

Initiative of engineers played critical role in WTC investigation

The attacks in New York City the morning of September 11, 2001, caused one of the worst structural disasters in U.S. history. People across the entire nation gathered to console those affected by the disaster, and professionals in security, transportation, and other industries reevaluated their operations to reduce the chances that anything like it would happen again. The community of licensed engineers took its place beside the others in this effort.

When the Structural Engineering Institute (SEI) of the American Society of Civil Engineers (ASCE) called me the afternoon of the attacks, I readily agreed to lead the study of the World Trade Center (WTC) collapse. I was eager to help obtain a better understanding of how buildings respond to extreme events so that we can design safer structures in the future.

photo courtesy of FEMA



ASCE is America's oldest professional engineering society, and SEI frequently participates in structural building performance studies through its Critical Infrastructure Response Initiative. Before September 11, ASCE had already investigated four other structural failures in 2001. When it initiated the 9/11 project, it did so without any specific funding or support from the government. Those involved soon discovered the immensity of the investigation, however, and the Federal Emergency Management Agency (FEMA) agreed to provide financial assistance.

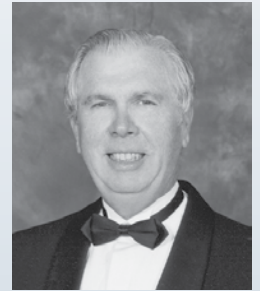
As with any investigation of a construction disaster, the first step was to conduct field observations of the site as quickly as possible. During this effort, a licensed New York engineer was part of each data collection team. After the wreckage was cleared, the teams continued collecting data from steel salvage

yards, where we removed and later tested samples of the collapsed structures. We also reviewed available construction documents and conducted interviews with witnesses of the collapse and with people involved in the design, construction, and maintenance of each building.

Using the gathered information, we conducted a preliminary analysis of the damage done to the WTC complex and formed some initial opinions and recommendations. We were impressed that the buildings were able to remain standing for an extended period of time

after sustaining such intense damage, noting that the length of time before their collapse played a key role in the number of people who were able to evacuate safely. The investigation did not uncover any substandard structural features in the two towers. On the contrary, many of the structural and fire protection features exceeded the minimum code requirements of the time. We determined that the buildings could have stood for an indefinite period of time if they had not been subjected to an additional severe event. The subsequent fire after each plane hit, however, further weakened the structural frames and finally led to collapse.

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W. Gene Corley, Ph.D., P.E., S.E.
Member, Advisory Committee
on Council Activities

UPDATE



Betsy Browne
NCEES Executive Director

Exam development improves methods as well as exams

Because each NCEES exam undergoes a Professional Activities and Knowledge Study (PAKS) every six to eight years, exam development volunteers must often carry out several PAKS at the same time. Currently, the Council is performing PAKS for four of the Principles and Practice of Engineering (PE) exams: electrical and computers, metallurgical, naval architecture and marine, and petroleum engineering.

The PAKS process always reveals ways that the Council can keep exams current with technological advances and other developments in the engineering and surveying professions. For the metallurgical engineering PAKS, for example, the Council will address the fact that engineers are using more nonmetal materials in fabrication. The metallurgical exam committee has proposed expanding the Metallurgical PE exam to include materials engineering, and the PAKS will help determine the knowledge areas that should be included in a broader exam.

The metallurgical PAKS is scheduled to begin next month. Once the PAKS is complete, the NCEES Board of Directors will determine if the specification changes warrant the creation of a new exam for materials engineering or if they require simply expanding and changing the name of the current exam to the Metallurgical and Materials PE exam.

The petroleum and the naval architecture and marine engineering exam committees are taking advantage of digital communication as they perform PAKS for their exams, choosing to launch PAKS surveys online. The petroleum exam committee employed the Web site of the Society of Petroleum Engineers to host its survey and received a very high response rate. The naval architecture and marine engineering subcommittee used the same method to survey members of the Society of Naval Architects and Marine Engineers. The committee was able to e-mail reminders to members who hadn't responded and saved a significant amount on printing and mailing costs.

Web conferencing saves time and money

Council staff has been working with psychometric consultants to conduct certain exam committee meetings through Web conferences. These online conferences allow volunteers to communicate from their separate locations, eliminating the time and expense of traveling across the country. With travel costs increasing each year, Web conferencing is also a great way for the Council to save money.

The convenience and savings of Web conferencing enable more volunteers to participate, increasing the number of subject-matter experts involved in developing exam specifications. This past spring, for example, volunteers viewed the results of the PAKS survey and developed specification recommendations for the Civil PE exam through six sessions of Web conferences. These conferences replaced the necessary activities for each of the six modules of the exam and involved nearly 50 volunteers.

