Technology has a Place in Future Civil Engineering Industry

At present, a CET can become registered in about 34 states after passing the two exams and attaining requisite experience. Eight more states are added if the CET graduate acquires an MSCE. Furthermore, there appears to be movement in some state registration boards to accept CET graduates for Professional Registration where such opportunity had previously been prohibited. For one, South Carolina now will permit CET graduates to seek P.E. registration. We expect that the change is in recognition that the CET degree from 4-year ABET-TAC accredited programs, such as ours at Wentworth, have been found to provide adequate

background preparation to enter the practice of civil engineering by the Board of Registration in South Carolina. But will this opening of a door be short lived with the "raise the bar" initiative? There are hopeful signs that the door for CET will still be open.

It appears that there will indeed be a future path available for the CET graduate to achieve professional licensure. Both NCEES and ASCE have opened their positions on additional education requirements associated with "raise the bar" to offer a second path to professional registration, i.e. BS + MSCE. The dual path adoption is in recognition that some college graduates in fields such as biology, chemistry, material science or metallurgy, geology and others may develop career paths in the civil engineering industry and eventually want or need to obtain P.E. licensure. The reasoning for allowing BS+MSCE recognizes that there may be added rigor in MSCE programs over and above that needed to obtain the +30 credits (details of which have not been established) . Entry into an MSCE program may require substantiation that sufficient background education has first been acquired. Perhaps the CET graduate would have to take a series of broader education courses and a third science that the future BSCE would already have. However, the basic background coursework in selected civil engineering technical topics would already have been accomplished and learned. The formal rules for such implementation are still some years away. However, the fact that some Wentworth graduates in CET now go on to earn MSCE degrees for career advancement augers well that others, in greater numbers, could also be expected to be able to obtain MSCE degrees and then be qualified to take the P.E. exam.

From our view into the future, we at Wentworth are excited that there will be an increased demand for C.E.Technologist graduates who can 'hit-the-ground-running'. We become really excited when we consider there are just 25 CET programs accredited by ABET-TAC, in a larger community of 250 CE programs in U.S. higher education. There is more than 10 to 1 ratio in the number of BSCE graduates to CET graduates. With the recent ASCE Paraprofessional Exploratory Task Committee report, and a continued study beginning soon, it would be expected that the realization of both the usefulness and need for C.E.Technologists will increase. As noted above, much work in civil engineering done by PE's today probably does not really require professional licensure. For the sake of business model and efficiency of staff utilization, this work is likely better suited to the C.E.Technologist, particularity one with 8 to 12 to 20 years experience. Figure 1 illustrates our view of the current and future civil engineering work force where the future could well see a far greater number of C.E.Technologists than P.E.s. A possible outcome of the ASCE study would be a recommendation for establishing a credentialing level for technologists who will be filling the future void that this author believes will likely be created by "raising the bar" for professional registration.

Summary

Currently, graduates with civil engineering technology degrees from 4-year institutions can eventually become registered professional civil engineers in more than 40 states. Many of our students choose the technology path in higher education because the instruction they receive is viewed as more practical and 'hands-on'. The CET program at Wentworth is thriving, and has gained considerable recognition over the past decade, with employers of our graduates saying that their new employees are indeed well prepared technically for the civil engineering tasks. It would appear that there will be an increasing demand for technologists for both field and office engineering, and it is hoped that ASCE and the civil engineering industry are about to realize the

career path potential for the C.E. Technologist. As the need for rebuilding America's infra-structure grows more and more acute, the technologist will be in ever greater demand as a real 'hands-on' problem solver. This renaissance in C.E. Technology may in fact see new CET programs forming at traditional engineering schools! Wentworth, along with the limited number of other technology schools, is uniquely poised with time-tested 'hands-on' heritage, that can blossom into the future 'new' technology needed to keep the U.S. civil engineering profession a globally competitive workforce.

