Report of the

ENGINEERING LICENSURE QUALIFICATIONS TASK FORCE

March 2003

A Task Force of the
National Council of Examiners for Engineering and Surveying

with the

American Academy of Environmental Engineers
ABET, Inc.
American Council of Engineering Companies
American Society for Engineering Education
Engineering Deans Council
American Society of Civil Engineers
American Society of Heating, Refrigerating, and Air-Conditioning Engineers
American Society of Mechanical Engineers
Canadian Engineering Qualifications Board
Institute of Electrical and Electronics Engineers—USA
National Society of Professional Engineers

The report of the Engineering Licensure Qualifications Task Force (ELQTF) is a cumulative report documenting the work, comments, and research of the task force and representing the consensus of members' viewpoints on issues, findings, and recommendations. NCEES is pleased to sponsor this work and to accept the diversity of viewpoints represented by members of the engineering profession. The report will be useful to the Licensure Qualifications Oversight Group (LQOG) as it proceeds to formally review, evaluate, and further investigate the ELQTF findings and recommendations from the perspective of the mission of NCEES in protecting the health, safety, and welfare of the public. Additional input, responses, updates, or formal statements from societies should be directed to the NCEES Board of Directors for forwarding to LQOG.

CONTENTS

Section 1 Introduction and Background....1
Section 2 The Engineering Profession....3
Section 3 Engineering Licensure....6
Section 4 Background of Engineering Licensure and Accreditation....8
Section 5 Other Licensure Systems....13
Section 6 Current Engineering Licensure System....23
Section 7 Concerns with the Current System....27
Section 8 Licensure Concepts Considered and Recommended....31
Section 9 Consensus Licensure Model....41
Section 10 Implementation Issues....44
Section 11 Conclusion....46

Tables

Table 4.1 ABET EC-2000 Criterion 3....12
Table 5.1 U.S. and Canadian Comparison—Organization and Administration....16
Table 5.2 U.S. and Canadian Systems—Operational Requirements....17
Table 5.3 U.S. and Canadian Comparison—Engineers' Role in Society....21

Figures

Figure 6.1 NCEES Model Law Requirements for Licensure....24
Figure 9.1 ELQTF Consensus Licensure Model....41

Appendices

Appendix A NCEES Model Law....47
Appendix B Summary of Other Related NCEES Activities....69
Appendix C Summary of Member Organization Positions on Licensure....72

SECTION 1—INTRODUCTION AND BACKGROUND

The current system of engineering licensure is supported by the three E's of qualification: education, experience, and examination. All the major professions in the United States have similar systems of licensure and use similar qualifications, but each uses different means of assessment and varying levels of rigor and formality. Some are more unified in their approach than others, but none seem as fractured as the engineering profession. The various engineering councils, societies, institutes, and state boards that play a role in licensure are not well unified. Many are moving in similar directions, but few are moving in concert. Some are actually moving in opposite directions.

Also apparent is that engineering licensure is neither well understood nor highly valued by many of its stakeholders. Some believe that our licensure system has not adapted to the current engineering marketplace, is not relevant in certain areas of the profession, and is not adequate for the new emerging fields of engineering. Such concerns plus the natural pressures of business and technology downplay the importance of licensure if not erode the status of engineering as a true profession. Business and technology will run their own course, but the other concerns about our licensure system must be addressed.

The National Council of Examiners for Engineering and Surveying (NCEES) commissioned the Engineering Licensure Qualifications Task Force (ELQTF) in 2001 to assess the current licensure system and develop recommendations for enhancement or change. Recognizing that there are many stakeholders in licensure, several key engineering organizations were asked to participate.

The task force is composed of NCEES members as well as representatives from several engineering organizations. The engineering organizations are divided into two types: member organizations and consulting organizations. Member organizations are those that agreed to fund a representative for direct participation in the process. Consulting organizations are those that chose not to fund a delegate but agreed to stay in communication throughout the life of the task force.

- NCEES Members. NCEES members have varied over the life of the task force but generally have included representatives from each zone plus the chair. In 2002–2003, 15 NCEES members plus liaisons from the Board of Directors and staff were on the task force.

- Member Organizations. In 2002–2003, 11 societies agreed to serve as member organizations:
  - American Academy of Environmental Engineers (AAEE)
  - American Society of Mechanical Engineers (ASME)
  - Institute of Electrical and Electronics Engineers–USA (IEEE–USA)
  - American Society of Civil Engineers (ASCE)
  - National Society of Professional Engineers (NSPE)
  - ABET, Inc.
  - American Council of Engineering Companies (ACEC)
  - American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
  - American Society for Engineering Education (ASEE)
  - ASEE Engineering Deans Council (EDC)
  - Canadian Engineering Qualifications Board (CEQB)

- Consulting Organizations. In 2002–2003, 11 consulting organizations were members:
  - American Institute of Chemical Engineers (AIChE)
  - Architectural Engineering Institute of ASCE (AEI-ASCE)
  - National Institute of Ceramic Engineers (NICE)
  - The Minerals, Metals & Materials Society (TMS)
  - American Nuclear Society (ANS)
  - Institute of Industrial Engineers (IIE)
  - Society of Fire Protection Engineers (SFPE)
  - American Society of Agricultural Engineers (ASAE)
  - International Society for Measurement and Control (ISMC)
  - Society of Manufacturing Engineers (SME)
  - Comité Mexicano para la Práctica Internacional de la Ignenieria (COMPII)

The goals of the task force were to identify concerns with the current licensure system from the perspectives of the various stakeholders, gather relevant information, establish suitable goals for a licensure system, determine viable concepts that may address the perceived concerns, develop ideas and alternatives for consideration, and make recommendations. The task force identified several concerns through lengthy internal discussions, but other concerns were identified from the feedback obtained from NCEES, engineering societies, and individuals who spoke directly to the task force or through other means such as general publications and Web sites.

Five subcommittees gathered supporting information about the current system, other professional licensure systems and proposals for engineering licensure, the Canadian system, the stakeholders, and other NCEES committees and task forces. The information gathered by the subcommittees makes up much of this report. A summary of related NCEES activities is included as Appendix B.

Using the information gathered, the task force generated licensure goals, concepts, ideas, and alternatives. After obtaining additional feedback from both inside and outside NCEES, the task force reached consensus on the concerns and recommendations. This report summarizes the relevant information gathered, the deliberations of the task force, and its conclusions and recommendations.

The ultimate goal of the task force was to produce a thorough assessment of the current licensure system and formulate recommendations that represent a consensus from a broad cross-section of the profession. Everyone involved wanted the process to unify licensure within the profession and make recommendations applicable to the 21st century. The task force believes it accomplished the former. Time will tell if it accomplished the latter.

SECTION 2—THE ENGINEERING PROFESSION

Of the professions, engineering is possibly one of the least understood. The term engineer is used so loosely in American society that the general public has difficulty understanding engineers and what they do. The profession has always recognized many different engineering disciplines, but now specialization is rapidly producing new disciplines. The distinction between engineering and science is not precise, and the overlap seems to be expanding. Because of these conditions, the task force began its assessment by defining the terms *engineers* and *engineering* and identifying the profession's role in modern society.

2.1 Engineers and Engineering. The term *engineer* is used in many different ways in America. Many who labor in our society are called engineers when they are not. For example, a person who operates and maintains the various mechanical systems in a building is sometimes referred to as a building engineer. A person who operates heavy equipment is referred to as an operating engineer. Even household workers are sometimes referred to as domestic engineers, and the list goes on. Unfortunately, this ambiguous use of the word occurs even within the engineering profession.

Some engineers believe that a person is part of the engineering profession only when he or she is licensed to practice. This, however, excludes a large number of people with engineering education and experience who are actually performing engineering services in areas exempt from licensure. Others say that a college graduate with a degree in engineering is part of the engineering profession even if he or she has never practiced. Based on results gathered from licensure focus groups, NCEES realizes that a majority of engineering graduates believe this. Still others believe that a person can become an engineer without a college degree if he or she acquires engineering skills through experience. There are thousands of people currently practicing engineering who fit these descriptions. So what is an engineer? What is a profession, and who is included in the engineering profession?

Merriam Webster's Collegiate Dictionary, 10th edition, defines engineering as follows:

> The application of science and mathematics by which the properties of matter and the sources of energy in nature are made useful to people; the design and manufacture of complex products.

In other words, engineers are people who apply science and mathematics to produce works and products that are beneficial to humanity. Because of their special education, training, and experience, they constitute a profession.

Licensure is not included in this definition, which prompts several important questions. Is licensure an integral part of a profession? Is an unlicensed engineer—practicing in an environment exempt from licensure—part of the engineering profession? To find the answers, one must first understand the definition of a profession.

2.2 Engineering as a Profession. Webster's Third New International Dictionary defines a profession as follows:

> A calling requiring specialized knowledge and often long and intensive preparation including instruction in skills and methods as well as in the scientific, historical, or scholarly principles underlying such skills and methods, maintaining by force of organization or concerned opinion high standards of achievement and conduct, and committing its members to continued study and to a kind of work which has for its prime purpose the rendering of a public service.

This definition certainly fits engineering, but it does not reference licensure, at least not directly. The definition does, however, require of a profession "high standards of achievement and conduct" either by the "force of organization" or by the "force of concerned opinion." Force of organization or concerned opinion could constitute licensure since government is an organization and the mechanism for implementing concerned opinion. However, state licensing laws exempt many engineers from licensing. Typically, those who do not offer or provide engineering services directly to the public are exempt from licensure. Clearly, the opinions of engineering societies and engineering governance organizations are important. The "force of opinion" could also be construed as court decisions or marketplace pressures.

A majority of the task force members agreed that it would be desirable for all engineers whose practice affects the public health, safety, and welfare to be licensed. But, the fact is, licensure is not an integral part of the entire engineering community in the United States, and unlicensed engineers are indeed part of the engineering community. Perhaps the profession should change state laws to require licensing of all practicing engineers, but that is something beyond the scope of this task force.

2.3 The Practice of Engineering. In general terms, the practice of engineering is the undertaking of engineering activities. However, in the eyes of the law, the practice of engineering is defined in very detailed and precise terms. The individual state laws by which an engineer applies for and receives an engineering practice license define those terms. A segment of the engineering profession will always be licensed. For the purpose of regulation, the NCEES Model Law defines an engineer (and most state laws include something similar) as follows:

> A person who is qualified to practice engineering by reason of special knowledge and use of the mathematical, physical, and engineering sciences and the principles and methods of engineering analysis and design, acquired by engineering education and engineering experience.

The legal definition of the practice of engineering distinguishes between engineering work that is regulated from that which is not regulated. However, it is in the words *practice of engineering* that we find need for further clarification.

To a regulator, the words *practice of engineering* refer to a person who is licensed to practice engineering. In a general sense, however, these words also relate to unlicensed engineers who perform engineering tasks in unregulated areas. Licensing laws make provisions for such

definitions. For example, many state laws provide licensing exemptions for engineers working in industry. Thus the general term *practice* must apply to them as well. Perhaps the best distinction between these two conditions is *licensed practice* versus just plain *practice*. When considering the engineering profession, one must recognize that the legal privilege to practice engineering applies, in proper context, to both licensed and unlicensed engineers. In spite of those segments of the engineering community legally exempt from licensure requirements, engineers do care deeply and conscientiously about protection of the public welfare. For those groups to which exemption applies, there are perhaps safeguards in place to provide protection of the public by means other than professional licensure.

2.4 Areas of Practice. Licensed practice is required for engineers in certain settings, while unlicensed practice is allowed in others. Descriptions that have been used to characterize *licensed* versus the *unlicensed* settings include the following:

- The built environment versus the industrial environment
- Services provided directly to the public versus services provided indirectly
- Engineered systems versus engineered components or products
- Custom projects versus mass products
- Real property improvements versus nonreal property improvements
- Services governed by standard of care versus services governed by strict liability

None of these descriptions is complete by itself, but together they provide a reasonable distinction between the regulated and the unregulated settings of engineering practice.

2.5 The Disciplines. Engineering practice is separated into many disciplines, and most disciplines are separated into various subdisciplines. There are several longstanding disciplines—such as chemical, civil, mechanical, and electrical—which are considered to be the core disciplines, and there are many others that are considered to be specialties. Many specialty disciplines were outgrowths of the core disciplines, but others were and are being created by advancements in new technology. In the past, all the engineering disciplines were physics based, but new branches of engineering are emerging that are principally based in the biological sciences and information technology. Clearly, the nature of engineering is continuing to evolve.

This trend has been called by some the splintering of the engineering profession. While it has always been splintered to some degree, splintering is now accelerating. Clearly more and more disciplines will be spawned by advancements in technology and sustained by new markets. Some of these new engineering disciplines may be true engineering in the classic sense, but others will be a blend of engineering and science with a greater emphasis on science.

The task force understands that this movement will continue and that the role of licensure in the expansion of the profession will be increasingly difficult to define. Will this simply increase the unlicensed portion of the profession, or will licensure have a place in the new disciplines and areas of practice? Are the new disciplines really engineering? The task force could not definitively answer such questions. The future will depend on the position that states take with respect to regulation of these new and emerging areas of engineering practice.

2.6 Engineering and Science. Engineering and science have always overlapped. Engineering starts with an understanding of science and ends with its application. Scientific principles must be applied to understand and recognize the importance of scientific phenomena. As science continues to advance and the engineering profession continues to splinter, the overlap of science and engineering will naturally increase. Compounding this situation is the fact that the financial viability of engineering educational institutions requires that they become more and more research oriented. As the pressure for funded research increases, the resources directly devoted to engineering education may suffer, fostering additional overlap.

The engineering profession is diverse, difficult to define, and changing rapidly. Licensure may be the one common denominator that connects these dichotomies. Some consensus in the profession may help encourage a broader acceptance of licensure in the future, but there are significant differences even within the profession. The task force has developed recommendations that would allow licensure to embrace more elements of the profession while avoiding the imposition of mandatory licensure on the entire profession. The task force was cautious about lowering the current licensure standard of minimum competence to increase numbers. Such a move, the task force believes, would go against the number one goal of licensure: the protection of the public health, safety, and welfare.

SECTION 3—ENGINEERING LICENSURE

3.1 Purpose of Licensure. Before 1900, practitioners in professions such as engineering, medicine, and dentistry typically considered government regulation of their activities intrusive. This was considered encroachment of nonprofessionals into specialized realms of knowledge. Most professions preferred self-regulation to licensure, arguing (in the case of engineering) that only engineers should pass judgment on other engineers. However, in the early 1900s, issues of public safety became a leading concern and licensure began to appear inevitable. In the decade between 1910 and 1920, a few states began to enact engineering licensure laws. In 1907, Wyoming became the first state to enact an engineering licensure law, followed by Louisiana in 1908. The first all-inclusive engineering registration law passed in the United States was enacted by the Florida legislature in May of 1917.

3.1.1 *Protection of the Health, Safety, and Welfare of the Public.* Engineering licensure laws were enacted by states and jurisdictions for the protection of the health, safety, and welfare of the public. Every state licensure law begins with words similar to the following: "The Legislature deems it necessary, in the interest of public health and safety, to regulate the practice of engineering in this state." The professional engineer license grants the practitioner the privilege to be in responsible charge of engineering work and to perform engineering services for the public.

3.1.2 *Engineering as a Profession.* Many community members consider engineering to be a profession similar to medicine, law, and architecture. A significant difference, however, is that over the past hundred years, higher education requirements for engineering have remained stagnant at a four-year degree (with credit-hour requirements dropping somewhat) while for other professions, educational requirements have become considerably more rigorous. There is support in some sectors for considering the current

baccalaureate engineering degree as an entry-level degree that should be supplemented by additional schooling in order for a person to practice engineering at the professional level.

3.1.3 *Code of Conduct.* Licensure guides the practitioner and the engineering profession in the important area of ethics. While both technical and professional societies have codes of ethics for guidance, none of these codes has legal standing in the practice of engineering. On the other hand, by virtue of their laws and rules, state licensing boards have standards of conduct that are legally binding. The recognition and enforcement of these standards gives greater definition to the profession and significantly enhances the image of licensed engineers in society and in the engineering community.

3.1.4 *Engineering Regulated by the States.* The practice of engineering in the United States is regulated in each of the 50 states and 5 territories, including the District of Columbia. Each licensing jurisdiction regulates the practice of engineering by means of an Engineering Practice Act, which, along with rules promulgated by the jurisdiction, serves to protect the health, safety, and welfare of the citizens of that jurisdiction. Such laws and rules define engineering practice and establish requirements for an individual to become licensed as a professional engineer in that jurisdiction. Licensure signifies that a practitioner has met certain experience and education requirements of the jurisdiction in which the license was granted and has passed examinations demonstrating his or her technical competency.

3.1.5 *Goals of a Licensure System.* The task force concluded that any licensure system should contain the provisions below. The task force kept these goals in mind as it deliberated the issues and formed its recommendations.

- Must protect the health, safety, and welfare of the public
- Must be enforceable
- Must be fair to applicants
- Should accommodate future conditions
- Should facilitate licensure and neither hinder nor discourage it
- Should be workable and able to be implemented
- Should be credible and logical
- Should be efficient and not overly complex
- Should enhance the stature of engineering in society

3.2 Stakeholders. At its organizational meeting, the task force discussed the stakeholders' interest in modifying the licensure system. The task force members agreed that the perspectives of the following groups must be taken into consideration when making recommendations:

- Public
- Professional and technical societies
- Foreign licensing bodies
- Academia
- NCEES and its Member Boards
- ABET

- Industry
- Licensed engineers
- Potential applicants for licensure
- Insurers
- Engineering-related groups (such as geologists and environmental specialists)
- Engineering firms
- All levels of government

Many of the groups listed above were represented on the task force as discussed in Section 1.