The Council has also used Web conferencing in specification development for the FE and the Naval Architecture and Marine Engineering PE exams. Because exam specifications are unrestricted information, these meetings are ideal for online conferencing. The Council is pursuing methods of providing a completely secure conferencing environment to conduct even more meetings through Web conferences.

Council enjoys success with FE exam

This past year was an important milestone for the Fundamentals of Engineering (FE) exam. Not only did it undergo changes in exam content and specifications, but it also came entirely in-house with this past exam administration. The Council has successfully completed this move and now develops, assembles, produces, and scores the FE exam at headquarters.

Another accomplishment related to the FE exam is the completion of the white

paper titled “Using the Fundamentals of Engineering (FE) Examination to Assess Academic Programs,” which is an update of a paper published in 2003 on the same topic. This issue of *Licensure Exchange* includes an excerpt from the updated paper (see page 5). For a copy of the entire report or for more information, please contact NCEES Director of Professional Services Mike Shannon, P.E., at mshannon@ncees.org.

Betsy Browne
NCEES Executive Director

October 2005 exam pass rates

FE exam pass rates

FE exam pass rates below reflect results for examinees who attended EAC/ABET-accredited engineering programs.

FE all modules

Examination Module	First-time takers	Repeat takers
Chemical	84%	34%
Civil	68%	16%
Electrical	67%	19%
Environmental	76%	24%
Industrial	66%	16%
Mechanical	78%	22%
General	67%	14%

FE general exam only

Examinees' College/University Degree Discipline	First-time takers	Repeat takers
Aeronautical	80%	0%
Agricultural	76%	19%
Architectural	63%	16%
Biological	65%	33%
Chemical	63%	30%
Civil	63%	10%
Computer	48%	17%
Construction	68%	10%
Electrical	51%	14%
Eng. Mechanics	65%	3%
Eng. Physics	72%	0%
Environmental	65%	14%
General Eng.	79%	17%
Industrial	36%	3%

FE general exam only (continued)

Examinees' College/University	First-time takers	Repeat takers
Mechanical	76%	21%
Mining and Mineral	54%	35%
Petroleum	59%	51%
Structural	80%	13%
Other	70%	14%

PE exam pass rates

Examination	First-time takers	Repeat takers
Agricultural	28%	20%
Chemical	77%	27%
Civil	59%	26%
Control Systems	78%	37%
Electrical & Computer	58%	27%
Environmental	73%	28%
Fire Protection	43%	39%
Industrial	62%	26%
Mechanical	65%	32%
Metallurgical	45%	19%
Mining & Mineral	62%	23%
Nuclear	58%	43%
Petroleum	89%	43%
Structural I	46%	21%
Structural II	58%	36%

Surveying exam pass rates

Examination	First-time takers	Repeat takers
FS	60%	36%
PS	66%	30%

MESSAGE



Martin A. Pedersen, L.S.
NCEES President

NCEES taps into valuable resources

Past presidents are one of the Council's most valuable resources. A past president has typically served five to seven years on the Board of Directors: as zone vice president or treasurer and then as president-elect, president, and immediate past president. Unfortunately, the knowledge they accumulate from these years of events, discussions, and decisions can be lost when the final gavel sounds at the end of their terms on the Board.

I have met many of the past presidents of the Council, and they always offer their service, support, and guidance to current officers of the Council. Many past presidents continue to attend Annual Meetings and work on committees and task forces, and many also continue to serve on or participate with their state boards. Through continued involvement, they are able to keep up with Council activities, but in the past others have not and are sometimes unaware of Council events.

This year I initiated a discussion group with past presidents and invited one past president from each zone to attend: Ted Fairfield (Western 2001–2002), Bob Krebs (Northeast 2002–2003), Don Hiatte (Central 2003–2004), and Jon Nelson (Southern 2004–2005). Past President Hiatte was unable to attend because of a prior commitment.

Topics for this meeting included the Council's current activities and the important initiatives facing the Council. I also asked the past presidents to relate which initiatives from their terms needed to be continued, and we discussed methods for keeping the most recent past presidents informed of Council happenings.

Each of the attending past presidents felt that the meeting was valuable and that it should continue. It was suggested that past presidents could serve as a resource at the Board of Directors' orientation session each fall. They could describe the history of certain issues and make the new Board aware of pitfalls and problems that were encountered previously and should be avoided or approached differently.

