

AC 2009-1501: ASSESSING STATE ENGINEERING EXAMINING BOARDS AND HIGHER EDUCATION'S RESPONSE TO THE 2006 NCEES MODEL LAW FOR PROFESSIONAL ENGINEERING LICENSURE

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Assessing Higher Education Response to the 2006 NCEES Model Law for Professional Engineering Licensure

Introduction

To obtain a professional civil engineering license, engineers must complete requirements in three areas: academic training, professional experience, and national examinations. The American Society of Civil Engineers (ASCE) and the National Council of Examiners for Engineering and Surveying (NCEES) have proposed additional requirements beyond those currently in force, particularly in the area of academic training. Both ASCE and NCEES anticipate that these changes will more adequately prepare engineers for the tasks that they will face in the future, allowing NCEES to ensure maximized public health, safety, and welfare consequential to civil projects. Additionally, ASCE believes that implementation will enhance the stature of the profession in general.

As the graduate committee in the Department of Civil and Environmental Engineering at Brigham Young University (BYU), the authors of this paper were charged with planning for potential impacts that a change in the academic requirements for licensure would have on our department. The authors used this opportunity to ascertain if civil engineering departments at other universities were making changes in their programs and if they were taking planning actions based on these proposed licensing requirements. The purpose of this paper is to summarize the results of a survey conducted to aid in this effort. Before presenting the survey the paper outlines current requirements for professional engineering licensure, identifies proposed changes to licensure requirements, and outlines the study objectives. Following this introductory information, the research methods are presented and survey results summarized, including issues and discussion. Finally, conclusions to the research are provided.

Current Licensure Requirements

The academic training required for professional licensure is a four-year Bachelor of Science (BS) degree from an ABET/EAC (ABET, Inc., Engineering Accreditation Commission) accredited program. ABET/EAC is a non-governmental association that specifies curriculum requirements and minimum learning outcomes that an accredited civil engineering program must provide to each engineering student. ABET/EAC oversight ensures nationwide uniformity and quality in engineering education.

The professional experience requirement for licensure is satisfied through post-baccalaureate work experience under the supervision of a licensed engineer. Individual state licensing boards approve work experience on a case by case basis and there are few general guidelines available which establish appropriate work. Licensing boards typically require four years of experience, but some allow credit for time spent in completion of a graduate degree to substitute for a portion of the professional experience. Licensing boards review the quality of the professional experience to determine whether the experience was appropriate. Many jurisdictions also require that the engineering experience be progressive in nature, which means increasing in breadth, depth, and responsibility, rather than one year's experience repeated a number of times.¹

The examination requirement for professional licensure is fulfilled by passing at least two national examinations: the Fundamentals of Engineering Examination (FE) and the Principles and Practice of Engineering Examination (PE). The FE exam is administered by the NCEES and taken shortly before or soon after graduation. The PE is taken after the professional experience requirement is completed. Upon passing the PE exam, an individual may obtain a professional license.

Proposed Changes to Licensure Requirements

ASCE has expressed concern that a BS degree is not sufficient preparation for professionally licensed civil engineering practice.² ASCE has reported that the knowledge, skills, and attitudes of the 21st century engineer exceed those faced by the 20th century engineer. They state that globalization, sustainability requirements, emerging technology, and increased complexity require additional education.² ASCE has twice, in 1998 and 2005, formed committees to analyze current requirements to determine what is lacking and to categorize proposed academic requirement changes. The first committee issued ASCE Policy Statement 465 (PS-465).³ This led to ASCE writing a document, the Engineering Body of Knowledge (BOK), which was published in 2004.⁴ The second committee revised the BOK, adding specificity and clarity, and published the updated BOK in 2008.⁵ This BOK proposes increasing the academic requirement to include a 30 hour Master of Science (MS) degree or 30 hours of similar coursework in addition to the BS degree.²

ASCE encouraged NCEES to change licensure requirements to include the additional academic work as proposed by the BOK.⁵ In response, the NCEES committee on Uniform Procedures and Legislative Guidelines passed a motion in 2006 to add language to the Model Law for Engineering Licensure stating that beginning in 2015 a candidate must have 30 credit hours in addition to the BS degree in order to sit for the PE exam.⁶ State licensing boards are now considering adopting this model law in their licensing requirements.