SECTION 4—BACKGROUND OF ENGINEERING LICENSURE AND ACCREDITATION

The task force reviewed the history of licensure and the accreditation of engineering education.

4.1 Licensure. The 10th Amendment to the U.S. Constitution states that "The powers not delegated to the United States by Constitution, nor prohibited by it to the states, are reserved to the states respectively, or to the people." As a consequence, there is no national licensure system for professions, including engineering. Licensure is the province of the states and territorial jurisdictions.

The first engineering registration law was passed in Wyoming in 1907 to address problems in land surveying, water rights, and water diversion in the previous decade. Since surveying was a branch of civil engineering at that time, laws for engineering qualifications and registration were created in response to this need.

In 1929, the ASCE proposed a form of registration law. Representatives of engineering societies at conferences held in December 1929, March 1930, and June 1931 considered this, and on April 15, 1932, a revised draft was approved and the following resolution adopted.

> Resolved, To recommend the adoption of this Model Law for the Registration of Professional Engineers and Land Surveyors by all national, state and local organizations of engineers as a model to be followed in the framing of all new registration laws and the amending of existing laws, with a view to attaining a uniform high standard throughout the United States.

In 1932, an NCSBEE (now called NCEES) Committee on Accredited Engineering Schools formulated a Suggested Schedule for Rating Engineering Schools. This schedule included ratings of entrance requirements, graduation requirements (credit hours), curriculum, degrees, and faculty. One of the more interesting of the 14 requirements stated that "No college will be accredited until it has been inspected and reported on by the National Council of State Boards of Engineering Examiners (NCSBEE)."

The *History of the National Council of Examiners for Engineering and Surveying* states that in 1932, the American Society for Mechanical Engineers (ASME) "called for all national organizations to attend a conference on the Certification into the Engineering Profession. Since the Council had

been working to develop the National Bureau of Engineering Registration (NBER), which was working to achieve many of the same goals, [these] two movements came together at this conference." D. B. Steinman represented the Council. "He helped draft 'A Plan for Joint Action in the Development of the Engineer' that called for the formation of the Engineers' Council for Professional Development. This was to be run by a committee composed of representatives from the major engineering societies, SPEE, and [NCSBEE.]" Eventually, the Engineers' Council for Professional Development—which later became known as ABET, Inc.—was established as the accrediting agency for schools of engineering. The minimum qualifications for an engineer were codified that same year and included a four-year approved course in engineering, a specific record of four or more years of engineering work, and successful passing of a written and oral examination covering technical, economic, and cultural subjects.

The 1937 NCSBEE Model Law offers three avenues to licensure:

- Graduation plus experience
- Examination plus experience
- Engineers of long-established practice

Experience is the dominant factor in the model. At that time, there were inconsistencies from state to state in exam length, type of exam (written exams, oral exams), exemptions for education, and exemptions for experience. Further revisions were made in 1943 and 1946. The Engineer-in-Training classification was added in 1943, and the 1946 revision reflected court decisions on definitions of professional engineer and practice of engineering. By 1950, all the states as well as Alaska, Hawaii, the District of Columbia, and Puerto Rico had adopted registration laws of some kind. The Model Law revisions of 1960 raised the qualifications for registration and eliminated the eminence clause and the grandfather clause but added provisions for public utility employees under the exemption clause.

Graduation, experience, and examination became relatively balanced requirements in the 1960 model. During that period, committees opposed exempting graduates of an accredited program from the examination. In 1965, the first NCSBEE Fundamentals of Engineering examination was administered. By 1984, all Member Boards began to use uniform national examinations provided by the Council, both the Fundamentals and Principles and Practice of Engineering examinations.

In 1967, the NCSBEE shortened its name to the National Council of Engineering Examiners (NCEE). In 1989, the name was changed again to its present form, the National Council of Examiners for Engineering and Surveying (NCEES) to reflect the Council's representation of both engineering and surveying regulatory boards.

In 1971, teaching engineering at a college or university offering an approved curriculum of four years or more was recognized as engineering experience.

The Model Law Engineer (MLE) terminology was added to Section 12 of the Model Law in 1998. This was intended to improve mobility across jurisdictions.

The NCEES Web site (www.ncees.org) provides a timeline of NCEES history. This history reflects the continuing search for uniformity and commonality in the recognition and mobility of engineering registration/licensure from one jurisdiction to another.

4.2 **Accreditation.** Established in New York in 1932, the Engineers' Council for Professional Development (ECPD) was the predecessor of ABET. As a result of surveys conducted by professional engineering societies in the 1920s, ECPD was formed to fill the apparent need for a joint program for promoting engineering as a profession. Hence, ECPD originally focused on the following:

- Guidance—Supplying information to engineering students and potential students
- Training—Developing plans for personal and professional development
- Education—Appraising engineering curricula and maintaining a list of accredited curricula
- Recognition—Developing methods whereby individuals could achieve recognition from the profession and the general public

Seven engineering societies founded the organization and contributed to its original direction and focus: the American Society of Civil Engineers (ASCE); the American Institute of Mining and Metallurgical Engineers (now SME-AIME); the American Society of Mechanical Engineers (ASME); the American Institute of Electrical Engineers (now IEEE); the Society for the Promotion of Engineering Education (now ASEE); the American Institute of Chemical Engineers (AIChE); and the National Council of State Boards of Engineering Examiners (now NCEES). Within its first year of existence, ECPD emerged as an accreditation agency and in 1936, evaluated its first engineering degree programs. Ten years later, ECPD conducted its first evaluations of engineering technology degree programs.

In 1980, ECPD was renamed the Accreditation Board for Engineering and Technology (ABET) in order to more accurately reflect its emphasis on accreditation.

In 1964, the Engineering Technology Committee (forerunner of the Technology Accreditation Commission, or TAC) was formed as a separate group from the Engineering Education and Accreditation Committee (the forerunner of the Engineering Accreditation Commission, or EAC) to accredit programs in engineering technology. In 1984, what is now known as the Applied Science Accreditation Commission (ASAC) was formed to accredit engineering-related and technology-related programs. In 2000, the Computing Accreditation Commission (CAC) was formed to accredit computer science programs.

The current mission of ABET is as follows.

ABET serves the public through the promotion and advancement of education in applied science, computing, engineering, and technology. ABET will:

- Accredit educational programs.
- Promote quality and innovation in education.
- Consult and assist in the development and advancement of education worldwide in a financially self-sustaining manner.
- Communicate with our constituencies and the public regarding activities and accomplishments.
- Anticipate and prepare for the changing environment and the future needs of constituencies.
- Manage the operations and resources to be effective and fiscally responsible.

The ABET accreditation criteria for engineering programs, developed and administered by the EAC, have undergone significant changes in the last five years. In 1997, following nearly a decade of development, ABET adopted Engineering Criteria 2000 (EC-2000), considered at the time a revolutionary approach to accreditation criteria. EC-2000 focuses on what is *learned* (output) rather than what is *taught* (input). Institutional educational programs must demonstrate a continuous quality improvement process and adopt program outcome objectives. In providing more flexibility than earlier accreditation criteria, EC-2000 allows more program innovation rather than stifling it and encourages new assessment processes and subsequent program improvement.

The new criteria were optional from 1995 through 2001 but are now mandatory for all engineering accreditation reviews beginning in the 2002–2003 cycle. EC-2000 can be seen in its entirety at http://www.abet.org/images/-Criteria/2002-03EACCriteria.pdf. Among seven general criteria and one program-specific criterion for accreditation, Criterion 3 requires demonstration that students are achieving the educational outcomes identified in Table 4.1.

Table 4.1—ABET EC-2000 Criterion 3

	Educational Outcomes for Students (paraphrased from the original source)
a	They will have the ability to apply knowledge of mathematics, science, and engineering in their chosen fields.
b	They will have the ability to design and conduct experiments and to analyze and interpret experimental results.
c	They will have the ability to design systems, components, or processes to meet specified objectives in their chosen fields.
d	They will have the ability to work as members of multidisciplinary project and/or research teams and have an understanding of leadership in teams and organizations.
e	They will have the ability to identify, formulate, and solve engineering problems.
f	They will have an understanding of professional and ethical responsibility and the value of mentorship and peer support.
g	They will have the ability to communicate effectively in written, oral, and graphical forms.
h	They will have an education that is supportive of a broad awareness of the diversity of the world and its cultures and that provides an understanding of the impact of engineering practice in the global community.
i	They will understand the importance of updating and maintaining their technical skills and continuing their education throughout their professional careers and understand the importance and responsibilities of professional licensure.
j	They will have a knowledge of contemporary issues.
k	They will have the ability to use the principles, techniques, skills, and modern engineering tools necessary for successful engineering practice.

The pre-EC-2000 criteria were somewhat prescriptive; for example, they required one-half year of humanities and social sciences, one year of mathematics and basic sciences (with key subject areas specified), and one-and-a-half years of engineering topics. These topics specifically include mechanics, thermodynamics, electrical and electronic circuits, materials science, transport phenomena, computer science, and other subjects specific to the discipline, often including one-half year of engineering design.

In response to shortcomings identified by both educators and practitioners, in the early 1990s, the EAC, composed of representatives from 21 engineering societies and associations (including NCEES), began to formulate the new EC-2000 criteria that are now mandatory for accreditation of engineering programs.

Criterion 4, Professional Component, reflects a less prescriptive approach to engineering curricula. For example, EC-2000 now requires only a general education component that "complements the technical content of the curriculum and is consistent with the program and institution objectives," requires a year of a combination of college-level mathematics and basic sciences "appropriate to the discipline," and retains one-and-a-half years of engineering topics.

The new criteria do not specify subjects to be included in math/science or engineering topics, nor do they include the amount of time to be devoted to engineering design.

The relaxation of prescriptive curriculum requirements has made some practitioners and the licensing community concerned that EC-2000 does not include the physics-based core topics that traditionally have been the basis of an engineering education. There is also concern that the EC-2000 implicitly supports a blurring of lines between science and engineering, a blurring that may also be the inevitable consequence of the changing vocation of engineering programs from emphasis on undergraduate education to emphasis on the research enterprise. This is seen by many as a consequence of weakening state support for public higher education in times of significant fiscal stress. While many would argue that faculty members engaged in active research programs provide a stimulating undergraduate engineering educational experience, others are concerned about the disappearance of hands-on engineering experience among engineering faculty.

Another consequence of EC-2000 is that it naturally supports the emergence of nontraditional engineering disciplines, such as software-based or biology-based engineering. The corresponding education tracks may not need to be physics-based in the sense of traditional engineering disciplines. Therefore, from the point of view of state legislative responsibilities for the protection of the health, safety, and welfare of the public, an engineering degree from an accredited program may not, in and of itself, ensure that the engineer has a solid foundation in physics-based core engineering subjects.

SECTION 5—OTHER LICENSURE SYSTEMS

The task force reviewed the licensure systems of other professions in the United States and the engineering licensure system used in Canada. It also reviewed proposals for licensure reform from the NSPE and ASCE.

5.1 Other Professions in the United States. The task force reviewed the licensure requirements for accountants, architects, attorneys, landscape architects, medical doctors, and nurses. All these professions have national organizations similar to NCEES that provide model guidelines for their licensure requirements and prepare examinations. As is the case with engineering, the state licenses individuals, and the state requirements often deviate from the proposed national guidelines.

5.1.1 *Accounting.* Some accountancy licensure boards have recently changed their educational requirements to require that candidates have a bachelor's degree or higher with 150 hours of undergraduate and/or graduate courses before they can take a two-day, four-section exam that is offered semiannually. The exam is graded in sections, and if the candidate passes two sections and scores a minimum of 50 percent on the other two sections, the candidate is considered "conditioned." The candidate has four additional attempts to pass the other two parts. If the candidate passes one of the parts and scores a minimum of 50 on the other part, the candidate is given an additional four attempts on the last part. If the candidate does not pass after these attempts, he or she must retake

and pass all four sections again. In addition, the candidate must have at least one year of experience verified by a certified public accountant (CPA) before a license is actually granted.

5.1.2 *Architecture.* The licensure requirements for architects include a five-year accredited professional degree or equivalent and an exam. The candidate must have at least three years of experience in the Intern Development Program of the National Council of Architectural Registration Boards (NCARB) before being allowed to sit for the exam, which has nine parts. Each part is graded individually, and the candidate can pass by sections. Once a section is passed, it does not need to be retaken, and there is no limit on the number of re-exam attempts allowed.

5.1.3 *Landscape Architecture.* Licensure as a landscape architect requires a candidate to have a professional degree in landscape architecture, three years of experience under a licensed landscape architect, and a history of acceptable professional conduct. Licensure also requires passing a written exam. If the candidate does not have a degree in landscape architecture, he or she may substitute 10 years of acceptable experience in lieu of the degree. The candidate must have six years of combined education and work experience. The candidates take a three-day national exam, which consists of five sections, with each section being graded separately. Once a section is passed, it does not need to be retaken.

5.1.4 *Law.* The legal profession requires candidates to have a Bachelor of Science degree or 75 percent of the coursework toward a bachelor's degree, plus a Doctor of Laws degree from a school approved by the American Bar Association. The candidate must also exhibit good moral character and take a three-day exam consisting of a multistate bar exam, state bar exam, and multistate professional responsibility exam. The candidate is allowed to take the exam upon graduation. He or she must pass the exam in its entirety.

5.1.5 *Medicine.* The medical profession requires a candidate to have a bachelor's degree, be a graduate of an approved medical school, and pass medical examinations consisting of multiple steps. The candidate must then have 36 months of postgraduate medical training (during which he or she would have limited privileges of practice) based upon the medical degree and passing Step 1 and Step 2 of the United States Medical License Examination (USMLE). Step 1 and Step 2 are taken during the period in which the student is officially enrolled in medical school or immediately after graduation. One year of postgraduate residency is required before a candidate is eligible to take Step 3. The USMLE organization recommends to medical licensing authorities that they require candidates to successfully complete Steps 1, 2, and 3 within a seven-year period, beginning when the candidate passes the first step. It also recommends that the candidate be allowed no more than six attempts to pass each step without demonstrating additional education experience acceptable to the licensing authority. The examinations are computer-based with one score for the entire exam. Step 1 is eight hours, Step 2 is nine hours, and Step 3 has two eight-hour sessions.

5.1.6 *Nursing.* The nursing profession requires candidates to graduate from an approved program with either an associate's or a bachelor's degree. The nursing exam is computerized and consists of 85 to 250 questions. The number of questions is adjusted as

the candidate takes the exam. The candidate either passes or fails the entire exam, and there is no limit on the number of times the exam can be taken, but there is a limit on the frequency. There are no experience requirements other than the practical requirements included in the degree program.

5.1.7 *General Information.* The accounting, legal, and nursing professions allow candidates to take their licensing exams immediately after graduation. The medical profession allows a candidate to start taking the exams while he or she is in medical school and to complete the last exam during the mandatory postgraduate training. Landscape architects are required to have at least one year of experience if they have only an undergraduate degree before taking the exam, and architects are required to have a minimum of three years of experience in the Intern Development Program of NCARB before being allowed to sit for the exam. There is no uniformity in the number of times an exam can be taken or in the time period required for passage of all phases of an exam.

The percentage of graduates of specific programs who obtain licensure in the various professions is not known. A very high percentage of medical doctors who graduate from medical school obtain licenses to practice medicine. Based on the number of CPAs and the number of accounting graduates, it is estimated that only 10 to 15 percent of accounting graduates become licensed CPAs.

5.2 Canadian Engineering Licensure System. The Canadian engineering licensing system was compared to the United States' system. Although both systems are predicated on the basis of education, examination, and experience, there are significant differences in their philosophies and implementation. The Canadian system requires applicants to demonstrate experience and knowledge of a broad range of engineering and engineering-related (impact of engineering on society) concepts to obtain a license. In contrast, the present U.S. system emphasizes principally the technical: technical education, technical examinations, and technical experience.

In Canada, the provinces have legal authority over engineering licensure, as implemented through 12 provincial licensing bodies. These bodies are all members of the Canadian Council of Professional Engineers (CCPE), a national organization that promulgates substantial and detailed guidelines for all licensure qualifications and processes. Its various divisions evaluate university academic programs for accreditation, make available standardized examination syllabi, and provide guidelines for applicant experience evaluation. As in the United States, licensure requirements and procedures are subject to the laws of the various jurisdictions. However, the fact that they are all members of the same umbrella organization, and that this organization is heavily involved in all areas of licensure, tends to mitigate differences among jurisdictions, generally resulting in greater consistency and higher mobility than we enjoy in the United States. Another fact is that this organizational structure creates a link between the licensing bodies and the accreditation process, including the setting of the criteria for accreditation.

The following tables compare the U.S. and Canadian licensure systems. Factual comparisons are quantifiable aspects of the requirement or implementation. Cultural comparisons are an attempt to succinctly describe an underlying philosophy.

5.2.1 *Comparison–Organization and Administration.* Table 5.1 compares the organization and administration of the licensure processes in the United States and Canada.