All of you are aware of the value of friendships and acquaintances when negotiating, trying to advance a particular project, or gathering information. Many past presidents have been leaders of other organizations or companies and have a great ability to call upon and communicate with other leaders. Their

experience is invaluable to the Council. We need to keep these resources within reach so that we can call upon them as necessary.

One of the goals and strategies of the Board of Directors this year is to contact state boards to see how the Council could better serve them in issues with legislators. Maybe this role would be appropriate for a group of past presidents.

Maybe they could serve as expert witnesses in front of legislative committees when model law issues arise.

I welcome additional input from Council members and past presidents on other ways a group like this could assist our organization. I think this could be an ongoing project that benefits the whole Council.

Martin A. Pedersen, L.S.
NCEES President

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FEATURE

Using the FE examination to assess academic programs

The material in this article is excerpted from a white paper of the same title. For a copy of the original report or for more information, please contact NCEES Director of Professional Services Mike Shannon, P.E., at mshannon@ncees.org.

Outcomes assessment is now an integral part of the engineering accreditation process in the United States as a result of the implementation of Engineering Criteria 2000 (EC2000) by ABET, Inc. One potentially effective tool for assessing certain aspects of engineering education is the NCEES FE exam, sometimes called the EIT exam.

This exam was developed to measure minimum technical competence and is the first step in the professional licensing of engineers. It is a pass-fail exam taken each year by approximately 40,000 people, most of whom are recent college graduates or seniors within one year of graduating. Although the exam results do provide some specific data on performance in a given subject, these data are not used directly for licensing. The exam data can, however, serve as a valuable resource in making valid comparisons when properly used in the assessment process.

FE examination

As the only nationally normed examination that addresses specific engineering topics, the FE exam is an attractive tool for outcomes assessment. In fact, since 1996 the FE exam has been formatted for the express purpose of facilitating the assessment process. For example, the discipline-specific exams for chemical, civil, electrical, environmental, industrial, and mechanical engineering were developed to include topics from upper-level courses—topics that were not appropriate when students from all engineering disciplines took the same exam. Exam content was revised to better measure students' knowledge of subjects taught in current junior- and senior-level engineering courses. The topics included in the discipline-specific exam were determined

via surveys that were sent to every ABET-accredited engineering program in the United States. The most recent survey was conducted in 2004, and a new set of exam specifications became effective for the October 2005 exam.

Through careful analysis, FE exam results may be used to assess particular aspects of the following ABET Criterion 3 outcomes: (a) an ability to apply knowledge of mathematics, science, and engineering; (b) an ability to design and conduct experiments, as well as to analyze and interpret data; (c) an ability to design a system, component, or process to meet desired needs within realistic constraints; (e) an ability to identify, formulate, and solve engineering problems; (f) an understanding of professional and ethical responsibility; and (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Although the FE exam does provide a means of assessment, its widespread use as an assessment tool should be analyzed carefully. The FE exam should not, for example, be used to determine the curricular content of any program: its purpose is to test competency for licensure. The exam is not intended to force programs to be similar. For licensure purposes, the total score is evaluated rather than the score in any specific subset of questions. Passing the exam does not denote competence in all subjects but instead shows an average minimum competency in several subject areas.

One potential error in using the FE exam results as an assessment tool is focusing on the percentage of candidates who pass the exam. This criterion is too broad to be effective in improving subdiscipline instruction. Too often, the passing rates of individual programs are compared with those of other institutions, and these rates become more important than the subject-matter evaluations. Administrators or faculty who select those who are allowed to attempt the examination

As the only nationally normed examination that addresses specific engineering topics, the FE exam is an attractive tool for outcomes assessment.

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Surveying Speaker's Kit celebrates successful first year

The Speaker's Kit uses exciting, up-to-date graphics to introduce students to parts of the profession that they've never seen before, and the fast-paced, 60-second introduction video grabs their attention right away." These are some of the reasons that Michelle Chapman, recruiting coordinator for the Florida Surveying and Mapping Society (FSMS), enjoys using the Surveying Speaker's Kit.

"Students don't know very much about the profession, but they're eager to learn," observes Chapman. FSMS has dedicated immense effort to educate students about the profession, and it is just one of the many societies in the United States that have found the Speaker's Kit to be a valuable tool in accomplishing this goal.

This month marks the first anniversary of the Surveying Speaker's Kit. The kit, titled "Measuring the World Around Us: A High-Tech Career in Professional Surveying," resulted from the joint efforts of the American Congress on Surveying and Mapping (ACSM), the National Society of Professional Surveyors (NSPS), and NCEES. Since its introduction at last year's Board Presidents' Assembly, the kit has been distributed to every U.S. surveying licensing board, each college and university with an ABET-accredited surveying program, and every state affiliate of NSPS.