Motivation and Study Objectives

As indicated in the introduction, the authors of this paper were charged with planning for potential impacts that a change to the academic requirements for licensure would have on the graduate program in their department and in other departments around the country. Specifically, the authors were trying to determine if a coursework-only MS degree (which their department does not currently offer) would be a better way to serve the students. The authors were also interested in how business owners and state licensing boards are responding to the proposed changes to licensure. To satisfy their curiosity and develop a more quantitative assessment, short surveys were developed to target three significant groups: academics, business leaders, and state licensing boards. The objective was to get a sense of the present sentiment towards the proposed changes in licensure requirements and whether or not those surveyed supported the additional proposed educational requirements.

Research Methods

Separate surveys were designed for each of the groups with a common introduction featuring links to PS-465 and NCEES's proposed model law. These links permitted responders to review the pertinent documents prior to taking the survey. Additionally, two key questions were

common to all surveys. The first question was: How familiar are you with efforts by organizations such as ASCE and NCEES to require 30 hours of coursework beyond the BS degree for those applying for first time professional licensure? The second common question was: Do you agree with or support the BS + 30 requirement in the new model law?

In addition to the two common questions, each survey gathered general information about the academic training and professional status of those surveyed to determine to what degree, if any, individual sentiment was related to the education or professional status of the respondents.

The academic survey contained questions about expected effects of the NCEES model law on demand for graduate programs. The survey included specific questions about current offering of coursework-only MS degrees and willingness to provide such a degree if currently lacking. The academic survey was sent to the civil engineering department chair, or equivalent, of 113 private and state universities in the 48 contiguous states. Of the 113 surveys distributed by email, 48 responses were completed.

The engineering business leader survey contained questions about firm size, expected effects on business, and the willingness of the business to help defer additional costs to those employees who seek additional education to comply with the proposed changes. The survey was distributed to the four leading members of each of the 50 state American Council of Engineering Companies (ACEC) branches. The ACEC president, president-elect, national director, and executive director were also invited to take the survey. Eighty-nine of the 204 surveys were completed.

The state licensure board survey was sent to the chairperson, or equivalent, of the licensure board of each of the 50 states. Of the 50 licensure board surveys distributed, 26 were completed. The licensure board survey asked if the respondent believed the NCEES model law would be implemented by their state and an anticipated timeline of adoption. The survey also asked respondents if this issue had been discussed with other governmental leaders in their state.

Survey Results

This section focuses on the results from the academic survey, though supporting data from the other surveys are included. This focus is based on the interest of the authors in identifying how civil engineering departments view the proposed change, what impact they feel the change will have on their programs, and what steps are being taken to prepare for these changes.

Response rates for the three groups were 42% for academics, 50% for state licensing boards, and 44% for engineering business leaders. All groups were very familiar with the proposed changes, with more than 80% of each group considering themselves more than somewhat familiar with the proposed changes as shown in Table 1.

Support for the proposed changes was more widely varied. Educational leaders had the highest rate with 60% supporting the new model law proposed by NCEES. Other groups were less supportive as shown in Table 2. Seventy-one percent of business leaders do not support the changes. In the engineering business leader survey, 67% of the respondents believed that implementation of the new model law would have detrimental effects on their business.

Table 1 Results to the question: How familiar are you with efforts by organizations such as ASCE and NCEES to require 30 hours of coursework beyond the B.S. degree for those applying for first time professional licensure?

	Very familiar	Familiar	Somewhat familiar	Not familiar
Academics	64%	21%	13%	2%
Licensing Boards	67%	25%	8%	0%
Business Leaders	52%	42%	5%	1%

Table 2 Results to the question: Do you agree with or support the B.S. +30 requirements in the new model law?