Table 5.1—U.S. and Canadian Comparison—Organization and Administration

U.S. System	Canadian System
Factual Comparison	
Education EAC/ABET **Examination** NCEES **Experience** State Board	**Education** CCPE (CEAB) **Examination** Technical only for non-CEAB graduates: Provincial licensing bodies use CCPE (CEQB)—Syllabi Nontechnical—professional practice: Provincial licensing bodies use CCPE guidelines **Experience** Provincial licensing bodies use CCPE (CEQB) guidelines
Cultural Comparison	
Oversight of engineering licensure is divided among separate entities for accreditation, exam development, and qualifying experience evaluation.	All facets of engineering licensure including education, examination, and qualifying experience evaluation are under CCPE and/or its members, the 12 licensing bodies.

5.2.2 *Overview of Systems.* Table 5.2 compares the operational requirements of the engineering licensure systems in the United States and Canada.

Table 5.2—U.S. and Canadian Systems—Operational Requirements

U.S. System	Canadian System
Factual Comparison	
Education ▪ 4-year engineering degree • EAC/ABET • Non-EAC/ABET ▪ Related degree **Examination** ▪ Fundamentals of Engineering (FE) exam–technical ▪ Principles and Practice of Engineering (PE) exam–technical ▪ Optional local laws/rules **Experience** ▪ 4 years (typical) ▪ Reported on PE exam application	**Education** ▪ 4-year engineering degree • CEAB • Non-CEAB ▪ Related degree **Examination** ▪ No technical exam unless non-CEAB degree ▪ Professional Practice Exam (PPE) (based on a national guideline and syllabus) • During EIT term • 3 hours, closed book, 100 items, objectively scored (typical) • Professionalism, practice, laws/rules **Experience** ▪ 4 years (typical) ▪ Typical structured intern program: • Under P.Eng. • Explicitly shared responsibility • Periodic reporting • Verified by supervisor • Application of theory • Practical experience, management, communications, professional and ethical responsibility, social implications
Cultural Comparison	
Values rigorous academic education Places higher value on technical component of experience Requires employment verification for experience	Values rigorous academic education Places higher value on broad experience, immersion in profession Sets explicit criteria for experience; requires independent validation of specific exposures

5.2.3 *Education.* Both the U.S. and Canadian systems rely on accredited post-secondary formal education as the typical entry point into the licensure system, although both also allow for alternative programs based upon nonaccredited or engineering-related degrees. Both systems also recognize advanced engineering degrees from schools offering accredited undergraduate programs in related disciplines as potential justification for reducing examinations or the work experience requirement.

5.2.4 *Examination.* The examination requirements differ significantly in the two systems. The current U.S. model requires an eight-hour technical FE exam that candidates typically take when they are college seniors and an eight-hour technical PE exam completed after the candidate acquires the requisite experience. The Canadian model has no counterpart to the U.S. FE and PE exams. Graduation from a CEQB-accredited program, typically with 160 semester hours corresponding to an eight-semester (four-year) program of six to nine courses per semester, is deemed adequate evidence of technical qualification for licensure. This is a consequence of the way the engineering profession is organized in Canada, where one organization—CCPE—established the criteria for both accreditation and examination. The Canadian Professional Practice Examination (PPE) is completed near the end of or after requisite experience, similar to the situation with the U.S. PE exam. However, the exam differs materially from the U.S. PE exam in that it is three hours in length and deals entirely with nontechnical issues such as professionalism, ethics, legal obligations, and engineers' role in society. The exams used in the Canadian system are summarized below.

- Technical Examinations. The only technical exams offered or potentially required within the Canadian system are used to assess whether a candidate without a CEAB-accredited degree meets academic qualifications. National guidelines developed by the CCPE for different disciplines provide direction and set the syllabus for the examinations. The examinations are classified mainly as technical or confirmatory. The technical exams are assigned to identify gaps in a candidate's educational background, and confirmatory exams are assigned to confirm the candidate's quality of education. Some licensing bodies use different names for the exams. For example, the Alberta Board of Examiners may require that non-CEAB candidates take and pass confirmatory examinations, exploratory examinations, qualifying examinations, or proficiency examinations, depending on their assessment of a candidate's academic qualifications.

- Confirmatory Examinations. If a candidate is close to being academically qualified, he or she may be assigned one to four confirmatory examinations. These exams are of a professional level, and successful completion generally results in the candidate's being considered academically qualified.

- Exploratory Examinations. If little information is available to assess a candidate's credentials, a number of exploratory examinations may be assigned to determine the candidate's knowledge of fundamental principles. The candidate's performance on these exams determines which qualifying or proficiency exams are then required.

- Qualifying Examinations. If complete information upon which to assess a candidate's academic credentials is not available, qualifying examinations may be assigned. The candidate's performance on the qualifying examinations provides the information necessary to determine which proficiency examinations may be required. If the candidate passes the qualifying examinations, the committee may consider the exams to be confirmatory and treat the candidate as if he or she had passed confirmatory examinations.

- Proficiency Examinations. As many as 15 of these exams may be required to assess proficiency in particular areas identified as deficient in a candidate's academic background. The candidate may be at the fundamental level, the professional level, or at the fundamental level in some areas and at the professional level in other areas. As an alternative to taking proficiency examinations, the candidate may be permitted to substitute approved university courses, if available, for the assigned examinations. Generally, two courses are required to cover the material in one examination. Successful completion of the proficiency examination program results in the candidate's being considered academically qualified.

- Professional Practice Examination (PPE). A candidate usually takes the nontechnical Canadian PPE near the end of the intern period. Applicants for licensure are required to pass the PPE to confirm that they have sufficient knowledge of the considerations and obligations that accompany the privileges of professional status and of the legal concepts relevant to professional engineering practice. National guidelines developed by the CCPE provide direction and set the syllabus for the PPE. For example, Alberta uses the following weightings for different topic areas:

  A. Professionalism (30%)
     1. Definition and interpretation of professional status
     2. The role and responsibilities of a professional in society
     3. The role and responsibilities of a professional to management
     4. Professional conduct, ethical standards, and codes
     5. Safety and loss management—the professional's duties
     6. Environmental responsibilities
  B. Professional Practice (20%)
     1. Professional accountability for work, workplace issues, job responsibilities, and standards of practice
     2. Continuing competence
     3. Quality management and standards of skill in practice
     4. Business practices as a professional
     5. Insurance and risk management
     6. Professional and technical societies
     7. Nonstatutory standards and codes of practice

C. Regulatory Authority Requirements (9%)
    1. Safety and loss management—regulatory aspects
    2. Environmental regulations
    3. Occupational health and safety
    4. Workers' compensation
    5. Other statutory standards of practice
D. Law and Legal Concepts (25%)
    1. Canadian legal system and international considerations, basics of business organizations
    2. Contract law—elements, principles, types, discharge, breach, interpretation, etc.
    3. Tort law—elements, application of principles, interpretation, liabilities of various kinds
    4. Intellectual property—patents, trademarks, software issues, copyrights
    5. Arbitration and alternative dispute resolution (ADR)
    6. Expert witness
E. The Act (16%)
    1. Definitions of the professions and scopes of practice
    2. Structure and functions of a provincial association
    3. Regulations and bylaws
    4. Registration
    5. Discipline and enforcement
    6. Use of seals and stamps

5.2.5 *Experience.* The typical U.S. engineering graduate must acquire four years of relevant experience for licensure, which is reported on the licensing application for evaluation by the individual boards. National guidelines are not universally adopted, leaving open the possibility of considerable variation from one jurisdiction to another as to threshold criteria.

The Canadian system places a high value on proper experience as a key component of a prospective engineer's training and uses a more formal approach to determining what constitutes suitable experience. A typical Canadian qualifying experience regimen includes enrollment in the association's intern program; working under supervision of a P.Eng.; demonstrating progression in the areas of technical capability (specifically including application of theory); demonstrating responsibility, maturity of judgment, and communication skills; and being exposed to the areas of practical experience, management, professionalism, ethical responsibilities, and the social implications of engineering. Both the EIT and the supervising P.Eng. (and often a third-party mentor) must submit periodic progress reports to the association.

5.2.6 *Engineers' Role in Society.* Table 5.3 compares engineers' role in society in the United States and Canada.

Table 5.3—U.S. and Canadian Comparison—Engineers' Role in Society

U.S. System	Canadian System
Factual Comparison	
Anyone can claim to be engineer Industrial exemption common	Protects title engineer No industrial exemption
Cultural Comparison	
Places higher value on technical expertise ▪ Deep definition of professional • Education—technical • Examination—technical • Experience—defaults to technical	Places higher value on stewardship ▪ Broad definition of professional • Education—technical • Examination—professional practice • Experience—technical and emphasizes engineers' role in and impact on society

Although the concept of engineer licensure dates from the 1920s in both the United States and Canada, the paths followed since then have diverged to some extent, possibly reflecting differences in the two cultures. Generally speaking, the United States emphasizes demonstration of proficiency in the technical aspects of engineering as the single principal requirement for licensure, and the U.S. licensure system has evolved to support this premise. Canada approaches licensure more broadly, requiring demonstration of an appreciation for engineers' role in society in addition to technical competence and fostering a distinction between a competent practitioner and a professional.

5.2.7 *Conclusions.* The Canadian licensure system operates under the premise that technical competence and professionalism are both vital for protection of the public. The CEAB degree program provides technical education with competence demonstrated by graduation, and a structured internship program confirms the technical knowledge and provides professional education. A candidate's competence is demonstrated through periodic reporting and by passage of the practice examination.

5.3 Other Proposals for Engineering Licensure. In recent years, NSPE and ASCE have prepared and promoted new models for engineering licensure. The task force considered these proposals and their backgrounds. A brief summary of each proposal is provided.

5.3.1 *ASCE Proposed Model.* ASCE proposes to allow candidates to take the PE examination anytime after graduation and also proposes to increase the minimum academic prerequisites for licensure and the practice of civil engineering at a professional level. The proposal of the "Bachelor's plus Master's or 30 credits" refers to a total post-secondary education that fulfills the practice-oriented body of knowledge required for entry into the professional practice of civil engineering. For an individual with a Bachelor's of Science in civil engineering from an ABET-accredited program, the additional coursework might

consist of a master's degree or 30 semester hours of acceptable upper-level undergraduate or graduate-level courses in technical and/or professional practice topic areas. The additional educational requirements are intended, in combination with a bachelor's degree, to fulfill the requisite practice-oriented body of knowledge necessary for each engineer's unique engineering practice requirements.

5.3.2 *NSPE Proposed Model.* The engineering licensure model proposed by NSPE was developed with the following premises:

- To hold paramount the safeguarding of public welfare, health, and safety
- To recognize the effect that the increasing number of emerging technologies is having on the licensure process
- To recognize that both the FE and PE examinations are knowledge-based examinations with similar, if not the same, topic areas being covered in portions of both examinations
- To recognize that many engineers move into specialized areas following graduation and that there are no PE examinations available in those specialized areas
- To recognize that having to wait four or more years following graduation before being eligible to take the PE examination is a hindrance toward licensure for those whose employment does not require licensure or for those whose employer does not encourage licensure
- To encourage more engineering faculty members to become licensed in order to promote the licensure process to students

The NSPE model has two tracks. For a person applying for an engineering license, both tracks require an EAC/ABET-accredited engineering degree or the equivalent, a minimum of four years of acceptable progressive experience, a comprehensive experience and portfolio review, the PE knowledge-based examination with a professional practice experience-based examination to be taken after four years of experience is obtained, and a mandatory continuing professional competency (development) program following licensure. One track requires passing the FE examination; the other track would waive the FE examination for those who have obtained either a master's or doctoral engineering degree (primarily for faculty members). For the four years of progressive experience, one year of acceptable experience would be allowed for a master's degree in engineering and a maximum of two years for a doctoral engineering degree.

NSPE also recognizes the need for additional coursework in technical and professional practice issues for those pursuing an engineering license. NSPE has a professional policy supporting in concept the premise of ASCE Policy 465 on B+M/30.

SECTION 6—CURRENT ENGINEERING LICENSURE SYSTEM

The NCEES Model Law served as the baseline for the work of the task force. This section provides a summary of the current Model Law and discussions of the variation of its application across the U.S., mobility issues under the current system, the status of licensure in the profession, and the relevance of licensure.

6.1 NCEES Model Law. The current NCEES model for professional engineering licensure is defined in Sections 130.10 A and C of the Model Law. The minimum requirements (ref. Figure 6.1) are as follows:

- Four-year EAC/ABET or equivalent degree
- Eight-hour FE exam
- Four years of acceptable experience
- Eight-hour PE exam

All jurisdictions recognize the EAC/ABET degree; five boards recognize only EAC/ABET degrees.

Candidates for the FE examination must provide evidence that they have either completed, or are in the final semester of completing, the requirements for an EAC/ABET-accredited degree.

Candidates for the PE examination, as the final step toward licensure, must provide the following:

- Detailed descriptions of experience accumulated toward licensure, describing supervision by licensed (or otherwise qualified) engineers and demonstrating increasing levels of responsibility for engineering decisions
- Five references from engineers having personal knowledge of the applicant's work (minimum of three from licensed engineers), attesting to the character and technical competence of the applicant
- Verification of successful completion of the FE examination
- Verification, through the application and subject to confirmation by a Member Board, of the absence or acceptable resolution of disciplinary action

  In some jurisdictions, candidates must also verify successful completion of a state-specific examination, typically an ethics examination.

The Model Law is in Appendix A of this report. It contains the licensure process shown in Figure 6.1.

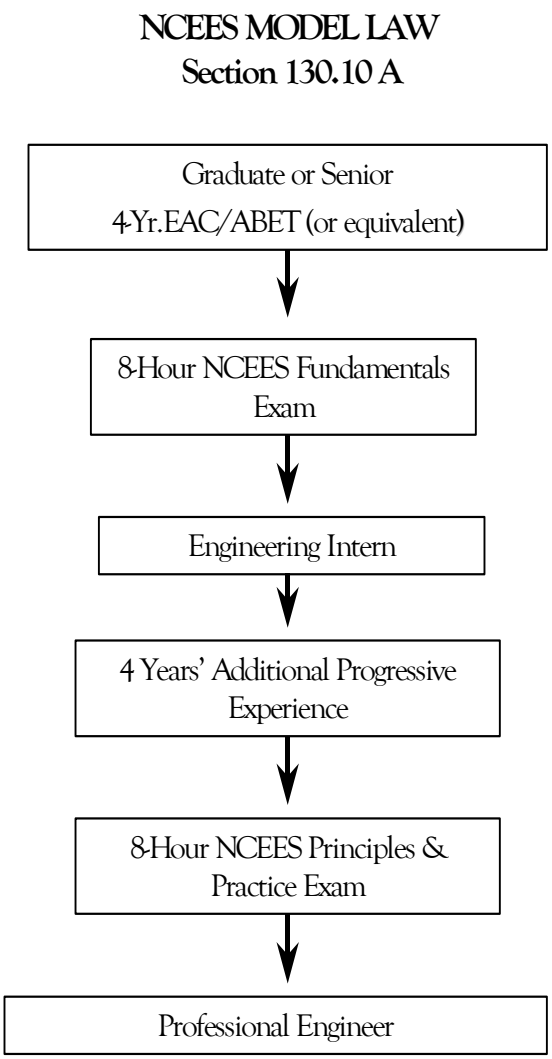

Figure 6.1—NCEES Model Law Requirements for Licensure

6.2 Variations from State to State. Little uniformity exists across the jurisdictions regarding adoption of the Model Law requirements. A 2000 NCEES survey showed the following:

- Education: Some jurisdictions accept only EAC/ABET engineering degrees, without consideration of equivalency; others recognize non-ABET degrees but require additional compensatory experience; some recognize four-year TAC degrees; some recognize related-science degrees; and some require no engineering degree.

- Examination: Most jurisdictions allow students to take the FE examination during their last semester of studies, and some allow it earlier in the senior or junior years. Some waive the FE examination on the basis of advanced degrees and/or accumulated experience; some require the accumulation of four years of acceptable experience prior to the PE examination, whereas

others accept less experience before the PE exam but not before earning licensure. Some jurisdictions require more than four years of pre-PE examination experience for candidates with an engineering degree and significantly more pre-PE experience for nondegreed candidates.

- Experience: Most jurisdictions require four years of qualifying experience prior to licensure of degreed applicants, but some require less. Most jurisdictions require a greater amount of experience for nondegreed licensure, if allowed at all. Jurisdictions are not uniform in the amount of experience credit earned by advanced engineering degrees or by academic experience in teaching and research.

6.3 Mobility Considerations. The Model Law defines licensure by comity or endorsement as follows:

A person holding a certificate of licensure to engage in the practice of engineering, issued by a proper authority of a jurisdiction or possession of the United States, the District of Columbia, or any foreign country, based on requirements that do not conflict with the provisions of this Act and possessing credentials that are, in the judgment of the board, of a standard not lower than that specified in the applicable licensure act in effect in this jurisdiction at the time such certificate was issued may, upon application, be licensed without further examination except as required to present evidence of knowledge of statutes, rules, and design requirements unique to this jurisdiction.

A person holding an active Council Record with the National Council of Examiners for Engineering and Surveying, whose qualifications as evidenced by the Council Record, meet the requirements of this Act, in the judgment of the board, may, upon application, be licensed without further examination except as required to examine the applicant's knowledge of statutes, rules, and design requirements unique to this jurisdiction.

A key issue restricting mobility lies in the underlined passage above.