ACSM/NSPS has also begun to build relationships with the National Middle School Association and the National Council of Teachers of Math through which it hopes to share its message about careers in surveying.

Nearly 300 kits have been distributed already, and requests continue to pour in. To keep up with demand, ACSM has already ordered a second round of production for the kit's CD.

Convenience and accessibility

"Some of us are reluctant to speak in public, even on a topic that we are incredibly familiar with," says ACSM Executive Director Curt Sumner, L.S. "But the kit provides an excellent framework to build on."

By including a speaker's guide and slide-by-slide notes, the kit makes it easy for people to talk about surveying. Speakers can also watch the sample presentation, which is based on the slide-by-slide notes and is designed to help speakers get a feel for the content and pacing of the presentation. A

Web site, www.surveyingcareer.com, has also been developed to supplement the kit.

Flexibility

While the kit does include tools to assist the speaker, it by no means demands a static or rigid presentation. The kit provides a useful structure, and speakers are encouraged to supplement the presentation with illustrations from their own experience. The presentation can last anywhere from 20 minutes to an hour, and surveyors can bring in examples of their work or conduct technical demonstrations as part of the presentation.

Strong, consistent message

When listing the advantages of the Speaker's Kit, Sumner first mentions consistency. "It's important to have a clear and current message



MISSION

The Mission of NCEES is to coordinate with domestic and international organizations to promote licensure of all engineers and surveyors.

NCEES Strategic Plan

to the community,” he says. “We need to have a consistent presence throughout the country as we raise public awareness about the surveying profession.”

According to Sumner, ACSM/NSPS plans to update the presentation as necessary to maintain the relevance and timeliness of the message. When the time comes, sending out updated copies of the CD should be relatively quick and simple. Because the kit’s CD contains all of the kit’s materials except for the brochure, ACSM often sends the CD alone, which greatly reduces distribution and production costs. ACSM also encourages state boards and state surveying societies to reproduce the CD for distribution on the state level.

Just as he discussed in the February 2005 issue of *Licensure Exchange*, Sumner notes the ongoing need for NCEES and NSPS/ACSM to work together. “The Speaker’s Kit is another way that these two organizations can collaborate,” he says. “It’s a great tool to attract the next generation to this worthwhile profession.”

March 12–18

Surveyors Week showcases profession’s significance

In 1984, President Ronald Reagan established the first National Surveyors Week. “In the development of our country, the role of the surveyor has been of vital importance.” With these words, his proclamation began by emphasizing the longevity and significance of the surveying profession.

Since that time, NSPS has continued to devote the third week of March to promoting and celebrating the surveying profession. The society has registered a request for a permanent proclamation of National Surveyors Week and hopes that it will pass through Congress this year.

NSPS encourages surveyors to view this week as a special opportunity to raise public awareness about the importance of surveying by showing people how it affects their lives. To help surveyors do this, NSPS has created the Surveyors Week Publicity Handbook. This step-by-step guide to generating public interest in Surveyors Week is available at www.acsm.net/nsps/nationalsurveyor.html.

This year, NSPS will celebrate Surveyors Week on March 12–18. Here are a few ways that surveyors across the country can join in the celebration.

Introduce elementary, junior high, or senior high school students to surveying.

The Surveying Speaker’s Kits are specifically designed to introduce students to the variety of career opportunities available in the surveying profession. Professional surveyors can request a kit from NSPS or from their state boards.

Stage a demonstration of new surveying technologies. Most people don’t realize the amount of work that surveying involves, but introducing them to the newest gadgets and technological capabilities is a good way to enhance their interest in and appreciation for the profession.

Present the Speaker’s Kit to a Boy Scout Council in your local area. In 1989, NSPS began assisting Boy Scouts of America (BSA) with the Surveying Merit Badge, which BSA has issued to scouts since 1910 when the organization was founded. NSPS is currently promoting the use of the Speaker’s Kit when surveyors help scouts obtain this badge.

NCEES Staff



Deborah Long, Ed.D.
Certified Ethics Trainer

Ethical behavior: a priority for engineers and surveyors

Ethical misconduct is the stuff of everyday headlines and news shows. We are bombarded with stories about the many moral failures of our political leaders, top athletes, and entertainers. The stakes have never been higher regarding personal and professional integrity. We live in a time when ethical temptations and dilemmas will confront us more frequently, largely because of new technological capabilities. Technology allows us to introduce new innovations into our homes and workplaces with little time for research on the social, economic, and medical impacts they may have on our lives. The twenty-first century promises to be a period of enormous ethical challenges.

