

ASCE Policy 465: The Impact on Transportation Engineering Workforce Development

THE AMERICAN SOCIETY OF CIVIL ENGINEERS' (ASCE) POLICY 465 SUPPORTS THE CONCEPT OF THE MASTER'S DEGREE OR EQUIVALENT AS A PREREQUISITE FOR LICENSURE AND THE PRACTICE OF CIVIL ENGINEERING AT A PROFESSIONAL LEVEL. THIS FEATURE REPORTS ON THE ACTIONS OF ASCE AND IDENTIFIES AREAS WHERE THIS POLICY IMPACTS THE TRANSPORTATION ENGINEERING WORKFORCE.

INTRODUCTION

Workforce development is a critical issue facing the transportation engineering profession. The central issue, stated succinctly, is: Will we have an adequate supply of effective professionals to address the transportation needs of the future? Recognizing the importance of this issue, the leadership of the Institute of Transportation Engineers (ITE) has established the goal of assuming a proactive role in influencing the transportation engineering workforce pipeline.

The basic baccalaureate education for the vast majority of transportation engineers is an undergraduate degree in civil engineering (B.S.C.E.). Many have earned advanced degrees, either in civil engineering or related fields. According to ITE statistics, 77 percent of ITE members have earned or currently are pursuing an undergraduate degree in engineering. Of these, 93.5 percent are in civil engineering or a related field.

It is assumed that ITE members who indicate civil engineering, traffic engineering, or transportation engineering as their primary undergraduate or graduate education major have earned degrees or were enrolled in civil engineering programs. With the exception of one master's degree program, there are no accredited transportation or traffic engineering programs in the United States.

Civil engineering programs in the United States are accredited by the Accreditation Board for Engineering and Technology (ABET). ABET accredits programs in all engineering disciplines, but professional societies representing specific disciplines also establish program criteria that must be met in addition to the general ABET criteria.¹

The American Society of Civil Engineers (ASCE) establishes program criteria for civil engineering and also trains and provides evaluators for the accreditation

process. Through this relationship and other activities, ASCE plays a pivotal role in defining the content of the undergraduate experience of civil engineers, which is the educational avenue followed by most transportation engineers.

In October 2001, the ASCE Board of Direction adopted ASCE Policy Statement 465: Academic Prerequisites for Licensure and Professional Practice, which supports the concept of the master's degree or equivalent as a prerequisite for licensure and the practice of civil engineering at a professional level. In 2004, the ASCE board adopted a revised policy, which reads, in part:

"Admission to the practice of civil engineering at the professional level means professional engineering licensing requiring attainment of a Body of Knowledge through appropriate engineering education and experience. Fulfillment of this Body of Knowledge will include a combination of:

- A baccalaureate degree,
- a master's degree, or approximately 30 coordinated graduate or upper level undergraduate credits or the equivalent agency/organization/professional society courses providing equal quality and rigor, and
- appropriate experience based upon broad technical and professional practice guidelines which provide sufficient flexibility for a wide range of roles in engineering practice."²

This represents a departure from the model currently in place, which has as its basis a four-year baccalaureate degree as the minimal entry-level qualification to enter the profession and a combination of advanced engineering education and professional practice plus the passage of two examinations—the Fundamentals of Engineering (FE) and the Professional Engineering (PE.)—to become a registered professional engineer. Implementa-

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tion of this policy will have a significant effect on the education of transportation engineers and their preparation for engineering practice.

The objective of this feature is to summarize ASCE's recent actions and discussions regarding Policy 465 and the subsequent development of a basic Body of Knowledge (BOK), and to raise issues on how this policy and ASCE actions may impact the transportation engineering profession. This feature is not an advocate for or against the policy. Its purpose is simply to report on the actions of ASCE and the reasons for these actions, and to identify areas where this policy impacts the transportation engineering workforce.

DEVELOPMENT OF ASCE POLICY 465

The civil engineering profession has a long history of self study, evaluation of curriculum issues and examination of the question: What is the basic educational preparation for the practice of engineering? Conferences have been held and reports have been prepared on the subject since 1918.³

The impetus for the development of Policy 465 can be traced directly to the 1995 ASCE Education Conference held in Denver, CO, USA, where the issue was brought to the forefront.⁴ Four primary action areas were identified at the conference, one of which was the first professional degree. The Task Committee on Civil Engineering Educational Initiatives was formed to investigate and respond to these issues and report to the ASCE president.

REASONS FOR CHANGE

Many reasons and arguments have been advanced to support the concept of the master's degree or equivalent as the first professional degree. These include the following:

Shrinking Curriculum

The number of semester hours required to earn a bachelor's degree in civil engineering is shrinking. In the 1940s, the typical program required between 150 and 155 hours for graduation. Today, programs require 133 hours or less. Indications are that this downward trend is continuing. Several states, by legislative mandate, have set require-

WILL WE HAVE AN ADEQUATE SUPPLY OF EFFECTIVE PROFESSIONALS TO ADDRESS THE TRANSPORTATION NEEDS OF THE FUTURE?

ments that all baccalaureate programs require a maximum of 120 hours. In most of these states, however, engineering programs have been allowed to increase to 126 to 128 hours.