Some jurisdictions use the Model Law Engineer (MLE) standard for licensure by comity, a standard well beyond the grasp of many applicants from jurisdictions that have less stringent interpretations (although such applicants can always attain licensure by meeting all the requirements of an applicant for initial licensure, including examination). Member Boards and their legislative bodies must resolve the question, What model is adequate to protect the public?

Obviously, the nonuniform application of licensure laws is a major restriction to mobility. Additional limitations to individual mobility are imposed by requirements for engineering firms to register in the jurisdiction of practice.

NCEES, Member Boards, and state legislatures need to continue to improve the mobility of licensed engineers and engineering firms. Addressing these issues for domestic engineers would pave the way for international mobility.

6.4 Status of Licensure in the Profession. The most critical stakeholder in licensure is the public. The presence of exemptions, formal or implied, for government, industry, and academic practice has great influence on the acceptance of licensure.

- Engineering organizations, professional and technical, whose members traditionally provide service directly to the public see a need for licensing engineers. Their commitment to protecting the public health, safety, and welfare requires that the profession maintain certain standards. This is evidenced by the published positions, structures, and level of licensure in the membership in these organizations.

- Engineering organizations whose members are mainly employed in industry or government tend to be less involved in the licensure process because the individual's responsibilities to the public are typically less direct.

- Government bodies that regulate engineers and surveyors have the responsibility to protect public health, safety, and welfare. For this group of stakeholders, the answer is fairly clear: practicing engineers who are not exempt by law must be licensed.

  Not included above are engineers involved in the new and rapidly growing engineering fields in which licensing is not considered an issue, for example computer-based industries in which services are provided under contract or by consultants. Institutions with accredited engineering programs in these disciplines often see no need for their graduates to become licensed. Industries hiring graduates of these programs frequently do not support licensing either.

6.5 Relevance of Engineering Licensure. Industry and government in many ways operate similarly to an engineering firm. The product or products and size may be different, and the engineer's relationship to the public may be less direct, but the protection of public health, safety, and welfare should be just as important.

Not all engineers employed by engineering firms are licensed, but those in responsible charge must be licensed. This fact may encourage young engineers to aspire to licensure. This is not necessarily the case for engineers in industry and government. Management cites the demand for higher salaries of P.E.'s as a negative when seeking licensed engineers to fill management positions where exemptions exist.

Role models in management who are licensed engineers often do not exist. For many industry and government engineers, this presents a problem. Technical skills and monetary goals frequently overshadow the benefits of licensure during the preparatory phases of career selection and development. This places engineers employed in industry and government at a disadvantage under the existing model.

The current model favors a progressive path to licensure that is best started while in college. By the time an engineer progresses to the management level, it is often more difficult to obtain a license if the FE exam was not taken soon after college. Too often, these efforts toward licensure are delayed until a career change forces the individual to seek licensure. At this point, time is an additional impediment to licensure.

The growth of specialty engineering disciplines (splintering) and the fact that specific examinations are not available for all specialties act as an impediment for many graduate engineers. Currently, fewer than 20 PE modules are offered. There are more than 100 EAC/ABET-accredited engineering programs including optical engineering, polymer science and engineering, paper science and engineering, radiological health engineering, and human factors engineering. Some graduates in these disciplines may opt to take existing examinations, but many will avoid the process altogether. For the latter, the available examinations do not provide a fair or equitable measure of their minimum competence to practice engineering in their area of expertise. To these graduates, the model may be relevant, but the examination process is not specific enough.

The current licensure model (Figure 6.1 above) is relevant in all areas of practice, including government, academia, and industry; however, exemptions in statute or by mutual consent diminish the relevance of licensure.

SECTION 7—CONCERNS WITH THE CURRENT SYSTEM

The task force identified and discussed several concerns with the current engineering licensure system. Each concern is described in this section, and the position of the task force is presented. The concerns are listed below under the current qualifications for licensure—education, experience, and examination—plus a fourth section covering other related concerns. Concerns that the task force believes can be alleviated through changes to the current licensure system are addressed in Section 8 with recommendations.

7.1 Education

7.1.1 *EAC/ABET Only.* The current Model Law calls for an EAC/ABET engineering degree or the equivalent for entry into the engineering licensure track. This language does not directly address related science degrees. Licensing boards are inconsistent in their interpretation of equivalency, thereby affecting comity. Boards are not uniform in their treatment of degree types such as related sciences, technology, and advanced engineering degrees not founded on an EAC baccalaureate degree. Boards are currently addressing these special cases through a nonuniform mixture of state statute and board rule.

7.1.2 *Blurring of Science and Engineering.* The lines between science and engineering are blurring within engineering programs. The clear identity of the engineering profession is being lost. After a considerable amount of discussion, the task force determined that this an issue that the Model Law could not address.

7.1.3 *Specialization/Splintering.* Specialization in engineering is creating many new disciplines and subdisciplines. This pressures the examination program to create licensing opportunities for more disciplines. Policies constraining the existing exam structure limit its applicability to new disciplines. Broad exams may test some students on many topics they have never studied, thereby making students reluctant to attempt the exam and the

professors and department chairs reluctant to encourage their students to take the exam. The result is decreasing exam usage and fewer licensing opportunities.

7.1.4 *Reduction of Core Subjects.* There has been a reduction in the number of core engineering subjects for most disciplines. The "generic" engineering license is based on the presumption that all engineering programs have a common core. Without this common core, generic licensure could be questioned and found to be unsupportable in the future. In addition, the current engineering criteria (EC-2000) allows more specialization and requires less common core knowledge.

7.1.5 *Foreign Degrees.* The current Model Law permits equivalent educational processes to enter the licensure track. However, the term *equivalent* does not explicitly address the issue of foreign degree equivalency. The concern is that individual state boards are required to address this by board rule. The task force believes that the Model Law *should* address this issue by further defining the term *equivalent*.

7.1.6 *Engineering Education.* Engineering education is falling behind other professions in preparing students for practice. There has been a persistent decrease in the credit hours required for an engineering degree over the past several decades. At present, the nominal (but nonuniform) requirement is 128 semester hours, corresponding to an eight-semester (four-year) program of four to six courses per semester. Based on national averages, 128 semester hours represent the low point on a downward trend—driven partly by a state-centered desire to make the educational process as cost-efficient as possible and to compete for students across state lines—at least insofar as public institutions are concerned. This inexorable decrease in credit hours, coupled with ABET requirements for more and more of those credit hours for important but nontechnical professional training, represents a net national loss in the depth of engineering education in core subjects. Engineering education must properly prepare students for engineering practice, especially in two areas by (1) providing professional practice skills and (2) providing the appropriate breadth of technical subjects. The task force agrees that additional education beyond the current 128 +/- credit-hour programs is necessary in the future to prepare students for engineering practice at the professional level.

7.1.7 *Licensed Educators.* Compared to years past, a relatively low ratio of licensed educators teach in today's engineering programs. Students may complete academic programs without exposure to the concept and value of licensure in engineering, only to encounter licensure requirements later in their career without the proper preparation. Some educators assign little value to licensure; therefore, many students do not hear about it, understand it, or embrace it.

7.2 Experience

7.2.1 *Lack of Experience Guidelines.* Engineering interns presently have little or no access to information regarding their boards' definition of progressive engineering experience.

7.2.2 *Variation of State Board Interpretations.* State boards have different interpretations and expectations regarding experience requirements. For example, some states require experience verification while others do not. In addition, board interpretations and expectations may change as the board composition changes. Uniformity and commonality between jurisdictions is not sufficient.

7.2.3 *Engineering Experience Under Non-P.E.'s.* The Model Law currently allows for experience to be gained under the supervision of a licensed professional engineer as well as an engineer who is not licensed. This flexibility is not embraced by all boards, and without it, engineers working in areas exempt from licensure have difficulty pursuing licensure.

7.2.4 *Experience Credit for Advanced Degrees.* The current Model Law provides one year of experience credit for a master's in engineering and an additional year of credit for a doctorate in engineering. Some state boards do not accept such experience credits or allow other credits for advanced degrees.

7.2.5 *Teaching and Research Experience.* The current Model Law states that teaching of advanced-level engineering courses and/or engineering research and design projects constitute creditable engineering experience. Some think such experience should not qualify for licensure or at best qualify only in part.

7.3 Examination

7.3.1 *Timing of PE Examination.* The current Model Law requires candidates to obtain acceptable experience before attempting the PE examination. Most, if not all, jurisdictions have adopted this requirement, although the details of the required engineering experience vary somewhat. The requirement to obtain experience prior to taking the PE examination may discourage some candidates from pursuing licensure, as passing the PE examination typically requires refreshing the breadth of technical knowledge learned as an undergraduate.

7.3.2 *Advanced Degree Exemption.* Some jurisdictions waive either the FE examination or the PE examination or both for candidates who have advanced degrees. There is a lack of consistency among jurisdictions on this issue.

7.3.3 *Practice Examination.* The current PE examination is a knowledge-based examination that covers technical subject matter. It does not cover practice aspects that engineers face when offering services to the public, for example legal practices, contract law, ethics, regulatory requirements, and construction administration.

7.3.4 *Relevance of FE Examination.* There has been some criticism that the FE examination is not relevant. Many educators do not encourage students to take the examination because the content of the examination is not covered in their curriculum, and they do not think that licensure is important for graduates of their programs. In addition, there is the perception that not all engineering disciplines are covered in the current FE examination format and specification.

7.3.5 *Relevance of PE Examination.* There has been some criticism that the PE examination is not relevant. Only about 15,000 engineers are licensed each year in the United States from a pool of about 65,000 engineering graduates and foreign engineers coming into the United States. Many also argue that the examination does not adequately cover their fields of specialization.

7.4 Other Related Concerns

7.4.1 *Stature of the Profession.* There were several members of the task force who expressed concern about the stature of the engineering profession. An example was the ASCE's position that retaining a four-year education requirement for engineering licensure while medicine, law, architecture, and others have increased academic requirements for licensure has diminished the stature of engineering. Other members noted the lack of clear structure and requirements in the experience part of the licensure process as a problem. In a similar vein, many task force members expressed concern that the titles used in the engineering profession were a part of the stature problem and voiced particular concern for the term *engineer intern*. It is also the contention of some boards that graduate engineers who have not entered the licensing process should not be entitled to use the title engineer at all. Finally, the relative lack of specialty certifications, specifically post-licensure certification, was cited as contributing to the perception that the stature of the engineering profession is slipping as compared to that of the medical profession. Overall, the task force agreed that this issue was one that deserves some attention and at least some aspects of the problem can be addressed in the process of adopting a new licensure model.

7.4.2 *Engineers Not Becoming Licensed.* While exact numbers are difficult to determine, it is generally agreed that only about 20 percent of graduate engineers who are practicing engineering are licensed. This has various ramifications, and while the task force members did not see universal licensure as an appropriate goal of the licensing process, many do believe that the large number of practicing engineers who do not pursue licensure is a problem. Clearly, the industrial exemption is at the heart of this issue. Many members of the task force believe it is important to find a way to encourage more industry engineers to become licensed in an appropriate way, and consequently have them regulated by their state boards and governed by the ethical aspects of their profession. This would have the effect of improving the protection of the health, safety, and welfare of the public as it relates to engineered products. It was agreed that this is an important concern, especially among the organizations that have many unlicensed engineers, such as IEEE and ASME, and that changes to the licensure model could address the issue. Some members even expressed the hope that appropriate licensing model changes could eventually attract enough industry engineers into the process that the industry exemption might become irrelevant. This issue actually overlaps many others, including the titles used by engineers, the licensing examinations, the timing of the examinations, and the scope of practice limitations.

7.4.3 *Industry and Government Not Encouraging Licensure.* The task force discussed at length the problems that occur because much of industry and government fails to require or encourage licensure for their engineering employees. This is closely linked to the limited penetration of licensure discussed in Section 7.2 but is distinct in that it focuses on the specific needs of engineers in these sectors for a process that is relevant to their more narrow practice of engineering as compared to engineers who are consultants. Like many of the other concerns discussed, there was significant overlap with recommendations associated with an intermediate level of licensure that would be more appropriate for engineers in industry or government, the content and timing of examinations, the titles that would encourage licensure, and the definition of an appropriate scope of authority.

7.4.4 *Current Licensure Model Not Recognizing Specialization.* This concern required extensive discussion, in part because it is an issue at two different levels. At one level, there is variation among the state boards in whether they use generic licensure or discipline licensure. That is, some states grant a license as a Professional Engineer, while other states designate whether the engineer is a civil engineer, electrical engineer, and so on. At the other level, there is continuing specialization within disciplines, so some civil engineers express a need for certification as an environmental engineer or geotechnical engineer, for example. The task force decided that any proposed changes to the licensure model should not attempt to make all state boards adopt either generic or discipline licensure. There was general agreement that specialty certifications are becoming more common, reflecting the need for this activity, and that the licensure model should at least recognize that this is occurring and perhaps encourage a more uniform approach to post-licensure certification.

7.4.5 *Mobility and Jurisdictional Concerns.* Members of the task force expressed continuing concern over the mobility of engineers, both among U.S. jurisdictions and internationally. It was generally agreed that recent steps by NCEES and the Member Boards to expedite the comity process for engineers who meet the MLE definition is a significant improvement. However, there is general consensus that more can and should be done. While a wide range of possible actions was discussed, many were only tangentially related to the adoption of a new licensure model.

SECTION 8—LICENSURE CONCEPTS CONSIDERED AND RECOMMENDED

Once a concern was determined to be worthy of consideration within the framework of the Model Law, it was further discussed, and ideas for addressing the concern were recommended. This section covers the ideas recommended to address each concern.

8.1 Education

8.1.1 *EAC/ABET or Equivalent.* Subject to the recommendations contained in parts 8.1.2 and 8.1.4, the task force recommends that the Model Law retain the existing EAC/ABET or the equivalent language without reference to other U.S.-based programs such as related science and technology. The task force recommends that individual boards continue to

address equivalency of U.S.-related science, technology, and advanced degrees as they are doing at present. International degrees are addressed separately in Section 8.1.3.

Graduates from an EAC-accredited program, either at the basic level (bachelor's) or advanced level (master's), must develop a number of abilities, including a focus on design. The ABET Engineering Criteria also specify a number of outcomes, as listed in criteria section 3. (a)–(k) and shown earlier in Table 4.1. These define the desired attributes of a well-rounded engineer and one that is prepared to assume the responsibilities of someone in responsible charge of engineering work.

Other U.S. degree routes are highly variable in their ability to provide assurance of proper engineering preparation. For example, the criteria for TAC (engineering technology programs) and for ASAC (applied science programs) have provisions that do not specify the same range of desired attributes as defined in the EAC list. In addition, a graduate engineer must master the details of mathematics, science, and engineering required for an engineer in responsible charge of engineering work. Other academic routes may cover some of these details, but they do not fully satisfy the educational background needed for an engineer in responsible charge.

Of necessity, each board must evaluate potential degree routes for equivalency, resulting in a variety of interpretations of what is equivalent. Because of the complexity and variability of this issue from state to state and from program to program, a uniform national standard is unlikely, and the current Model Law language should be retained.

8.1.2 *Core Topics in the FE Examination.* It is recommended that the FE exam cover those areas of knowledge and/or subjects that all engineers need to enter into an engineering internship that can lead to licensure for providing services directly to the public.

In recent years, there has been a trend in U.S. engineering curricula to reduce the number of core engineering subjects required. At many schools, undergraduate engineering students are no longer required to take such basic classes as statics, dynamics, thermodynamics, mechanics of materials, or electric circuits, resulting in a class of graduate engineers who struggle to appreciate, understand, or practice the broad profession of engineering. This erosion of the core engineering curriculum has resulted in entry-level engineers having a narrowed exposure to basic engineering principles. Therefore they lack the breadth of knowledge needed to understand broad design concepts and move effectively into practice. This trend began before the advent of ABET's move to the current outcome-based engineering criteria, but the new criteria have allowed this trend to continue and the pace of the trend to accelerate.

Exposure to common engineering subjects is very important to an engineer's career path. As entry-level professionals begin their careers, very few take their first job with the intent of staying with that employer for the duration of their work life. Even as professionals gain additional experience and advance into areas of project/program management or into business management, the need to have a broad understanding of engineering principles is an absolute necessity. In most cases, young professionals' employment

changes as their careers mature. This amplifies the need for a sound understanding of the core body of knowledge required of a professional engineer.

The recommended approach to address this trend is to recognize the FE examination as the logical means for graduates to demonstrate minimum competency in core subjects. It is important to note that the core subjects in engineering may not be limited to fundamental subjects but may include identified processes such as modeling, designing, prototyping, testing, constructing/manufacturing, and maintenance.

8.1.3 *Foreign Degrees.* It is recommended that the Model Law be revised to accept foreign degrees that are substantially equivalent to EAC/ABET degrees.

In the United States, the EAC/ABET engineering degree is the basic standard educational requirement for licensing, and all Member Boards accept the degree. Boards should therefore look to ABET for assistance through international agreements such as the Washington Accord. ABET also maintains a credential evaluation service currently used by many boards for equivalency determinations.

Because the international mobility of engineers and engineering graduates has accelerated in recent years, the number of international applicants to Member Boards has increased dramatically.

ABET, in conjunction with accrediting bodies and engineering societies from many countries, participates in joint efforts and agreements in an effort to provide equivalency information for engineering education for engineering programs in participating countries and their accreditation bodies. The Washington Accord, which originated as an agreement between English-speaking countries to recognize the equivalency of accreditation systems, has worked to provide the assurance of substantial equivalency of educational requirements for engineers from Great Britain, Canada, Australia, and others. Absent the assurances of agreements such as the Washington Accord, ABET has also been asked to provide substantial equivalency information to individual institutions in countries that are not members of the Washington Accord and is also developing other agreements.