While engineering and surveying educators diligently labor to provide meaningful course content for prospective practitioners, discussions of ethical dilemmas are often marginalized or sacrificed entirely to the demands of limited class time. Nevertheless, ethical decision-making skills are critical to the long-term success of engineering and surveying practitioners for a variety of reasons.

- ♦ **The public is demanding higher ethical conduct from business professionals.** Newspaper headlines and leading television stories indicate that the public is outraged by personal, government, and business scandals.
- ♦ **Legislatures continue to coerce practitioners to virtue by enacting legislation.** When a profession does not guard its own reputation and acts in such a way as to harm the public, state legislatures respond by creating new state laws. Typically, these laws deal with disclosure issues and consumers' rights.
- ♦ **Courses on ethics are becoming a mandatory part of the curriculum.** In order for university and college engineering programs to be accredited by ABET, they must meet EC2000 requirements, which include that engineering graduates demonstrate "an understanding of professional and ethical responsibility."

An increasing number of regulatory agencies are examining the possibility of testing their licensees for ethical competence. Although students or licensees who participate in courses on ethics do not necessarily become more ethical, mandatory licensee participation in ethics courses sends a powerful message that ethics is important to the profession. Moreover, research studies indicate that participation in those courses may, depending on their format, enhance ethical decision-making skills and, at the very least, orient students and licensees to the best practices of the profession.

- ♦ **Complaints and lawsuits against individual licensees continue to take up the limited resources of professional associations and state regulatory agencies.** State regulatory agencies report that while the majority of complaints filed against professional engineers and surveyors are dismissed without cause, a significant number of the problems targeted in all complaints filed have to do with ethics, professionalism, and etiquette. Of the complaints that result in disciplinary action, such as suspension or revocation of licensure, the most frequently cited problems have to do with serious misjudgment: for example, the misapplication of one's professional seal or practicing outside the field of competence.
- ♦ **There is a clear and urgent need.** Organizations that study ethics reveal that cheating and lying among high school and college students are on the rise. Some of these young people will enter the engineering and surveying professions as ethical illiterates. They will look to their professional organizations, to their licensing agencies, to their teachers, and to their supervisors for guidance in making ethically sound business decisions.
- ♦ **Federal sentencing guidelines urge organizations to adopt comprehensive, effective training programs.** Until recently, companies could claim some

Why are we licensed?

As a teacher of real estate licensing courses, I often discuss with my students why licensing boards and regulatory agencies exist. In the case of real estate licensure, state boards and commissions implement laws and regulations to protect the public. I explain that without licensing requirements in my profession, the public would still be subjected to the misbehavior of curbstone operators who sold swampland to unsuspecting consumers in the early part of the twentieth century.

Licensure in the United States dates back to 1883 when dentists became the first professionals to be licensed in this country. But the history of licensure actually begins in twelfth-century Europe. The first regulation to control a profession was established by King Roger II of Normandy, who decreed that doctors prove their competency before practicing medicine. Before doctors were allowed to practice, they had to be examined and certified by their colleagues.

Today in the United States, millions of professionals—doctors, lawyers, pharmacists, accountants, engineers, surveyors, and others—are regulated and licensed by either professional societies or licensing authorities. In the public's eyes, licensure has become synonymous with the term *professional*. The licensure process demands a measure of competence and dedication and provides assurance that individuals have demonstrated at least a minimum level of competency.

There are still some professions that do not require licensure, and many areas of engineering do not require licensure. While there are many good arguments on both sides of the issue, licensing individuals who deal with public health, safety, and welfare is worthwhile for two important reasons. First, licensed professionals have to answer to their peers. Second, the possibility of having a license revoked can cause licensed professionals to behave and think differently than unlicensed individuals. Having something to lose—one's reputation and livelihood—can be a very compelling reason to act ethically and in the public's best interest.

distance between themselves and the wrongful acts of their employees. Federal sentencing guidelines now require that judges hold the company, as well as its executives, liable for employees who go astray. Practitioners in the engineering industry are particularly vulnerable here since they are often involved in projects with federal contracts.

- ♦ **New technologies and other developments will create a more competitive—and perhaps cutthroat—marketplace.** If engineering and surveying professionals do not have strategies to deal with unethical conduct or are unable to demonstrate ethical behavior, a great deal of time and money will be spent dealing with misconduct and litigation rather than helping clients and con-

sumers. Areas of particular concern to the engineering and surveying professions include protecting the public, the environment, and intellectual property.