Decreasing Technical Requirements

What has been eliminated with the downsizing of the curriculum has been the coverage of civil engineering technical subjects. The number of hours required in basic math and science—calculus, chemistry, physics, etc.—has not changed. The size of the liberal arts, or general education, portion of the curriculum has not been reduced and, at some institutions, it actually may have been increased.

In the last decade, most universities have established a common general education core required of all students. For engineering students, this has meant an increase in the hours required in the humanities, social sciences and the arts.

A survey of several university curricula indicated that the number of engineering credits required for a B.S.C.E. has decreased between 12 and 24 hours. Another survey of accredited civil engineering programs found that 81 percent require a single transportation engineering course and only seven of the 90 programs responding required a second course in transportation.⁵

Education Requirements of Other Professions

At the turn of the century, an engineering degree required four years of study. At that time, a medical degree also required four years and a law degree required three years. Engineering has not changed, but the other professions have increased the number of years of study required to enter professional practice. In recent years, both accountancy and pharmacy requirements have been modified to include master's level study to obtain licensure.

Changing Role of the Civil Engineer

Many leading civil engineers have expressed concern that the leadership role of civil engineers has been declining. They cite statistics demonstrating that engineering organizations, government engineering agencies and project teams increasingly are headed by non-engineers. In addition, the relatively low salaries paid to civil engineers is mentioned as an indicator of a disturbing trend.

Other issues include the need for civil engineers to learn and apply new technologies typically not included in the traditional curriculum and the "low-tech" perception of civil engineers. Some believe that, given the nature of what civil engineers do, the perception is that civil engineering is becoming a trade rather than a profession.

The Licensure Issue

Central to identifying a person's qualification for professional engineering practice is the issue of licensure. Registration as a P.E. is done on a state-by-state basis whereby each state establishes its own criteria. However, in most states, the requirements for licensure include proof of a bachelor of science in engineering earned at an ABET-accredited institution; experience in the practice of engineering under the supervision of an engineer; and passage of the FE and P.E. examinations.

With the educational model supported by ASCE, an engineer would be eligible for licensure after completing the master's degree or equivalent and experience. A key concern is if individual state licensing boards will accept this model. The issue is being debated.

Body of Knowledge

In 2001, ASCE created the Task Committee on Academic Prerequisites for Professional Practice.⁶ A subcommittee was formed to develop recommendations for what should be taught and learned by future civil engineers; how it should be taught; and who should teach it. This subcommittee issued a report: "Civil Engineering Body of Knowledge for the 21st Century: Preparing the Civil Engineer for the Future."⁷

The report identifies 15 outcomes that "prescribe the necessary depth and breath of knowledge, skills, and attitudes required of an individual aspiring to enter the practice of civil engineering at the professional level (licensure) in the 21st century."

The first 11 outcomes are identical to the outcomes specified by ABET in its accreditation criterion 3.⁸ They include issues such as the ability to apply mathematics; the ability to function on teams; the ability to communicate; and a recognition of the need to engage in lifelong learning. The additional outcomes proposed by ASCE include:

- An ability to apply knowledge in a specialized area of civil engineering;
- An understanding of the elements of project management and construction and asset management;
- An understanding of business and public policy and administration fundamentals; and
- An understanding of the role of the leader and leadership principles.

Other engineering disciplines also are involved in efforts to define the BOK. The ASCE initiative is being discussed and debated by organizations responsible for licensure.⁹

MISCONCEPTIONS

Obviously, a change as radical as the one proposed raises many questions. The Task Committee on Academic Prerequisites for Professional Practice and its subcommittees have encountered many opposing views in their work and have attempted to answer them. The 10 issues found to have caused the most confusion and the facts as listed in the ASCE news article are as follows:¹⁰

- ASCE is making it impossible for a person to have an engineering

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career with only a bachelor's degree. Fact: Many engineers are not licensed and still have productive engineering careers. Policy 465 recognizes that future licensure will require more knowledge than is provided by the current civil engineering bachelor's degree.

- The new policy will be implemented immediately. Fact: Policy 465 will be implemented gradually over the next two decades.
- The goal is to eliminate the four-year degree. Fact: Policy 465 provides the foundation for a new BOK for engineers. It outlines expectations for engineering education and training.
- Education is more important than experience. Fact: Policy 465 will help produce engineers who are better prepared for on-the-job-challenges.
- All those receiving a bachelor's degree in civil engineering will need to be licensed. Fact: This will not change from the current situation. Many civil engineers will continue

to work without being licensed.