8.1.4 *Engineering Education.* It is recommended that the Model Law provide for at least a bachelor's degree plus additional coursework in specialties related to practice. The number of hours of additional work is not prescribed at this time.

In recent years, at least one professional society, ASCE, has pointed to negative impacts caused by current engineering curricula, especially in light of the national trend of reducing the number of credits required for engineering degrees. Therefore, ASCE has recommended required coursework past the bachelor's degree. Recently, ASCE has adopted the Bachelor's Plus Master's or 30 Credits (B+M/30) statement to convey its goal for minimum educational credentials. The rationale regarding the necessity of additional engineering education in the future is presented below.

Engineering must restructure its 150-year-old educational model to meet the challenges of the 21st century. Engineering education must provide future practitioners with the fundamental tools, attitudes, and outlooks to account for and manage complexity. The current four-year bachelor's degree is becoming inadequate academic preparation for the practice of engineering at the professional level. Additional education will provide the next generation with the skills and attitudes necessary to ensure the high standards of the profession and protect public health, safety, and welfare.

Today's world is fundamentally challenging the way engineering is practiced. Complexity stems from every aspect of a project, from preproject planning with varied stakeholders to construction with minimum environmental and community disturbance. The risks and challenges to public health, safety, and welfare will continue to escalate in complexity, and the engineering profession must respond proactively. The National Research Council (NRC) recently published a report citing three serious concerns with engineering graduates. Many have "little knowledge of the design process," "inadequate knowledge of the role of technology in their professions," and "little knowledge of business, economics, and management." These issues cut to the core of engineering. Graduates who do not understand the big picture will be challenged to provide safe, practical design in a complex future.

Engineers are expected to simultaneously possess greater breadth of capability and greater specialized technical competence than was required of previous generations—a nearly impossible challenge with fewer college credits. Students take at least 20 fewer credits than did their counterparts in the 1920s. While they take comparable proportions of math, science, and general education, today's students take, on average, 18 fewer credits of engineering topics. That is a full semester less of technical education at a time when by almost universal consensus the complexity of the modern engineering project escalates. How can tomorrow's engineers design safe, cost-effective projects, accounting for greater complexity and uncertainty, with less formal education?

To effectively manage the complexity of engineering in the future, to make informed, ethical, and safe decisions in the face of rising uncertainty, ambiguity, and increased stakeholder involvement, engineers must acquire additional fundamental knowledge. Additional education for engineers translates to a safer, better future for the public. Consumers and stakeholders rely on the value, judgment, and services that professional engineers provide.

8.1.5 *Licensed Educators.* The Model Law currently recognizes teaching advanced courses and participating in sponsored research as being acceptable engineering experience. The task force confirms this position without additional changes to the Model Law as recommended in 8.2.7 below.

The increasing presence and funding of institutional research in engineering schools is unlikely to abate. Engineering faculty members are typically engaged in entrepreneurial funded research activities that are comparable to many of the elements and responsibilities of the nonacademic practice of engineering. The Model Law should therefore support the concept of academic work in engineering as acceptable experience

for licensure. This applies more to the experience qualification than education, but it may provide an incentive for more engineering faculty to become licensed, thereby increasing the exposure of students to the concept and importance of licensure. The Model Law contains provisions that recognize certain teaching and research activities as approved experience. For example, the definition of the practice of engineering in Section 110.20 A.6, line 37, includes "...teaching of advanced engineering subjects...."

8.2 Experience

8.2.1 *Goal-Oriented Experience.* The task force recommends that the current NCEES general experience guidelines be reviewed and modified to ensure a system that measures experience by meeting objectives with a minimum of four years of experience. Experience should include both technical and professional practice skills. Broad guidelines (Engineering Experience Guidelines) defining progressive engineering experience should be formulated.

8.2.2 *Individual Recordkeeping System.* It is recommended that a verifiable recordkeeping program be formulated for use by individual applicants.

8.2.3 *Communication upon Passing the FE Examination.* In order to provide consistent guidance and structure to the engineering experience qualification and the subsequent evaluation process by state boards, it is recommended that the Engineering Experience Guidelines discussed in part 8.2.1 above, the verifiable recordkeeping program discussed in part 8.2.2 above, and the state's code of professional conduct be forwarded by state boards to all individuals who pass the FE examination.

8.2.4 *Allowance for Experience Under Supervision of an Unlicensed Engineer.* It is recommended that the Model Law be modified to facilitate crediting of experience gained working under the supervision of an unlicensed engineer. The modifications should indicate that the flexibility is clearly intended to apply to engineers who gain their experience in environments that are not subject to licensure requirements.

8.2.5 *Formal Mentoring Requirement.* The task force recommends against a mentoring program regulated by the state boards. While mentoring should be encouraged, including it as a requirement of the Model Law was not considered realistic for the United States.

8.2.6 *Credit for Advanced Degrees.* As incorporated in the current Model Law, it is recommended that credit for academic engineering experience be granted as follows:

- One year experience credit for a master's degree in engineering approved by the board
- One additional year of experience credit for a doctorate degree in engineering approved by the board

8.2.7 *Credit for Engineering Academic Experience.* As currently incorporated in the Model Law, it is recommended that direct experience credit be given for teaching engineering coursework at an advanced level and/or for engineering research and design projects.

8.3 Examination

8.3.1 *Timing of PE Examination.* Since the current PE examination is a knowledge-based examination, it is recommended that a candidate be allowed to take the PE examination at any time after the candidate has passed the FE examination and has met the education requirements. Licensure as a professional engineer would not occur until the experience was obtained and verified and any other requirements were also complete. The task force believes that this change would encourage licensure without detrimental effect.

8.3.2 *Advanced Degree Exemptions.* It is recommended that the FE examination be waived for a candidate who has been awarded a doctorate degree in engineering from an institution that has an EAC/ABET-accredited bachelor's or master's program and who has met all educational requirements for licensure. The PE examination and the required experience should not be waived.

8.3.3 *Practice Examination.* It is recommended that there be a nontechnical examination covering engineering practice issues for engineers seeking licensure.

8.3.4 *Relevance of FE Examination.* It is recommended that the current FE examination format be retained. The current examination contains a general morning module to be taken by all candidates and six discipline-specific afternoon modules that cover the subjects needed by a majority of engineering graduates. NCEES policies and procedures are sufficient to allow additional modules to be added when the requirements are met. The scope and specification for the FE examination are developed from a content survey of stakeholders that includes both educators and noneducators. It is increasingly important that content surveys capture relevant core subjects important to both education and the profession. While the primary function of the FE examination is to measure minimum competency, the results can be a valuable source of data for outcomes assessment of engineering program objectives.

8.3.5 *Relevance of PE Examination.* Currently, there are many PE examinations in various engineering disciplines. In some of these examinations are various modules for specific areas of specialization. There is no need for more technical examinations or modules at this time. Further, the policies and procedures already adopted by NCEES are sufficient to allow additional technical examinations and/or modules to be added as needed. Allowing candidates to attempt the PE examination immediately following graduation will reduce the concern associated with relevance of the examination.

8.4 Other Related Concerns. The discussions of areas of concern with the engineering licensing system that did not clearly fit into education, experience, or examination resulted in the following recommendations for changes to be incorporated into the proposed new licensure model.

8.4.1 *Stature of the Profession*

8.4.1.1 Extended Education. It is recommended that a footnote be added to the Model Law stating that the ABET-accredited degree in engineering is the minimum

education requirement, but there is a need to move to an increased education requirement in the next several years.

ASCE proposed the B+M/30 hours as the education needed for professional practice. The task force generally agreed that engineering has not kept up with other professions in moving to increased education requirements for those practicing the profession. The additional education requirements advanced by ASCE are not at this time universally embraced by the other disciplines; thus, there was reluctance to move immediately to this requirement.

The longer-term solution to the concern about the stature of the profession may be best addressed by developing pre-engineering baccalaureate programs and professional schools of engineering. When this occurs, it would be appropriate to require the professional degree as the education requirement for licensure with the associated change in the licensure model.

8.4.1.2 Specialty Certification. The task force recommends adding language to the Model Law that will allow for specialty certification. To recognize the increasing specialization within engineering, the task force considered the use of specialty examinations and specialty certifications. However, at present, the task force recommends only that the general nature of such certification be included in the Model Law and that further dialog with established certification groups (for example, environmental engineers, transportation engineers, and forensic engineers) as well as other technical societies is needed as a framework for specialty certification. However, it is recommended that such certification be post-licensure and that it be expanded. Details about whether such certification should be done by societies without reference to or association with the state board or done under an authority granted by state boards were not resolved.

8.4.2 *Practice in Exempt Areas.* The licensure process should be more applicable or desirable for engineers in industry or government or those otherwise offering services indirectly to the public. It should also reduce the undesirable effects of the industry exemption and should adopt more appropriate titles for engineers who are appropriately educated.

8.4.2.1 Tiered Licensure System. The task force recommends adopting a tiered system of licensure. A majority, but not all, of the members of the task force believe that such a system may appeal to more engineers in industry and government than does the current system. It is acknowledged that making the new system effective in attracting a larger percentage of practicing engineers into the licensure process will depend on active work of the participating societies such as IEEE and ASME, on defining and adopting limited practice authority by Member Boards and government organizations, and on other actions. Nonetheless, the majority of the members believe this is an important change that should be adopted by NCEES.

8.4.2.2 Modify or Improve Titles. In keeping with the tiered system of licensure, the task force recommends that the titles associated with the practice of engineering be modified to be Graduate Engineer, Associate Engineer, Registered Engineer, and Professional Engineer.

A Graduate Engineer or (discipline) Engineer would be a person who has completed the requisite engineering education. This designation allows such individuals to use the word engineer in their titles while not conveying licensure or any privilege of practice.

An Associate Engineer—a title that would allow for appropriate modifiers such as Associate Civil Engineer or Associate Project Engineer—would be a Graduate Engineer who has passed the FE examination. Like Graduate Engineer, Associate Engineer is not a licensed position and does not convey any privilege to practice. This designation is similar to the Engineering Intern position in the current system.

A Registered Engineer would be the first level of licensure. A Registered Engineer is an Associate Engineer who has obtained at least four years of engineering experience and has agreed to his or her state board's code of ethics. Registered Engineers would be licensed and have a limited authority for practice. While more needs to be done to define this authority, it might generally involve the right to submit designs for approval by standards groups (whether private or government) associated with engineered products, but it would not include the right to offer engineering services directly to the public or to submit design documents for approval that are associated with the built environment.

A Professional Engineer would be the second level of licensure. A Professional Engineer would be an Associate Engineer who has four years of engineering experience, passed the PE exam, passed an exam associated with engineering practice issues, and subscribed to the appropriate code of ethics. Professional Engineers would have complete practice authority just as is granted now by state boards.

The task force recognizes that the definition of the scope of authority for the Registered Engineer requires further study and recommends including representatives of societies such as IEEE, ASCE, and ASME in this discussion.

8.4.2.3 National Registry. The task force recommends that any new model incorporate a national registry of both Registered Engineers and Professional Engineers as these levels and titles become established. While the task force did not get into details of this process, it was generally suggested that this could be an extension of the current NCEES Records Program. The intent here is not to establish a national licensing authority, but to make it easier for both the individual engineer and the user of engineering services to obtain initial information about whether a specific individual has ever been licensed at either level by a state board.

8.4.3 *Mobility Concerns*

8.4.3.1 Mobility among U.S. Jurisdictions. Mobility among U.S. jurisdictions would be improved with several of the recommendations already provided in Section 8.2.

- Adopting a tiered licensure system would improve mobility, particularly for those who are practicing in industry and are fundamentally involved with the design of engineered products. The scope of authority that is adopted could make it possible for a Registered Engineer from any jurisdiction to submit design documents for approval by agencies such as the Federal Communications Commission, certifying that they meet specific electromagnetic radiation standards, for example. Standards associations could adopt similar practices.

- A national registry would also improve mobility for engineers, speeding the process of comity licensure for both Registered Engineers and Professional Engineers, much as the current NCEES Records Program does now. While the task force recognizes the difficulty involved in keeping any registry current, it believes that an expansion of the current Records Program to accomplish this function would be desirable and that any registry is a step forward from no registry at all. As long as all users of the registry—both those who are registered and licensed and those who require the information about who is registered or licensed—are appropriately informed of the limitations of the information available, such a registry would be a useful addition to the licensure system.

- The modification of the titles and the definition of the scope of authority are also suggested as an improvement for mobility. More universal recognition of titles used by graduate engineers working in industry would make it easier to limit the unauthorized use of titles by those who are not engineers. Standardized titles would also facilitate recognition of those who move to a new jurisdiction but continue to work in industry or government.

8.4.3.2 International Mobility. International mobility would be improved with several of the recommendations already provided in Section 8.4.2. Especially where companies are involved in the international practice of engineering, particularly through engineered products, it is the view of the task force that a tiered system can be an important first step in improving international mobility while improving the protection of the public. Having the Registered Engineer category could make it more reasonable and acceptable to have engineers working for a company having operations in both Canada and Mexico to have a U.S.-recognized engineer submit design documents for approval by U.S. authorities, for example. In a similar vein, it would become clearer to international engineers who want to offer engineering services directly to the public in the United States that they must become licensed as Professional Engineers just as their U.S. citizen counterparts are required to do.

The task force also determined there is merit in implementing an appropriate engineering registry to facilitate the international mobility of engineers. The International Register administered by the United States Council for International Engineering Practice (USCIEP) as part of an international initiative by the English-speaking nations and by countries of the Asia-Pacific Economic Cooperation (APEC) is recognized as a vehicle for that purpose. The task force recommends that the USCIEP continue its initiatives to facilitate the international transfer of credentials in much the same way that the NCEES Records Program facilitates the interstate mobility of engineers.

SECTION 9—CONSENSUS LICENSURE MODEL

The licensure concepts recommended by the task force and presented in Section 8 yield a licensure model depicted by Figure 9-1 below. A brief discussion of the key components of this Consensus Licensure Model is also presented in this section. Sections 7 and 8 of this report contain information about the issues and recommendations on each topic.

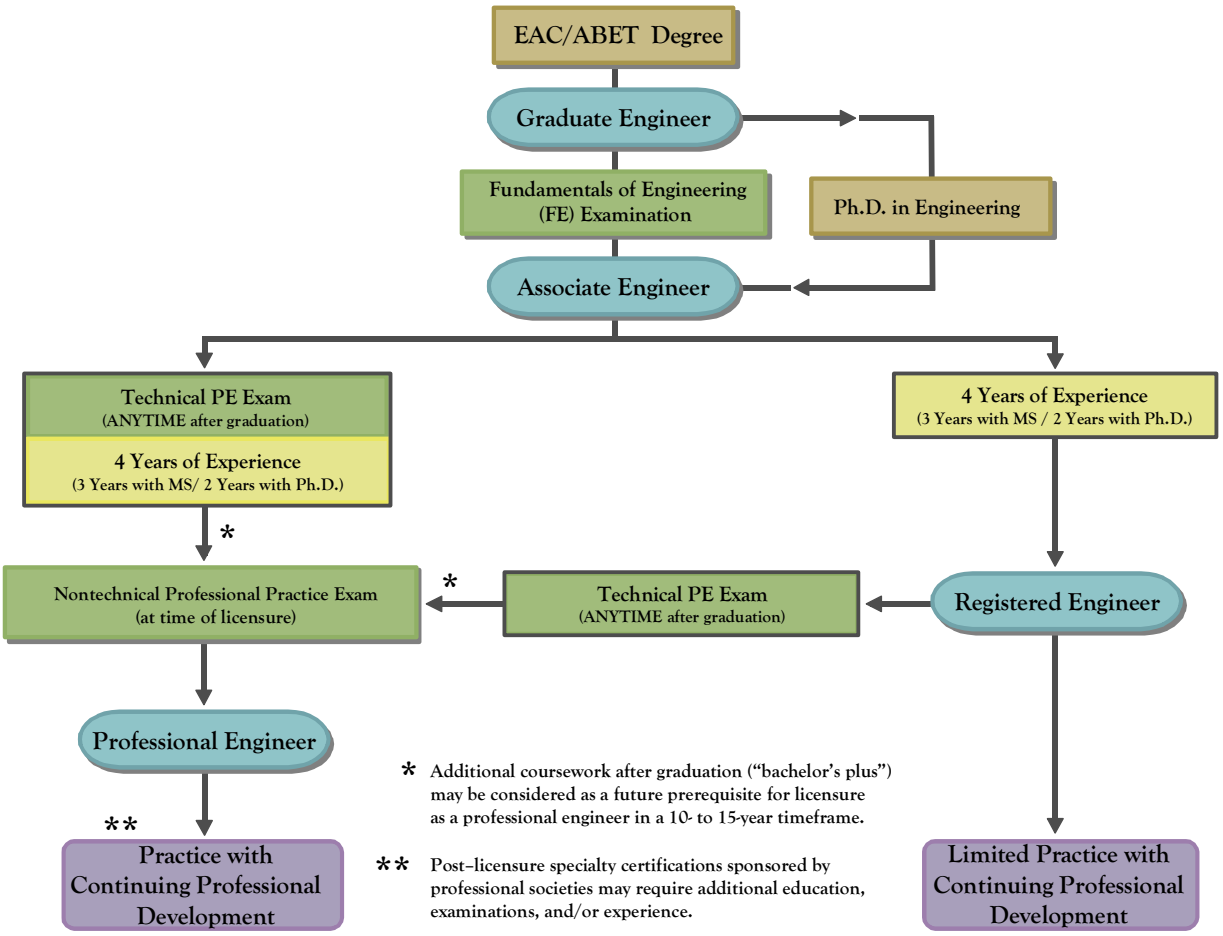

Figure 9.1—ELQTF Consensus Licensure Model

9.1 **Engineering Education.** The EAC/ABET degree box shown in Figure 9.1 refers to an EAC/ABET-accredited bachelor's degree in engineering, which remains the primary educational standard in the recommended model. An EAC/ABET-accredited post-graduate degree, which is now granted by a few programs in the United States, would also comply with this criterion. The recommended licensure model does not include provisions in the Model Law for either non-engineering bachelor's degrees or for engineering technology degrees. Such pathways to licensure would be addressed by individual states, as is presently the case.