Engineers and surveyors should be ethically competent as well as adequately skilled to obtain and hold a professional license. Students need to acquire the skills and habits of mature decision making so that when they enter the profession, they are prepared to deal with the problems they encounter. Even experienced engineering and surveying professionals need an opportunity to discuss the ethical temptations and dilemmas they face.

*Deborah Long, Ed.D.
Certified Ethics Trainer*



L. Robert "Larry" Smith, P.E.
NCEES Northeast
Vice President

Exams still a good test for licensure

Over too many years I have listened to protracted diatribes from those who feel that NCEES is becoming superfluous. They conclude that because only 20 percent of engineering graduates ever become licensed, we have missed our calling.

If 90 percent of adults get drivers' licenses, and only 5 percent of those individuals get licensed to drive semitrucks, would anyone say that system was failing?

I think we are right on target. I always ask, "What is the percentage of engineers who *need* to be licensed?" Most of the engineers who are not licensed are in industry, and they do not need to be licensed because of the industrial exemption.

There have recently been proposals to create a new category of licensure for these individuals, without the benefit of doing anything beyond passing the FE exam and staying gainfully employed for at least four years. I believe that handing out this title would still not bring any more engineers from industry into the fold.

Another group that doesn't get licensed includes candidates who are unable to pass the PE exam. I think that if they don't pass, we are definitely doing our job of protecting the public health, welfare, and safety. Should those who fail the PE exam be candidates for the proposed engineering title?

I'm also concerned about the statements some have made that the PE exam is an academic exam. I believe this is coming from engineers who haven't seen a PE exam since they passed it many years ago. The people on the civil exam committee would be amused to hear that it is an academic exam. The vast majority of them are engineering practitioners and not academics.

Twice the Council voted against allowing candidates to take the PE exam right out of college without the four-year wait to take it. Nevada, however, will now allow it. This concerns me because I have taken the time to sit with young engineers who have recently passed the PE exam. I always ask them if they think they could have passed the exam, right out of college. The answer has always been, "No way!"

I believe the confusion on this issue arose when someone noticed that the PAKS for the FE exam and the PE exam included many of the same knowledge areas. Some people went around screaming that they were the same exam. They are not. The same knowledge is to be tested, but at different levels of complexity. Graduate engineers do not immediately develop a new set of skills when they start work. They build off their education. How many engineers would put a new graduate in responsible charge of a project?

I have taken the time to sit with young engineers who have recently passed the PE exam. I always ask them if they think they could have passed the exam, right out of college. The answer has always been, "No way!"

The American Society of Civil Engineers (ASCE) has expressed concern that today's graduates are not receiving an adequate undergraduate education. ASCE is advocating that the basic educational requirements for licensure include a bachelor's degree plus 30 additional credits. The Council adopted this position at the last Annual Meeting. But apparently there are those who think that an undergraduate education is more than enough to take the PE exam. What bothers me the most is that people propagating this belief are undercutting public opinion and acceptance of our exams.

It is time for NCEES to return to its original philosophy and roots. We are here to protect public health, safety, and welfare. We do that by providing excellent exams that allow Member Boards to separate the sheep from the goats.

Before retiring, I owned a consulting business for 25 years. The number of employees usually ran between 12 and 15. I defined a specialty niche for us. We worked in certain specialty areas, and whatever we did, we tried to do best.

The Rhode Island Coastal Resources Management Council (CRMC) oversees all development and work along Rhode Island's waterways and shore. In spite of my avowed policy to never knowingly be underpriced, for many years my firm submitted more applications to CRMC than any other consulting firm in the area. I attribute this to the fact that we did our work well and were successful.

NCEES does an excellent job with its exams. I am proud to have worked on the civil exam committee since the early 1990s, and, from what I've seen, the exams are a good test to determine who should become licensed. The need for licensure is not going to go away. Those who work in the built environment, in my estimation, will always be required to become licensed. I believe that if NCEES continues to do a good job, we will always fill this very important role.

*L. Robert "Larry" Smith
NCEES Northeast Zone Vice President*

Initiative of engineers played critical role in WTC investigation (continued from page 1)

I presented these and other FEMA and ASCE findings to the House of Representatives in May 2002. At this meeting, we indicated that our findings were just the beginning. Determining the precise sequence of events and the definite causes of the collapse required additional research. The National Institute of Standards Technology (NIST) then assumed responsibility for the study, using the collected physical data and building on our findings to create the recommendations that we've all heard so much about in the news lately.

The recommendations will now be processed by standards-writing organizations. I think that the adopted suggestions will create codes that will benefit buildings recognized as potential terrorist targets and possibly other buildings as well. One such recommendation advocates increased interaction between structural and fire protection professionals in design. We suggested, and the NIST report concurred, that engineers should consider the behavior of the structural system under fire as an integral part of the design process. This may also indicate the need for interdisciplinary training in structural and fire protection engineering for engineers in both disciplines.