- Graduate work will be required immediately after the bachelor's degree. Fact: Each individual can determine when he or she pursues graduate studies.
- Degrees are everything; experience counts as nothing. Fact: Education is only the beginning for a professional degree. Experience and lifelong learning are important.
- Graduate work must lead to a traditional master's degree. Fact: The BOK defines what is required of the professional, not what courses must be contained in a degree program.
- The requirements of Policy 465 are quantitative rather than qualitative. Fact: Policy 465 was formulated to address concerns that the current bachelor's degree does not cover the BOK that future engineers will need to possess. Implementation may require changes to the undergraduate program as well as new approaches to graduate study and practice requirements.
- The hidden agenda includes job security for engineering faculty members. Fact: The purpose of Policy 465 is to affirm professionalism, not to extend the time spent earning a degree.

IMPLICATIONS OF POLICY 465 ON TRANSPORTATION ENGINEERING PRACTICE

Although full implementation of ASCE Policy 465 will not occur immediately, its effect on the practice of transportation engineering will be significant. Key issues affecting transportation workforce development include the following:

Undergraduate Preparation of Transportation Engineers

As previously stated, a bachelor's degree in civil engineering is the basic undergraduate education experience for transportation engineers.

- Will this change when Policy 465 is fully implemented?
- Will the basic four-year undergraduate civil engineering program be modified to include the full BOK with additional outcomes focusing on breadth—project management,

public policy, leadership, etc.—at the expense of greater technical depth?

- If other engineering disciplines do not follow ASCE's lead, will students select another major, thus decreasing the pool of potential transportation engineers?

Graduate Preparation of Transportation Engineers

At the present time, approximately one-third of ITE members either have or are pursuing a graduate degree in engineering—the vast majority in civil/transportation engineering.

- Will the emphasis on additional breadth outcomes decrease this number?
- Although the BOK document includes depth in a specialized area as a program outcome, will satisfaction of the breadth outcomes decrease the degree of specialization? Note: The BOK does not specify a particular undergraduate or graduate curriculum or courses. It does not specify that the graduate degree should be in civil engineering or any other discipline. However, it does contain recommended outcomes that should be satisfied independent of the field of study.
- How will this impact the preparation of transportation engineers?

Licensure

The performance of many aspects of professional activities in the transportation engineering field requires licensure. The development of designs, signalization plans, etc. requires the signature of a licensed professional engineer.

- How will this change with the implementation of Policy 465?
- Assuming that there will be grandfather provisions for those already licensed, will this lead to an increase or decrease in the number of licensed engineers practicing in the transportation engineering field?
- How will individual state licensing boards accommodate the proposed changes?
- What examinations will be required and when?

THE ISSUE OF WORKFORCE

DEVELOPMENT IS CRITICAL

TO THE TRANSPORTATION

ENGINEERING PROFESSION.

PTOE

The Professional Traffic Operations Engineer™ (PTOE) certification program requires that an applicant be a licensed engineer.

- Will the implementation of Policy 465 impact the PTOE program?

SUMMARY

The issue of workforce development is critical to the transportation engineering profession. The objective of this feature has been to provide some basic background information relating to ASCE Policy 465—master's degree or equivalent as a prerequisite for licensure and the practice of civil engineering at a professional level—and the ASCE BOK. It has attempted to summarize the key issues that led to the formulation of this policy.

It is not possible in this limited space to capture and report on the depth of discussions and the past writing devoted to the topic. Readers are encouraged to consult the ASCE Web site, accessible via www.asce.org/professional/educ/bodyofknowledge.cfm, to access the BOK report and www.asce.org/raisethebar to review ongoing ASCE activities on this subject.

Issues have been raised concerning possible implications of the implementation of this policy to the practice of transportation engineering and future workforce development. It is strongly recommended that ITE engage in discussions within its membership regarding ASCE Policy 465 and the BOK and that an ITE Task Force be formed to provide a formal response to ASCE. ASCE welcomes comment regarding policy and

implementation issues. Individual ITE members are encouraged to visit the ASCE Web site and provide feedback. ■

References

1. Information on accreditation and the accreditation process is accessible via www.abet.org.
2. American Society of Civil Engineers (ASCE), accessible via www.asce.org/pressroom/news/policy_details.cfm?hdlid=15.
3. Russell, J.S., B. Stoffer and S.G. Welsh. "The First Professional Degree: A Historic Opportunity." *Journal of Professional Issues in Engineering Education and Practice* (April 2000).
4. Ibid.
5. Ibid.
6. "Civil Engineering Body of Knowledge for the 21st Century." Prepared by the Body of Knowledge Committee of the Task Committee on Academic Prerequisites for Professional Practice, ASCE, Reston, VA, USA, 2004.
7. Ibid.
8. Criteria for Accrediting Engineering Programs, Effective for Evaluations during the 2005–2006 Accreditation Cycle, Engineering Accreditation Commission, Accreditation Board for Engineering and Technology (ABET), Baltimore, MD, USA, November 2004.
9. Laity, W.W. "A Vision of the Future of Mechanical Engineering." *ABET Communications Link*, Issue 3 (2004).
10. *ASCE News*, Volume 28, Number 10 (October 2003).



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