It is recommended that the Model Law be modified to define certain foreign degrees as being equivalent to an EAC/ABET degree to facilitate licensure mobility. This might include Washington Accord countries and those universities having had successful, current ABET accreditation equivalency reviews.

The single asterisk shown prior to the nontechnical professional practice examination box refers to the recommendation that additional education (bachelor's plus) be considered as a future prerequisite to licensure as a professional engineer in a 10- to 15-year timeframe. Such additional education is not recommended as a prerequisite for licensure presently. It is anticipated that such future additional educational requirements would not apply to any professional engineers who had been licensed as of the date of such future consideration (i.e., both presently licensed and then-licensed P.E.'s would not need to comply with the new requirements). The detailed requirements of bachelor's plus and the requisite body of knowledge (or processes) to be incorporated in such additional education remain to be defined at a later date.

9.2 **Graduate Engineer Title.** It is recommended that a graduate of an EAC/ABET-accredited engineering program be entitled to use the title Graduate Engineer or that of an engineer of a specific discipline, such as mechanical engineer. Graduate Engineers have no privileges of practice and are not licensed.

9.3 **Fundamentals of Engineering Examination.** Successful passage of the FE examination would remain a prerequisite for licensure, either as a Professional Engineer or as a Registered Engineer. The FE examination would continue to be taken usually in the senior year of college, although the exam could be taken earlier or after graduation, as is currently the case across jurisdictions.

As a means to encourage licensure of engineering faculty, it is recommended that a waiver of the FE examination be allowed in the Model Law for those who possess an EAC/ABET-accredited degree (see Section 9.1) and a Ph.D. or doctorate in engineering. No other FE examination waivers are recommended for reference in the Model Law.

9.4 **Associate Engineer.** It is recommended that the existing title Engineer Intern (previously Engineer in Training) be replaced with the title Associate Engineer. Associate Engineers have no privileges of practice and are not licensed.

9.5 **Engineering Experience.** The current experience provisions of the Model Law are proposed to be maintained. This requires four years of progressive engineering experience (reduced to three years with a master's in engineering and two years with a doctorate in engineering).
Existing Model Law language that refers to flexibility for experience gained under the direction of one other than a licensed Professional Engineer is proposed to be clarified so that it applies to

those engineers working in industrial and governmental environments that are exempt from licensure requirements.

It is recommended that upon passage of the FE examination, Associate Engineers receive from the state board a copy of guidelines for progressive engineering experience, a suggested employer-verified experience recordkeeping form, and a copy of the state board's code of professional conduct.

9.6 **PE Examination.** The task force recommends that candidates be allowed to take the PE examination, in its present technical format, anytime after they graduate with an EAC/ABET degree. Passing the FE examination would also be required before taking the PE examination. Licensure as a Professional Engineer would still require candidates to meet the experience requirements outlined above, regardless of when they pass the PE examination.

9.7 **Nontechnical Professional Practice Examination.** An applicant for licensure as a Professional Engineer would be required to pass a nontechnical professional practice examination after satisfying all other requirements. Such an exam might include professional practice topics such as project management, contract law, general codes and standards, ethics, and related topics. The length and format of the examination have not been determined.

9.8 **Registered Engineer.** It is recommended that a new tier of licensure be created with the title Registered Engineer, as depicted on the right side of Figure 9.1. A Registered Engineer would be required to possess an EAC/ABET-accredited engineering degree, to pass the FE examination, and to meet the experience requirements. The Registered Engineer would not be required to pass the PE examination or the nontechnical professional practice examination or to comply with additional engineering education requirements that might be considered in the future. The license would not be mandatory for engineers working in exempt areas. Registered Engineers would be under the jurisdiction of their licensing board.

The Registered Engineer would be authorized to use that title and would be required to comply with the state board's code of professional conduct. The Registered Engineer would not be authorized to offer engineering services directly to the public and would not be authorized to seal engineering documents that require the seal of a Professional Engineer. A Registered Engineer would need to work under the direct supervision and responsible charge of a licensed Professional Engineer or might practice without such supervision in an industrial or governmental environment that is exempt from licensure requirements in the jurisdiction in which the Registered Engineer practices. A Registered Engineer would be authorized to certify engineering work if that work did not require the seal of a Professional Engineer. The term *limited practice* in the box beneath the Registered Engineer refers to the limitations described here.

9.9 **Professional Engineer.** The Professional Engineer would be required to possess an EAC/ABET-accredited engineering degree, pass the FE examination, meet the experience requirements, and pass the PE examination and the nontechnical professional practice examination. Upon meeting these requirements, an engineer would be licensed as a Professional Engineer and granted the privilege to provide engineering services directly to the public.

9.10 Continuing Professional Development. It is recommended that the Model Law refer to continuing professional development for both Professional Engineers and for Registered Engineers. The choice to require mandatory continuing professional development would remain the decision of the individual state boards, as is the case presently.

9.11 Specialty Certification. The post-licensure specialty certification referenced in the footnote with two asterisks refers to programs that would be formulated and managed by professional and technical engineering societies. Each sponsoring organization would specify its requirements for additional post-licensure education, examinations, and/or experience. It is not recommended that the requirements for such specialty certification programs be addressed in the Model Law at this time.

SECTION 10—IMPLEMENTATION ISSUES

Implementation procedures for the task force recommendations within NCEES and suggestions for their implementation outside NCEES are covered in this section.

10.1 NCEES Implementation of ELQTF Recommendations. The procedure that NCEES will follow for the initial implementation of the task force recommendations is outlined below. Once Model Law revisions are completed, additional implementation steps may be taken.

10.1.1 The report of the task force will be issued to the Licensure Qualifications Oversight Group (LQOG) of NCEES. LQOG will perform additional research and consider the conclusions and recommendations of the ELQTF from an NCEES and regulatory perspective. LQOG may make requests to the task force for additional information and/or clarification of the information presented in the report.

The report shall also be issued to the member organizations and consulting organizations for comment. Comments shall be received by LQOG for consideration. NCEES leadership shall determine the proper approach. Comments received prior to July 1, 2003, may be included in the ELQTF presentation to NCEES at the 2003 Annual Meeting. Comments received after July 1, 2003 (as well as those before), shall be considered by LQOG.

10.1.2 The report of the task force will be presented to NCEES at the 2003 Annual Meeting (August 13–16, 2003, in Baltimore, MD) with a motion to receive the report and charge LQOG to research the conclusions and recommendations from the NCEES and regulatory perspective. LQOG will issue formal recommendations, if any, for proposed changes to the Model Law and for ultimate adoption and implementation by the Council. The ELQTF report will be available for general distribution at the Annual Meeting.

10.1.3 LQOG will prepare a report of their conclusions and recommendations for NCEES. The report will be presented for approval at a future annual meeting of NCEES.

a. LQOG recommendations approved by NCEES will be referred to the proper NCEES committees for consideration and incorporation into the NCEES Model Law, Model Rules and Regulations for Licensing Boards, and/or the Manual of Policy and Position Statements as applicable. The various committees may request clarifications by LQOG as they deliberate.
b. Recommendations rejected by NCEES may be referred back to LQOG for further deliberation or eliminated from further consideration, depending on the action of NCEES. Referrals will result in further deliberation by LQOG and the preparation of a response, which may be reconsidered by NCEES at a later annual meeting. Modified LQOG recommendations approved by NCEES will be forwarded to the proper NCEES committees for incorporation into the Model Law, Model Rules, and Policy Manual as applicable.

10.1.4 NCEES committees will compile and edit the approved Council recommendations into proposed revisions to the language of the Model Law, Model Rules, and Policy Manual, as applicable, and present them for ratification at an NCEES annual meeting. Proposed revisions rejected by NCEES could be referred back to the committees for further deliberation or eliminated from further consideration. Revisions approved by NCEES will be incorporated into the documents and thereby become part of the formal models, policies, and positions of NCEES.

10.1.5 ELQTF may remain an organized group until NCEES either rejects the recommendations of LQOG or approves them for incorporation into the Model Law, Model Rules, and Policy Manual, as applicable.

10.1.6 Following the issuance of the report of the task force, the task force may be reconvened to address LQOG requests if such requests cannot be handled by distance communications. The task force will be reconvened if requested by the chair or representatives of the member organizations subject to the approval of the NCEES President.

10.2 Other Implementation Considerations. Other implementation issues were discussed by the task force as summarized below.

10.2.1 The technical/professional societies will need to be active in advancing revisions to the licensure system at the state level.

10.2.2 An implementation plan in response to any change in the Model Law, Model Rules, and/or Policy Manual should consider the effects on mobility. Implementation of a revised system should not be a step backward in the effort to improve mobility. Member Boards should be included when an implementation plan is developed.

10.2.3 States may have to implement parallel licensing systems for a significant length of time to transition into a new system. Effective dates for new rules must be evaluated to allow for the transition.

10.2.4 Modifications to the educational requirements should include ABET interaction and input. Technical/professional society involvement on a wide scale will be necessary in this regard.

10.2.5 It may be necessary to grandfather in some current educators and/or gradually phase in the requirements. Some supplemental guidelines may need to be prepared to maintain continuity between the states.

10.2.6 If a nontechnical practice exam (see Sections 7.3.3 and 8.3.3) is implemented in the United States, it should be prepared using NCEES policies and procedures and include some collaboration with CCPE in order to benefit from their experience with a similar examination.

10.2.7 A coordinated program to communicate the issues and the recommended changes to all stakeholders will be important during and after NCEES deliberations of the recommendations from ELQTF and LQOG. The need for written materials and special workshops or symposia coordinated by NCEES should be considered.

SECTION 11—CONCLUSION

The task force concludes that some modifications to the current set of engineering licensure qualifications are necessary to address concerns with the current model licensure system in both a short-term and long-term sense. The corresponding recommendations of the task force are outlined in Sections 8 and 9 of this report. It is recommended that the modifications be expressed through revisions to the NCEES Model Law, Model Rules and Regulations for Licensing Boards, and the Manual of Policy and Position Statements, as applicable, as a first step to implementation.

APPENDIX A

NCEES MODEL LAW

(Revised August 2002)

CONTENTS

An Act 49

110 INTRODUCTION 49

110.10 General Provisions 49

110.20 Definitions 50

120 THE LICENSING BOARD 54

120.10 Board Appointments, Terms 54

120.20 Board Qualifications 55

120.30 Board Compensation, Expenses 55

120.40 Board Removal of Members, Vacancies 55

120.50 Board Organization and Meetings 55

120.60 Board Powers 55

120.70 Receipts and Disbursements 56

120.80 Records and Reports 57

120.90 Roster 57

130 CANDIDATES FOR LICENSURE 58

130.10 General Requirements for Licensure 58

130.20 Application and Licensure Fees 60

130.30 Examinations 60

140 LICENSEES 61

140.10 Certificates, Seals 61

140.20 Expirations, Renewals, and Reinstatement to Active Practice 62

140.30 Reissuance of Certificates 63

140.40 Public Works 63

150 DISCIPLINARY ACTIONS 63

150.10 Disciplinary Action Revocation, Suspension, Refusal to Issue, Restore or Renew, Probation, Fine, Reprimand 63

150.20 Disciplinary Action Procedures 64

150.30 Civil Penalties for Non-Licensees 65

150.40 Criminal Offenses 66

160 MISCELLANEOUS 66
160.10 Certificates of Authorization 66
160.20 Exemption Clause 67
160.30 Duties of Recorders 67
160.40 Invalid Sections 68
160.50 Repeal of Conflicting Legislation 68
160.60 Grandfathering of Photogrammetrists 68
160.70 Effective Date 68

LICENSURE OF ENGINEERS AND LAND SURVEYORS

AN ACT

To regulate the practice of engineering and/or[1] surveying or land surveying; provide for the licensure of qualified persons as professional engineers and/or professional surveyors or professional land surveyors and for the certification of engineer interns and/or surveyor interns; define the terms "Engineer," "Professional Engineer," "Professional Engineer, Retired," "Engineer Intern," and "Practice of Engineering"; define the terms "Professional Surveyor or Land Surveyor," "Professional Surveyor or Land Surveyor, Retired," "Surveyor Intern," and "Practice of Surveying or Land Surveying"; create a jurisdiction board of licensure for professional engineers and/or professional surveyors or professional land surveyors and provide for the appointment and compensation of its members; fix the term of members of the board and define its powers and duties; *establish the board as an independent jurisdiction agency which receives no funding from the jurisdiction general fund, relying on revenues from licensure and examination fees and interest to meet its operating and capital costs, and not having its budget, fees, or expenditures subject to review and/or approval by the legislative assembly or emergency board, or any other agency or department, but required to submit a full annual report of its activities and financial affairs to the governor for inclusion in annual financial statements;* set forth the minimum qualifications and other requirements for licensure as a professional engineer, and/or a professional surveyor or professional land surveyor and for certification as an engineer intern or surveyor intern; establish fees and expiration and renewal requirements; impose certain duties upon the jurisdiction and political subdivisions thereof in connection with public work; and provide for the enforcement of this Act and penalties for its violation.

Be it enacted by the General Assembly of the Jurisdiction of ..... as follows.

110 INTRODUCTION

110.10 General Provisions

A. Regulation of Engineers and Surveyors or Land Surveyors–In order to safeguard life, health, and property and to promote the public welfare, the practice of engineering and/or the practice of surveying or land surveying in this jurisdiction is hereby declared to be subject to regulation in the public interest. It shall be unlawful for any person to practice, or to offer to practice, engineering and/or surveying or land surveying in this jurisdiction, as defined in the provisions of this Act, or to use in connection with their name or otherwise assume, or advertise any title or description tending to convey the impression that they are a licensed engineer and/or surveyor or land surveyor, unless such person has been duly licensed or is exempted under the provisions of this Act. The practice of

[1] The *Model Law* has been simplified to serve boards of engineers and surveyors, or land surveyors, boards of engineers, boards of surveyors or land surveyors, and independent boards. The reader should substitute the appropriate "and/or" terminology and delete the text that does not apply to the situation. Text shown in italics is language specific to independent boards. Language specific to state government boards is shown in brackets ([ ]).

engineering or surveying or land surveying shall be deemed a privilege granted by the jurisdiction through the licensure board based on the qualifications of the individual as evidenced by their certificate of licensure, which shall not be transferable.

B. *Independent Board*

1. *It is the intent of this Act that the board shall be an independent jurisdiction agency. It shall receive no financial support from the jurisdiction general fund, and shall utilize its fees for licensure and renewal and for examinations as its principal source of revenue.*
2. *Any revenues from fines enacted by the board in disciplinary actions shall be deposited in the jurisdiction general fund, and shall not be available to the board.*
3. *All revenues, except fines, received by the board shall be deposited with the jurisdiction treasurer in a separate account for the board separate from the general fund.*
4. *Any such receipts shall constitute a continuous appropriation of such amounts for the purpose of carrying out the functions of the board. All necessary expenses of the board shall be paid from the account by the Treasurer in the same manner as other claims against the jurisdiction are paid, after approval thereof by the chairperson or secretary of the board.*
5. *Monies in the board account may be invested by the treasurer in the same manner as other jurisdiction monies, and any interest earned on monies in the board account shall be credited to that account.*
6. *The board shall adopt a budget only after a public hearing, using the same classifications of expenditures and revenues as tax-supported jurisdiction agencies.*

110.20 Definitions

A. Engineer

1. Engineer—The term "Engineer," within the intent of this Act, shall mean a person who is qualified to practice engineering by reason of special knowledge and use of the mathematical, physical, and engineering sciences and the principles and methods of engineering analysis and design, acquired by engineering education and engineering experience.
2. Professional Engineer—The term "Professional Engineer," as used in this Act, shall mean a person who has been duly licensed as a professional engineer by the board. The board may designate a professional engineer, on the basis of education, experience, and examination, as being licensed in a specific discipline or branch of engineering signifying the area in which the engineer has demonstrated competence.
3. Model Law Engineer—The term "Model Law Engineer" refers to a person who:
   a. Is a graduate of an engineering program accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC/ABET)
   b. Has passed the eight-hour NCEES Fundamentals of Engineering (FE) exam and an eight-hour NCEES Principles and Practice of Engineering (PE) exam using the NCEES cut score
   c. Has completed four years of acceptable engineering experience after confirmation of a bachelor of science degree in an engineering program, which may include up to one year of experience for a graduate engineering degree.
   d. Has a record clear of disciplinary action
4. Professional Engineer, Retired—The term "Professional Engineer, Retired," as used in this Act, shall mean a person who has been duly licensed as a professional engineer by the board and who chooses to relinquish or not to renew a license and who applies to and is approved by the board to be granted the use of the honorific title "Professional Engineer, Retired."