Other recommendations that may affect all buildings have to do with expanding and improving building evacuation systems and emergency rescue procedures. One suggestion is that fire protection and structural engineers assist emergency personnel in developing rescue procedures, and another recommendation promotes an increase in the number of

emergency exits for certain buildings. These measures would make entering damaged buildings safer for rescue workers and could expedite the evacuation process for those trapped inside. Only time will tell which recommendations will actually transfer into workable building codes.

For my part, the experience of leading the initial investigation demonstrated to me how willing many professional engineers are to help in difficult times. Many structural engineers immediately volunteered to advise rescue workers on September 11. As soon as they heard about the disaster, they made their way to Ground Zero to offer whatever assistance they could. As a result, no workers were seriously injured during the recovery efforts. This paints a vivid picture of the generosity and compassion that we as engineers, surveyors, and Council members need to exemplify as we fulfill our mission to protect public health, safety, and welfare.

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may be demonstrating this faulty mentality. In such situations, a program may end up “teaching to the exam” rather than truly assessing how well students have learned the subject matter in the curriculum.

Using the FE exam as an assessment tool

In light of these limitations, how can the FE exam be properly used as an assessment tool? First, the department or program faculty should determine what subjects to teach and to what depth and breadth to teach them. These decisions are a major part of the outcome goals to be set by each program as required by ABET EC2000. After determining the topics to teach, the faculty should set specific goals for student performance and then use the relevant portions of the FE exam to assess the students’ knowledge in specific areas such as water resources, electric circuits, or machine design. The faculty should then compare their goals to the knowledge demonstrated by graduates of the program. For this assessment process to be valid, the population taking the exam must be representative of the entire population of graduates from the program. This can be accomplished either by having all seniors take the exam or by choosing a sample appropriately.

FE exam topic coverage

To effectively use the FE exam as an assessment tool, faculty should know the specifications for the morning (AM) and afternoon (PM) portions of the exam as well as the level of understanding the questions are meant to measure. Changes to the specifications made as of the October 2005 exam were based specifically on faculty feedback to NCEES surveys. Assessments will be more meaningful if students take the discipline-specific PM exam module that addresses more advanced engineering topics rather than the general engineering PM exam module. However, even the general exam module will provide information on basic topics relevant to most programs.

FE exam results

NCEES publishes performance data on all FE exams administered. To make an effective assessment, faculty should request the proper performance data from NCEES so that comparisons are based on content congruent with their program. The NCEES Subject Matter Report summarizes data on EAC/ABET-program examinees who took the exam while still enrolled in school. This is the statistical group that should be used as a measure of instructional outcome. This report is currently available from your state licensing board, but only if the examinees completed the portion of the answer sheet requesting institution and program information.

Application of FE exam results

Prior to the exam, faculty should determine the expected performance in each topic area, depending on the emphasis of that topic in their program. For example, if a program places little emphasis on surveying or transportation facilities, students should be expected to perform accordingly. Conversely, if the program has a strong emphasis on structural analysis, a much higher performance in this area compared to the national average would be expected. For more conclusive results, faculty should also consider performance over several administrations of the FE exam rather than from just one test administration. The form of this expected performance will depend on the analysis method chosen, a variety of which have been developed to examine the data from the Subject Matter Report with regard to program assessment.

The following three methods, along with sample explanatory graphs, are described in more detail in the white paper from which this article has been excerpted:

- ◆ Percentage correct method
- ◆ Ratio method
- ◆ Scaled score method

Other issues

Effective assessment should result in continuous program improvement, and faculty should evaluate the results of student performance in individual subject areas. Doing so will identify the areas in which students are performing below the goals established by the faculty and perhaps significantly below national or state averages. Evaluations should instigate not only the necessary changes in textbooks, teaching mechanisms, and laboratory procedures but also the possible reallocation of faculty to improve student performance.

In one documented case in which FE exam results were used, student performance was significantly below the national average in hydraulics and hydrologic systems. The department head was surprised because the student evaluations for the course had been very good over several years. Upon investigation, he found that the laboratory procedures used to reinforce the theory were shallow and that the performance demand on the students was low. The laboratory procedures and depth of instruction were improved over several semesters without lessening instruction on the theory. The most recent exams indicate a significant improvement in student performance in this area. A point that cannot be overemphasized is that, for assessment purposes, the results of multiple exams should be considered and the exam content compared to the course content.