	Yes	No	Undecided
Academics	60%	19%	21%
Licensing Boards	8%	42%	50%
Business Leaders	16%	71%	13%

All academic respondents (department chairs or equivalent) that held an engineering BS degree also held an engineering MS degree or equivalent and 79% were professionally licensed engineers. If the model law were implemented, 89% of the educational leaders expected an increase in demand for graduate programs and of these, 81% stated current department had adequate capacity to handle the increased demand. Seventy percent of departments currently offer a coursework-only MS degree, and all those that do not said they would consider such a program in order to accommodate more students. In addition, 55% stated that their departments were already taking action to increase capacity for MS degree students.

Issues and Discussion

The survey results indicate that most academics are familiar with the proposed changes and believe that these changes will increase numbers of graduate level engineering students. They also reported that their institutions had the capacity (or were developing the capacity) to handle these increased educational demands.

One unexpected survey result came from the free response section, which was included in all three surveys. Many of the survey respondents included comments and raised potential consequences (foreseen or unforeseen) of the proposed model law. The authors of the paper found many of these arguments were new to them and should be raised in this paper for wider discussion.

Various concerns were raised in these comments, all to some degree related to the impact of the proposed changes on the recruitment of future engineering students and training of future civil

engineers. These arguments are presented to promote discussion and excerpts are presented as originally submitted. These raw comments carry weight that the authors believe would be lost if an attempt was made to summarize the issues. For the most part further comment on these topics will not be provided, other than to generally introduce general topic areas of the responses. The purpose for this presentation is to create both increased awareness and discussion of these issues. Based on the received comments, the authors believe proposed licensing change may have consequences that the civil engineering profession may not have fully considered and addressed.

One of the main topics raised in the comments is the potential impact that the additional education requirement will have on the projected shortage of engineers. These comments present the thought that this change may exacerbate the issue by making a Civil Engineering degree less attractive to students. These comments also suggest that the proposed change could lower the average salary of a Civil Engineering graduate, rather than raise it.

The comments from academic leaders who responded to the survey include the following thoughts related to recruiting and training future engineers (items in brackets were added):

“In my capstone design class of >90 students, we talked about this yesterday. I took a poll. Most are ASCE members. When I told them about the pending changes, they looked like they were punched in the stomach. This initiative will repel students from enrolling in CE programs at the BS level. Period.”

“[The new model law] will create a class of engineering graduates who cannot become registered and will lower the average salaries of BS graduates. Many bright young people who would have considered civil engineering will avoid it because the earnings potential of a BS graduate from the other engineering disciplines will be even higher than for civil graduates. Overall the supply of civil engineers in the US drops and most jobs go overseas. How has the profession benefited?”

“This is a vague and unnecessary resolution that will, in my opinion, result in [fewer] students pursuing Civil Engineering degrees. As a university educator who does significant work with k-12 students I have considerable difficulty recommending Civil Engineering as an option to students or their parents. Why choose CIV E and take the chance that after 4 years you won't have the GPA to get into graduate school and thus be precluded from a profession that you have spent significant time and money preparing for? I will personally recommend almost any other engineering discipline to high school students if this resolution is adopted. Based on my experiences I find this to be an extremely bad idea. Encouraging more formal and continuing education is a good thing. Rewarding engineers who improve their skills is a good thing. Mandating vague requirements that will prevent engineers, who are otherwise capable, from obtaining a professional engineering license is a big mistake.”

“I strongly encourage all students to obtain some level of graduate education (MS, MBA, JD, etc.), but to require it is telling them that to be a civil engineer takes more time and money than other disciplines, despite the fact that our pay scale is not greater than the other disciplines (often we are on the low side).”