5. Engineer Intern—The term "Engineer Intern," as used in this Act, shall mean a person who has qualified for, taken, and passed an examination in the fundamental engineering subjects, as provided in this Act.
6. Practice of Engineering—The term "Practice of Engineering," within the intent of this Act, shall mean any service or creative work, the adequate performance of which requires engineering education, training, and experience in the application of special knowledge of the mathematical, physical, and engineering sciences to such services or creative work as consultation, investigation, expert technical testimony, evaluation, planning, design and design coordination of engineering works and systems, planning the use of land, air, and water, teaching of advanced engineering subjects, performing engineering surveys and studies, and the review of construction for the purpose of monitoring compliance with drawings and specifications; any of which embraces such services or work, either public or private, in connection with any utilities, structures, buildings, machines, equipment, processes, work systems, projects, communication systems, transportation systems, and industrial or consumer products, or equipment of a control systems, communications, mechanical, electrical, hydraulic, pneumatic, chemical, environmental, or thermal nature, insofar as they involve safeguarding life, health, or property, and including such other professional services as may be necessary to the planning, progress, and completion of any engineering services.

   Design coordination includes the review and coordination of those technical submissions prepared by others, including as appropriate and without limitation, consulting engineers, architects, landscape architects, surveyors or land surveyors, and other professionals working under the direction of the engineer.

   Engineering surveys include all survey activities required to support the sound conception, planning, design, construction, maintenance, and operation of engineered projects, but exclude the surveying of real property for the establishment of land boundaries, rights-of-way, easements, and the dependent or independent surveys or resurveys of the public land survey system.

   A person shall be construed to practice or offer to practice engineering, within the meaning and intent of this Act, who practices any branch of the profession of engineering; or who, by verbal claim, sign, advertisement, letterhead, card, or in any other way represents themselves to be a professional engineer, or through the use of some other title implies that they are a professional engineer or that they are licensed under this Act; or who hold themselves out as able to perform, or who does perform any engineering service or work or any other service designated by the practitioner which is recognized as engineering.
7. Consulting Engineer—The term "Consulting Engineer," as used in this Act, shall mean a professional engineer whose principal occupation is the independent practice of engineering; whose livelihood is obtained by offering engineering services to the public; who is devoid of public, commercial, and product affiliation that might tend to imply a conflict of interest; and who is cognizant of their public and legal responsibilities, and is capable of discharging them.
8. Inactive Licensee—Licensees who are not engaged in engineering practice which requires licensure in this jurisdiction may be granted inactive status. No inactive licensee may practice in this jurisdiction unless otherwise exempted in this chapter. Inactive licensees are exempt from the continuing education requirements.

B. Professional Surveyor or Land Surveyor

1. Professional Surveyor or Land Surveyor—The term "Professional Surveyor or Land Surveyor," as used in this Act, shall mean a person who has been duly licensed as a professional surveyor or land surveyor by the board established under this Act, and who is a professional specialist in the technique of measuring land, educated in the basic principles of mathematics, the related physical and applied sciences, and the relevant requirements of law for adequate evidence and all requisite to surveying of real property, and engaged in the practice of surveying or land surveying as herein defined.
2. Model Law Surveyor—The term "Model Law Surveyor" refers to a person who meets the minimum requirements of this act and is a graduate of an EAC/ABET-accredited Surveying Engineering Group program, a Surveying and Mapping Group program accredited by the Applied Science Accreditation Commission of ABET (ASAC/ABET), or the equivalent.
3. Professional Surveyor or Land Surveyor, Retired—The term "Professional Surveyor or Land Surveyor, Retired" as used in this Act shall mean a person who has been duly licensed as a professional surveyor or land surveyor by the board and who chooses to relinquish or not to renew a license and who applies to and is approved by the board to be granted the use of the honorific title "Professional Surveyor or Land Surveyor, Retired."
4. Surveyor Intern—The term "Surveyor Intern," as used in this Act, shall mean a person who has qualified for, taken, and has passed an examination in the fundamental surveyor intern subjects, as provided by this Act.
5. Practice of Surveying or Land Surveying—The term "Practice of Surveying or Land Surveying," within the intent of this Act shall mean providing professional services such as consultation, investigation, testimony evaluation, expert technical testimony, planning, mapping, assembling, and interpreting reliable scientific measurements and information relative to the location, size, shape, or physical features of the earth, improvements on the earth, the space above the earth, or any part of the earth, and utilization and development of these facts and interpretation into an orderly survey map, plan, report, description, or project. The practice of surveying or land surveying includes, but is not limited to, any one or more of the following:
    a. Determining the configuration or contour of the earth's surface or the position of fixed objects thereon by measuring lines and angles and applying the principles of mathematics or photogrammetry.
    b. Performing geodetic surveying which includes surveying for determination of the size and shape of the earth utilizing angular and linear measurements through spatially oriented spherical geometry.
    c. Determining, by the use of principles of surveying, the position for any survey control (non-boundary) monument or reference point; or setting, resetting, or replacing any such monument or reference point.
    d. Creating, preparing, or modifying electronic or computerized data, including land information systems, and geographic information systems, relative to the performance of the activities in the above described items a. through c.
    e. Locating, relocating, establishing, reestablishing, laying out, or retracing any property line or boundary of any tract of land or any road, right of way, easement, alignment, or elevation of any of the fixed works embraced within the practice of engineering.
    f. Making any survey for the subdivision of any tract of land.
    g. Determining, by the use of principles of land surveying, the position for any survey monument or reference point; or setting, resetting, or replacing any such monument or reference point.

h. Creating, preparing, or modifying electronic or computerized data, including land information systems, and geographic information systems, relative to the performance of the activities in the above described items e. through g.

Any person shall be construed to practice or offer to practice surveying or land surveying, within the meaning and intent of this Act, who engages in surveying or land surveying or who by verbal claim, sign, advertisement, letterhead, card, or in any other way represents themselves to be a professional surveyor or land surveyor or, through the use of some other title implies that they are able to perform, or who does perform any surveying or land surveying service or work or any other service designated by the practitioner which is recognized as surveying or land surveying.

6. Inactive Licensee—Licensees who are not engaged in surveying or land surveying practice which requires licensure in this jurisdiction may be granted inactive status. No inactive licensee may practice in this jurisdiction unless otherwise exempted in this chapter. Inactive licensees are exempt from the continuing education requirements.

C. Board–The term "Board," as used in this Act, shall mean the jurisdiction board of licensure for professional engineers and professional surveyors or professional land surveyors, hereinafter provided by this Act.

D. Jurisdiction—A state, the District of Columbia, any territory, commonwealth, or possession of the United States that issues licenses to practice and regulates the practice of engineering and/or land surveying within its legal boundaries.

E. Responsible Charge—The term "Responsible Charge," as used in this Act, shall mean direct control and personal supervision of engineering work or surveying or land surveying as the case may be.

F. Rules of Professional Responsibility for Professional Engineers and Professional Surveyors or Land Surveyors—The term "Rules of Professional Responsibility for Professional Engineers and Professional Surveyors or Land Surveyors," as used in this Act, shall mean those rules, if any, promulgated by the board as authorized by this Act.

G. Firm—The term "Firm," as used in this Act, shall mean any form of business entity other than an individual licensee operating under his or her name that offers professional engineering or surveying or land surveying services to the public of their licensed personnel.

H. Managing Agent—The term "Managing Agent," as used in this Act, shall mean a natural person who is licensed under this Act and who has been designated pursuant to Section 150.40 of this Act by the firm. The managing agent is responsible for the engineering or surveying or land surveying work in this jurisdiction and/or for projects or property within this jurisdiction offered or provided by the firm. A licensee may not be designated as a managing agent for more than one firm. An engineer or surveyor who renders occasional, part-time or consulting engineering or surveying or land surveying services to, or for, a firm may not be designated as a managing agent. The managing agent's responsibilities include:

1. Renewal of the certificate of authority and notification to the board of any change in managing agent.
2. Overall supervision of the firm's licensed and subordinate personnel providing the engineering or surveying or land surveying work in this jurisdiction.
3. Institution and adherence of policies of the firm that are in accordance with the Rules of Professional Responsibility for Professional Engineers and Professional Surveyors or Land Surveyors, adopted pursuant to Section 150.10 B of this Act.

I. Rules—The Rules are those adopted pursuant to Section 120.60, Board Powers, subsection A, of this Act.

J. Signature—The term "Signature," as used in this Act, shall mean handwritten or digital as follows:
   1. A handwritten message identification containing the name of the person who applied it; or
   2. A digital signature that is an electronic authentication process attached to or logically associated with an electronic document. The digital signature must be:
      a. Unique to the person using it
      b. Capable of verification
      c. Under the sole control of the person using it
      d. Linked to a document in such a manner that the digital signature is invalidated if any data in the document is changed
   3. A digital signature that uses a process approved by the board will be presumed to meet the criteria set forth in Sections 110.20 a. through d. above.

K. Seal—The term "Seal," as used in this Act, shall mean a symbol, image, or list of information that may be found in the form of a rubber stamp, embossed seal, computer-generated data, or other form found acceptable to the board that is applied or attached to the document in a manner consistent with board rules. The seal shall contain the following:
   1. Jurisdiction of licensure
   2. Licensee's name
   3. License/certificate/registration number
   4. The words "Professional Engineer" and discipline (if licensed by) or "Professional Surveyor"
   5. Any other information required by the board

120 The Licensing Board

120.10 Board Appointments, Terms

A jurisdiction board of licensure for professional engineers and/or professional surveyors or land surveyors is hereby created whose duty it shall be to administer the provisions of this Act. The board shall consist of ..... professional engineers, ... professional surveyors or land surveyors, and ..... public members who shall be appointed by the governor. The engineer and surveyor or land surveyor members shall preferably be appointed from a list of nominees submitted by the respective engineering and/or surveying or land surveying societies of the jurisdiction and shall have the qualifications required by Section 120.20. Each member of the board shall receive a certificate of their appointment from the governor and shall file with the secretary of the jurisdiction a written oath or affirmation for the faithful discharge of their official duty. Appointments to the board shall be in such manner and for such period of time that the term of each member shall expire at the end of a different year, insofar as is possible. On the expiration of the term of any member, the governor shall in the manner hereinbefore provided appoint for a term of ..... years a professional engineer, a professional surveyor or land surveyor, or a public member having the qualifications required in Section 120.20. A member may be reappointed to succeed themselves. Each member shall hold office until the expiration of the term for which appointed or until a successor has been duly appointed and has qualified. In the event of a vacancy on the board due to resignation, death or for any cause resulting in an unexpired term, if not filled within three months by the governor, the board may appoint a provisional member to serve in the interim until the governor acts.

120.20 Board Qualifications

Each engineering member of the board shall be a citizen of the United States and a resident of this jurisdiction. They shall have been engaged in the lawful practice of engineering as a professional engineer for at least twelve years, shall have been in responsible charge of engineering projects for at least five years, and shall be a licensed professional engineer in this jurisdiction.

Each surveying or land surveying member of the board shall be a citizen of the United States and a resident of this jurisdiction. They shall have been engaged in the lawful practice of surveying or land surveying as a professional surveyor or land surveyor for at least twelve years, shall have been in responsible charge of surveying or land surveying projects for at least five years, and shall be a licensed professional surveyor or land surveyor in this jurisdiction.

Each public member *shall be a citizen of the United States and a resident of this jurisdiction and* shall not be or have been either an engineer or surveyor or land surveyor. The majority of the board members shall be engineers and/or surveyors or land surveyors.

120.30 Board Compensation, Expenses

Each member of the board shall receive compensation as prescribed in Section 120.60 of this Act when attending to the work of the board or any of its committees and for the time spent in necessary travel; and, in addition thereto, shall be reimbursed for all actual traveling, incidental, and clerical expenses necessarily incurred in carrying out the provisions of this Act.

120.40 Board Removal of Members, Vacancies

The governor may remove any member of the board for misconduct, incompetency, neglect of duty, or for reason prescribed by law for removal of jurisdiction officials. Vacancies in the membership of the board shall be filled for the unexpired term by appointment of the governor as provided in Section 120.10.

120.50 Board Organization and Meetings

The board shall hold at least ..... regular meetings each year. Special meetings may be held as the bylaws or rules of the board provide. The board shall elect or appoint annually the following officers: a chairman, a vice chairman, and a secretary. A quorum of the board shall consist of no fewer than ..... professional engineer members, ... professional surveyor or land surveyor members, and ..... public members.

120.60 Board Powers

A. The board shall have the power to adopt and amend all bylaws and rules of procedure not inconsistent with the constitution and laws of this jurisdiction or this Act, including, but not limited to, the adoption and promulgation of Rules of Professional Responsibility for Professional Engineers and Professional Surveyors or Land Surveyors which may be reasonably necessary for the proper performance of its duties and the regulation of its procedures, meetings, records, examinations, and the conduct thereof. These actions by the board shall be binding upon persons licensed under this Act and on non-licensees found by the board to be in violation of provisions of this Act and shall be applicable to corporations holding a certificate of authorization as provided in Section 160.10 of this Act. The board shall adopt and have an official seal, which shall be affixed to each certificate issued.
B. In carrying into effect the provisions of this Act, the board may subpoena witnesses and compel their attendance, and also may require the submission of books, papers, documents, or other pertinent

data, in any disciplinary matter, or in any case wherever a violation of this Act is alleged. Upon failure or refusal to comply with any such order of the board, or upon failure to honor its subpoena, as herein provided, the board may apply to a court of any jurisdiction to enforce compliance with same.

C. The board is hereby authorized in the name of the jurisdiction to apply for relief by injunction in the established manner provided in cases of civil procedure, without bond, to enforce the provisions of this Act, or to restrain any violation thereof. In such proceedings, it shall not be necessary to allege or prove, either that an adequate remedy at law does not exist, or that substantial or irreparable damage would result from the continued violation thereof. The members of the board shall not be personally liable under these proceedings.

D. The board may subject an applicant for licensure to such examinations as it deems necessary to determine their qualifications.

E. The board shall have the power and authority to require a demonstration of continuing professional competency of engineers and surveyors or land surveyors as a condition of renewal or relicensure.

F. The board has the authority for citation and fining of persons engaged in the unlawful practice of engineering or surveying or land surveying who are not licensed in this jurisdiction as provided by law.

G. No action or other legal proceedings for damages shall be instituted against the board or against any board member or employee or agent of the board for any act done in good faith and in the intended performance of any power granted under this Act or for any neglect or default in the performance or exercise in good faith of any such duty or power.

H. The board shall have the power and authority to waive requirements of this law pertaining to surveying or engineering licensure provided consideration is given to safeguarding life, health, and property, and promoting the public welfare.

I. In carrying out the duties, functions, and powers of the board, the board may contract with any jurisdiction agency for the performance of such duties, functions, and powers as the board considers appropriate. A jurisdiction agency may not charge the board for such services an amount that is greater than the actual cost of the services. Except as otherwise specifically provided in this Act, the board may contract with private entities for such duties, functions, and powers as the board considers appropriate.

J. The board may sue and be sued in its own name.

K. The board may, notwithstanding any other statute to the contrary, enter into contracts and acquire, own, encumber, issue, replace, deal in, and dispose of real and personal property.

L. The board may fix a per diem amount to be paid to board members for each day or portion thereof during which the member is actually engaged in the performance of official duties. Board members may also receive actual and necessary travel or other expenses incurred in the performance of their duties. If an advisory council or peer review committee is established by the board to assist it in carrying out its duties, functions, and powers, the board may also pay per diem amounts and actual expenses for members thereof.

M. *The board may establish and collect fees not to exceed amounts necessary for the purpose of carrying out its functions. Such fees shall cover engineering licensure, engineer intern certification, surveyor or land surveyor licensure, surveyor intern certification, and renewals and examinations. It may establish and collect separate fees for examination than those for licensure and/or certification as the board considers appropriate.*

120.70 Receipts and Disbursements

The secretary of the board shall receive and account for all monies derived under the provisions of this Act. [This fund shall be known as the "Professional Engineers' and Professional Surveyors or Land Surveyors' Fund" and shall be kept in a local bank or deposited with the jurisdiction treasurer, and shall be paid out only upon requisitions submitted by the secretary. All monies in this fund are hereby

specifically appropriated for the use of the board.] *Such monies shall be deposited with the jurisdiction treasurer and kept in a separate account from the jurisdiction general fund, which shall be known as the "Professional Engineers' and/or Professional Surveyors or Land Surveyors' Account," and shall be paid out only upon requisitions submitted by the secretary or board chairperson. All monies in this account including interest are hereby specifically appropriated for the use of the board.* [The secretary] shall give a surety bond to the jurisdiction in such sum as may be required by the laws of this jurisdiction. The premium on said bond shall be regarded as a proper and necessary expense of the board. The secretary shall receive such salary as the board shall determine. The board shall employ such clerical or other assistants as are necessary for the proper performance of its work, and shall make expenditures from the abovementioned fund for any purpose which, in the opinion of the board, is reasonably necessary for the proper performance of its duties under this Act, including the expenses of the board's delegates to meetings of and membership fees to the National Council of Examiners for Engineering and Surveying and any of its subdivisions. Under no circumstances shall the total amount of warrants issued in payment of the expenses and compensation provided for in this Act exceed the amount of monies collected.