Conclusion

The FE exam can be a useful part of a balanced assessment program that includes other standardized tests, assessment tools, alumni surveys, and placement data. The FE exam is particularly important because it is the only nationally normed test of upper-level engineering knowledge. The detailed reports of performance by subject area provide information that can help evaluate a program's success in achieving the outcomes specified by ABET. Over time, these reports can also help programs document the effects of curriculum revisions, teaching innovations, and other actions taken to improve student mastery of engineering topics.

In summary:

- ♦ Engineering programs should seriously consider using the FE exam subject-level performance data as part of their program assessment.
- ♦ A program will gain the most from the FE exam as an assessment tool if it requires all students to take the exam, particularly the discipline-specific PM exam modules; if faculty establish specific goals for their programs; and if the administration compares the program to peer institutions with similar requirements.
- ♦ Institutions must remember that the primary purpose of the FE exam is to assess minimal technical competency. Other assessment tools are necessary to evaluate skills in higher-level theories or critical thought that might be the focus of some portion of an institution's program.

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NEWS

ARKANSAS

- ◆ Doyle Cook and Ivan Hoffman are new appointees to the board, and Bill Ruck has been appointed to another term. Ken Cotter and Charles Tenney are no longer on the board.

CALIFORNIA

- ◆ Michael K. Welch is no longer on the board.

COLORADO

- ◆ Axel K. Johnson and Billy A. Harris Jr. are new appointees to the board. The term of Chuck Schloss has expired, and George O. Thomas is now an emeritus member.

ILLINOIS LS

- ◆ Donald Bullard and Joseph Stutz are new appointees to the board. Ralph Van Dorpe is no longer on the board.

KANSAS

- ◆ The board's fax number is 785-296-0167.

KENTUCKY

- ◆ Gwen Christon is a new appointee to the board. The term of Beverly E. Smith has expired.

LOUISIANA

- ◆ Donna Sentell is the board's new executive secretary. She replaces Glen Kent.

MAINE PE

- ◆ William A. Lotz and Donald A. Grant are new appointees to the board. The term of Wayne A. Hamilton has expired. Elwood Ellis has been appointed to the board for another term.

MISSISSIPPI

- ◆ The terms of Edward Springer, Thomas W. Elliott, and Homer D. Lang have expired.

NEBRASKA

- ◆ Melinda E. Pearson is the board's new executive director.

NEW MEXICO

- ◆ Clifford Anderson is no longer on the board.

OHIO

- ◆ Mark T. Jones is no longer the board's executive director. John F. Greenhalge is the acting executive director.

SOUTH CAROLINA

- ◆ Preston M. Young and Anderson M. Kinghorn Jr. are new appointees to the board. The terms of Deborah J. Livingston and James O. Gordon have expired.

WASHINGTON

- ◆ Scott Valentine is a new appointee to the board. The term of Albert J. Hebrank has expired.

WEST VIRGINIA PS

- ◆ The board has expanded its membership from three to five members. Mark H. Hornish, Roy E. Shrewsbury II, and Anthony J. Sparacino Jr. are new appointees to the board. The term of Marshall W. Robinson has expired.



Lawrence D. Hole, P.E.

Lawrence “Larry” D. Hole, P.E., passed away Monday, January 2, 2006. As a member of the Kansas State Board of Technical Professions since 1998, he served in many roles: secretary, vice chair, and P.E./L.S. committee chair. In July 2003, he was elected chair of the board and was later named an emeritus member. Hole served NCEES as a member of the mechanical engineering exam committee for four years. He participated on the FE content review committee and the awards committee.

His work for the engineering profession also included serving as past president of the Wichita chapter of the Kansas Society of Professional Engineers and as a founding member of the Wichita Council of Engineering Societies. He is survived by his wife, Anita, and his parents, Xury and Valeta Hole of Andover. In lieu of flowers, donations may be sent to the Wichita State University Engineering Department Scholarship Fund or the Andover United Methodist Church.

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Upcoming

EVENTS

DATE	EVENT	LOCATION
February 24–25	Board of Directors' Meeting	Monterey, Calif.
April 14	Holiday, Headquarters Closed	
April 21	PE/PS Exam Administration	
April 22	FE/FS Exam Administration	
April 27–29	Southern Zone Meeting	Savannah, Ga.
May 18–20	Northeast Zone Meeting	Charleston, W.Va.
May 29	Holiday, Headquarters Closed	
May 30–June 1	Board of Directors' Meeting	Santa Fe, N.Mex.
June 1–3	Joint Central/Western Zone Meeting	Santa Fe, N.Mex.
July 4	Holiday, Headquarters Closed	

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