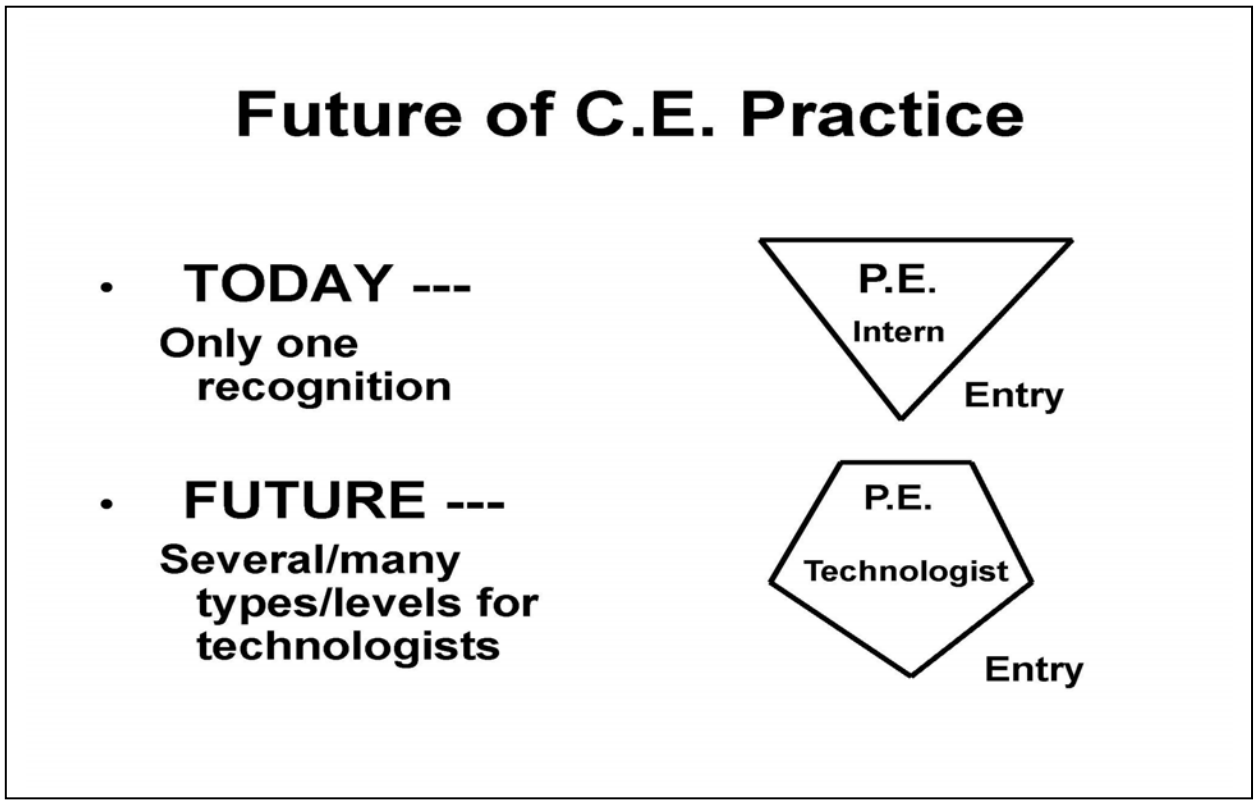

Figure 1. An Illustration of Relative Proportions in Civil Engineering Work Force, Today and Possible in the Future

These signs point to a vibrant CET program here at Wentworth. We have welcomed our largest ever freshman class in September 2008, with 92 incoming high school graduates, and about 20 transfer students. The population increase comes even with the general realization by parents and students of the difference between CET and CE education, and the restrictions in some states on professional registration. Therefore, we see the need to continue to improve our highly successful CE Technology program, and not jump into a new, and uncharted civil engineering program in the next year or two for fear of the future 'raise the bar' BSCE+30. If events unfold as expected and discussed in this paper, then the Wentworth CET program can expect a long productive life preparing the Civil Engineering Technologists of the 21st century.

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