There was a second running theme through many of the comments. These comments are all related to the assumed deficiency of training, if this deficiency exists, why it exists, and if additional academic training beyond a BS degree is the correct solution. Many of these comments argue that this deficiency in preparation and training is because of increasingly lowered BS degree requirements, rather than to new demands from the marketplace. This argument was raised by both academic and business leaders. In the view of the authors, this is an interesting thought that should be debated and discussed by the profession.

Responses from educational leaders stating this concern include:

“The undergraduate degree at many engineering schools has been watered-down significantly over the years. Therefore, the assertion that the younger generation is being asked to do more than [the older generation] is not correct. It would be best if the current curriculum at most engineering schools can be compared with the curriculum at the same schools in the past.”

“My concern with this requirement is that colleges and universities have dropped their required hours for graduation over the last 20 years and this is now a requirement to make up for this drop in hours. Why are these additional hours not added back to the original graduation requirements for ALL engineering graduates...”

A response from a state licensure board member was:

“Considering the engineering course work in a current [BS] degree and the additional technology available, it may be time to require additional college courses for a practicing engineer. I support making a bachelors degree a five year degree (150 hour) rather than making a bachelors degree nothing more than a technology degree (i.e. one by which the holder can not become licensed).”

Many of the survey respondents strongly supported additional academic training for engineers, but opposed making that training mandatory. These comments reflect the thought that our profession is very broad, and depending on the type of practice, mandatory academic training may not always be the best way to address the perceived shortcomings. This reasoning was included in many of the comments but is best presented by the following received from an academic leader:

“I support the bachelor's plus 30 hours but I do not support meeting that by trying to offer more master's degrees. There are perfectly good engineers who have bachelor's training and should become registered but are, for whatever reason, not suitable candidates for master's programs. We are trying to increase our master's numbers because we are currently turning away qualified applicants, not because we are gearing up to meet B+30 demands. My primary concern as this discussion has progressed is that we will lower the standards for obtaining a master's degree. Having supervised over 30 master's students myself, I do not intend to let the standards decrease.”

In some respects, these comments and concerns may reflect a misunderstanding of what ASCE and NCEES are trying to accomplish through the proposed changes. An ASCE leader made the following comment about the survey:

“I am a little concerned [about] the answers you will get from the survey...that is why I suggested some qualifying questions to make sure you understand the level of understanding the respondents have of the issue. I think there is still a lot of misunderstanding out there, and some opposition - particularly among those that don't understand the basis for the change.”

Indeed, some of the comments received indicated areas of misunderstanding. First, the proposed “bachelors plus 30” is not the same thing as requiring a masters degree and the model law does not indicate that the plus 30 hours of education must be from a university. Second, many of the comments from business leaders suggested they believed a primary motivation of the changes was to raise the salaries of civil engineers.

Summary and Conclusions

ASCE and NCEES have taken action to try to make additional education beyond a BS degree a requirement in order to obtain professional licensure. In order to understand the sentiment of academics, business leaders, and state boards to this proposed change, the authors conducted a survey with respondents from faculty of civil engineering departments, business leaders from ACEC, and members of state licensing boards.

The study found that nearly all of the respondents were at least somewhat familiar with the changes to the model law. Among academics and state board members, approximately half of respondents support the changes, the other were either against or undecided. Among business leaders from ACEC, 71% do not support the changes.

Results from the free response portion of the survey indicate that many who do not support the changes are concerned that they will result in fewer domestic engineers, exacerbating the present shortage. Others who do not support the change believe that there are better ways to accomplish the same objective (i.e., changes to undergraduate curriculum).

A primary motivation for developing the survey was to assess how the BYU Civil and Environmental Engineering graduate program might respond to the pending changes in professional licensure. The authors feel that no immediate action is necessary. Most survey respondents believed that additional education was valuable and, in some specialized fields, necessary so it is anticipated that graduate enrollment will remain elevated and fluctuate with economic outlooks within the profession. However, the survey and responses indicate that further clarification and debate may be required before the model law or some modified version takes hold in a way that impacts graduate programs.

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