120.80 Records and Reports

A. The board shall keep a record of its proceedings and of all applications for licensure, which record shall show (1) the name, age, and last known address of each applicant, (2) the date of application, (3) the place of business of such applicant, (4) education, experience, and other qualifications, (5) type of examination required, (6) whether or not the applicant was rejected, (7) whether or not a certificate of licensure was granted, (8) the date of the action by the board, and (9) such other information as may be deemed necessary by the board.
B. The record of the board shall be prima facie evidence of the proceedings of the board, and a transcript thereof, duly certified by the secretary under seal, shall be admissible as evidence with the same force and effect as if the original were produced.
C. Annually, as of the end of the fiscal year, the board shall submit to the governor a report of its transactions of the preceding year and shall transmit to the governor a complete statement of the receipts and expenditures of the board, attested by affidavits of its chairman and secretary.
D. Board records and papers of the following class are of a confidential nature and are not public records: examination material for examinations not yet given, file records of examination problem solutions, letters of inquiry and reference concerning applicants, board inquiry forms concerning applicants, investigation files where any investigation is still pending, and all other materials of like confidential nature.

120.90 Roster

A complete roster showing the names and last known addresses of all licensed professional engineers and of all licensed professional surveyors or land surveyors shall be published by the secretary of the board once each year, or at intervals as established by board regulation.

130 Candidates for Licensure

130.10 General Requirements for Licensure

Education, experience, and examinations (as described in *Model Rules and Regulations for Licensing Boards)* are required for licensure as a professional engineer or professional land surveyor.

A. As an Engineer Intern—The following shall be considered as minimum evidence that the applicant is qualified for certification as an engineer intern. A college senior or graduate of an engineering program of four years or more accredited by EAC/ABET, or the equivalent, shall be admitted to an eight-hour written examination in the fundamentals of engineering. Upon passing such examination, the applicant shall be certified or enrolled as an engineer intern, if otherwise qualified.

B. As a Surveyor Intern—The following shall be considered as minimum evidence to the board that the applicant is qualified for certification as a surveyor intern.
   1. A college senior or graduate of an EAC/ABET or ASAC/ABET surveying program of four years or more shall be admitted to an eight-hour written examination in the fundamentals of surveying. Upon passing such examination, the applicant shall be certified or enrolled as a surveyor intern, if the applicant is otherwise qualified.
   2. A graduate of a program related to surveying of four years or more as approved by the board and with a specific record of two years of progressive experience in surveying or land surveying shall be admitted to an eight-hour written examination in the fundamentals of surveying or land surveying. Upon passing such examination, the applicant shall be certified or enrolled as a surveyor intern, if the applicant is otherwise qualified.
   3. A graduate of a four-year or more program as acceptable to the board and with a specific record of four years of progressive experience in surveying or land surveying shall be admitted to an eight-hour written examination in the fundamentals of surveying or land surveying. Upon passing such examination, the applicant shall be certified or enrolled as a surveyor intern, if the applicant is otherwise qualified.

C. Professional Engineer or Professional Surveyor or Land Surveyor—To be eligible for admission to the examination for professional engineer or professional surveyor or land surveyor, an applicant must be of good character and reputation and shall submit five references with his or her application for licensure, three of which references shall be professional engineers or professional surveyors or land surveyors having personal knowledge of the applicant's engineering or surveying experience.
   1. As a Professional Engineer—The following shall be considered as minimum evidence satisfactory to the board that the applicant is qualified for licensure as a professional engineer.
      a. Licensure by Comity—A person holding a certificate of licensure to engage in the practice of engineering, issued by a proper authority of a jurisdiction or possession of the United States, the District of Columbia, or any foreign country, based on requirements that do not conflict with the provisions of this Act and possessing credentials that are, in the judgment of the board, of a standard not lower than that specified in the applicable licensure act in effect in this jurisdiction at the time such certificate was issued may, upon application, be licensed without further examination except as required to present evidence of knowledge of statutes, rules, and design requirements unique to this jurisdiction.

         A person holding an active Council Record with the National Council of Examiners for Engineering and Surveying, whose qualifications as evidenced by the Council Record, meet the requirements of this Act, in the judgment of the board, may, upon application, be licensed without further examination except as required to examine the applicant's knowledge of statutes, rules, and design requirements unique to this jurisdiction.

b. An engineer intern with a specific record of an additional four years or more of progressive experience on engineering projects of a grade and a character which indicates to the board that the applicant may be competent to practice engineering shall be admitted to an eight-hour written examination in the principles and practice of engineering. Upon passing such examinations, the applicant shall be granted a certificate of licensure to practice engineering in this jurisdiction, provided the applicant is otherwise qualified.

1. As a Professional Engineer (Alternative Section)
Jurisdictions that do not license by discipline – An engineer licensed in another jurisdiction in a specific engineering discipline may be licensed by this board as a professional engineer.

Jurisdictions that license by discipline—An engineer licensed as a professional engineer in another jurisdiction may be licensed by this board in any discipline in which the engineer can verify his or her competency.

2. As a Professional Surveyor or Land Surveyor—The evaluation of a professional surveyor or land surveyor applicant's qualifications involves consideration of education, technical, and surveying or land surveying experience, exhibits of surveying or land surveying projects with which the applicant has been associated, recommendations by references and a review of these categories during an examination. The surveyor intern applicant's qualifications may be reviewed at an interview if the board deems it necessary. The following shall be considered as minimum evidence to the board that the applicant is qualified for licensure as a professional surveyor or land surveyor.
   a. Licensure by Comity—A person holding a certificate of licensure to engage in the practice of surveying or land surveying issued by a proper authority of a jurisdiction or possession of the United States, the District of Columbia, or any foreign country, based on requirements that do not conflict with the provisions of this Act and possessing the credentials that are, in the judgment of the board, not lower than that specified in the applicable licensure act in effect in this jurisdiction at the time such certificate was issued may, upon application, be licensed without further examination except as required to present evidence of knowledge of statutes, rules, and surveying requirements unique to this jurisdiction.

      A person holding an active Council Record with the National Council of Examiners for Engineering and Surveying, whose qualifications as evidenced by the Council Record, meet the requirements of this Act, in the judgment of the board, may, upon application, be licensed without further examination except as required to examine the applicant's knowledge of statutes, rules, and surveying requirements unique to this jurisdiction.
   b. A surveyor intern with a specific record of an additional four years of combined office and field experience satisfactory to the board in surveying or land surveying, of which a minimum of three years' progressive experience has been on surveying or land surveying projects under the supervision of a professional surveyor or land surveyor, shall be admitted to an eight-hour written examination in the principles and practice of surveying or land surveying. Upon passing such examination, the applicant shall be granted a certificate of licensure to practice surveying or land surveying in this jurisdiction, provided the applicant is otherwise qualified.

130.20 Application and Licensure Fees

A. Application for licensure as a professional engineer and/or professional surveyor or land surveyor or certification as an engineer intern or surveyor intern shall be on a form prescribed and furnished by the board; shall contain statements made under oath, showing the applicant's education and a detailed summary of technical and engineering experience or surveying or land surveying experience; and shall include the names and complete mailing addresses of the references, none of whom should be members of the board, as set forth in Section 130.10.

   The board may accept the verified information contained in a valid Council Record issued by the National Council of Examiners for Engineering and Surveying for applicants in lieu of the same information that is required on the form prescribed and furnished by the board.

B. The licensure fee shall be established by regulation of the board for licensure as a professional engineer or a professional surveyor or land surveyor, for certification as an engineer intern or surveyor intern and shall accompany the applications.

C. The certification fee for corporations shall be established by regulation of the board and shall accompany the application.

D. Should the board deny the issuance of a certificate to any applicant, including the application of a corporation for a certificate of authorization, the fee paid shall be retained as an application fee.

130.30 Examinations

A. The examinations will be held at such times and places as the board directs. The board shall determine the acceptable passing grade on examinations. The board may require a take-home, pre-application questionnaire based on this jurisdiction's rules and regulations as they apply to professionalism and ethics.

B. Written examinations will be given in two sections and may be taken only after the applicant has met the other minimum requirements as given in Section 130.10, and has been approved by the board for admission to the examinations as follows:

   1. Fundamentals of Engineering—The examination consists of an eight-hour test period on the fundamentals of engineering. Passing this examination qualifies the examinee for an engineer intern certificate, provided the examinee has met all other requirements for certification required by this Act.
   2. Principles and Practice of Engineering—The examination consists of an eight-hour test period on applied engineering. Passing this examination qualifies the examinee for licensure as a professional engineer, provided the examinee has met the other requirements for licensure required by this Act.
   3. Fundamentals of Surveying—The examination consists of an eight-hour test period on the basic disciplines of surveying. Passing this examination qualifies the examinee for a surveyor intern certification, provided the examinee has met all other requirements for certification required by this Act.
   4. Principles and Practice of Surveying or Land Surveying—The examination consists of an eight-hour test period on the applied disciplines of surveying or land surveying, divided in separate parts as determined by the board. Passing these parts qualifies the examinee for licensure as a professional surveyor or land surveyor, provided the examinee has met the other requirements for licensure required by this Act.

C. A candidate failing one examination may apply for re-examination, which may be granted upon payment of a fee established by regulation of the board. Before readmission to the examination, in

the event of a second failure, the examinee may, at the discretion of the board, be required to appear before the board with evidence of having acquired the necessary additional knowledge to qualify.

D. The board may prepare and adopt specifications for the written examinations in engineering and surveying or land surveying. They shall be published in brochure form and be available to any person interested in being licensed as a professional engineer or as a professional surveyor or land surveyor. The board may elect to waive any additional written examination requirements for the performance of the activities described in Section 110.20 B.5.a. through d. to facilitate mobility between jurisdictions.

140 LICENSEES

140.10 Certificates, Seals

A. The board shall issue to any applicant who, in the opinion of the board, has met the requirements of this Act, a certificate of licensure giving the licensee proper authority to practice their profession in this jurisdiction. The certificate of licensure for a professional engineer shall carry the designation "Professional Engineer" and for a professional surveyor or land surveyor, "Professional Surveyor" or "Professional Land Surveyor." It shall give the full name of the licensee with licensure number and shall be signed by the chairman and the secretary under the seal of the board.

B. This certificate shall be prima facie evidence that the person named thereon is entitled to all rights, privileges, and responsibilities of a professional engineer or a professional surveyor or land surveyor while the said certificate of licensure remains unrevoked and unexpired.

C. Each licensee hereunder must, upon licensure, obtain a seal, the use and design of which is described in Section 110.20. It shall be unlawful for a licensee to affix or to permit their seal and signature to be affixed to any document described here below after the expiration or revocation of a license or for the purpose of aiding or abetting any other person to evade or attempt to evade any provisions of this Act. Whenever the seal is applied, the document must be signed by the licensee thereby certifying that he or she is competent in the subject matter and was in responsible charge of the work product. If a handwritten signature is used, it shall be adjacent to or across the seal. A digital signature may be used in lieu of a handwritten signature.

1. The seal, signature, and date shall be placed on all final specifications, land surveys, reports, plats, drawings, plans, design information, and calculations whenever presented to a client or any public or governmental agency. Failure to sign and seal any final work product constitutes a violation of this Act and shall be handled as a disciplinary action under this Act.
2. Drawings, reports, or documents, which require sealing, dating, and signing may also be transmitted electronically. The board shall, by rule, establish procedures for this process.
3. The seal, signature, and date shall be placed on all original documents in such a manner that the seal, signature, and date will be clearly visible on any copy. The application of the licensee's seal and signature shall constitute certification that the work thereon was done by the licensee or under the responsible charge of the licensee. In the case of multiple sealings, the first or title page of drawings shall be sealed, signed, and dated by all involved. In addition, each sheet shall be sealed, signed, and dated by the licensee or licensees responsible for each sheet. In the case of reports or specifications, the cover sheet shall be signed, sealed, and dated. In the case of an authorized firm, under Section 150.40 of this Act, each sheet shall be sealed, signed, and dated by the licensee or licensees involved. The principal in responsible charge shall sign, seal, and date the title or first sheet.
4. No licensee shall affix his seal or signature to sketches, working drawing, specifications, or other documents developed by others not under his direct personal supervision and not subject to the authority of that licensee. The licensee shall sign and seal only work within the licensee's area(s) of

competence. Failure to comply with this provision shall be a violation of this Act and could result in disciplinary action.

5. Plans, plats, specifications, drawings, reports, or other documents will be deemed to have been prepared under the responsible charge of a licensee only when all the following conditions have been met and documented:
   a. The client requesting preparation of such plans, plats, specifications, drawings, reports, or other documents makes the request directly to the licensee, or a member or employee of the licensee's firm;
   b. The licensee supervises the preparation of the plans, plats, specifications, drawings, reports, or other documents and has input into their preparation prior to their completion;
   c. The licensee reviews the final plans, plats, specifications, drawings, reports, or other documents; and
   d. The licensee has the authority to, and does, make any necessary and appropriate changes to the final plans, plats, specifications, drawings, reports, or other documents.
6. In circumstances where a licensee in responsible charge of the work is unavailable to complete the work, or the work is a site adaptation of a standard design plan, or the work is a design plan signed and sealed by an out-of-jurisdiction licensee, a successor licensee may take responsible charge by performing all professional services to include developing a complete design file with work or design criteria, calculations, code research, and any necessary and appropriate changes to the work. The non-professional services, such as drafting, need not be redone by the successor licensee but must clearly and accurately reflect the successor licensee's work. The burden is on the successor licensee to show such compliance. The successor licensee shall have control of and responsibility for the work product and the signed and sealed originals of all documents.

D. The board shall issue to any applicant who, in the opinion of the board, has met the requirements of this Act, an enrollment card as engineer intern or surveyor intern, which indicates that their name has been recorded as such in the board office. The engineer intern or surveyor intern enrollment card does not authorize the holder to practice as a professional engineer or a professional surveyor or land surveyor.

140.20 Expirations, Renewals, and Reinstatement to Active Practice

A. Certificates of licensure and certificates of authorization for firms shall expire on the last day of the month of ..... following their issuance and shall become invalid after that date unless renewed. It shall be the duty of the secretary of the board to notify every person licensed under this Act and every firm holding a certificate of authorization under this Act of the date of the expiration of the certificate of licensure or certificate of authorization and the amount of the fee required for its renewal. Such notice shall be mailed to the licensee or firm at their last known address at least one month in advance of the date of the expiration of the certificate.

   Renewal may be effected at any time prior to or during the month of ..... by payment of a fee as established by regulation of the board. Renewal of an expired certificate may be effected under rules promulgated by the board regarding requirements for re-examination and penalty fees.

B. If a licensee is granted inactive status, the licensee may return to active status by notifying the board in advance of this intention, by paying appropriate fees, and by meeting all requirements of the board including demonstration of continuing professional competency as a condition of reinstatement.

140.30 Reissuance of Certificates

A new certificate of licensure or certificate of authorization to replace any certificate lost, destroyed, or mutilated may be issued subject to the rules of the board. A charge established by regulation shall be made for each issuance.

140.40 Public Works

Any jurisdiction, county, or local government agencies or authorities, or officials or employees thereof, shall not engage in the practice of engineering or surveying or land surveying involving either public or private property without the project being under the direct charge and supervision of a professional engineer for engineering projects or a professional surveyor or land surveyor for surveying or land surveying projects, as provided for the practice of the respective professions by this Act.

150 Disciplinary Action

150.10 Disciplinary Action Revocation, Suspension, Refusal to Issue, Restore or Renew, Probation, Fine, Reprimand

A. The board shall have the power to suspend, revoke, place on probation, fine and/or reprimand, or to refuse to issue, restore or renew a certificate of licensure, to any professional engineer, professional surveyor, or professional land surveyor who is found guilty of:
   1. The practice of any fraud or deceit in obtaining or attempting to obtain or renew a certificate of licensure or certificate of authorization.
   2. Any negligence, incompetency or misconduct in the practice of engineering, surveying, or land surveying.
   3. Conviction of or entry of a plea of guilty or nolo contendere to any crime which is a felony, whether related to practice or not; and conviction of or entry of a plea of guilty or nolo contendere to any crime, whether a felony, misdemeanor, or otherwise, an essential element of which is dishonesty or which is directly related to the practice of engineering, surveying, or land surveying.
   4. Failure to comply with any of the provisions of this Act or any of the rules or regulations pertaining thereto.
   5. Discipline by another jurisdiction, territory, the District of Columbia, foreign country, the United States government, or any other governmental agency, if at least one of the grounds for discipline is the same or substantially equivalent to those contained in this section.
   6. Failure to provide information requested by the board as a result of a formal or informal complaint to the board which would indicate a violation of this Act.
   7. Knowingly making false statements or signing false statements, certifications, or affidavits to induce payment.
   8. Aiding or assisting another person in violating any provision of this Act or the rules or regulations pertaining thereto.
   9. Violating any terms of probation imposed by the board or using a seal or practicing engineering, surveying, or land surveying while the professional engineer's license, professional surveyor's license, or professional land surveyor's license is suspended, revoked, non-renewed, or inactive.
   10. Signing, affixing, or permitting the licensee's seal or signature to be affixed to any specifications, reports, drawings, plans, plats, design information, construction documents or calculations, surveys, or revisions thereof which have not been prepared by the licensee or under the licensee's responsibility or direct personal supervision.
   11. Engaging in dishonorable, unethical, or unprofessional conduct of a character likely to deceive, defraud, or harm the public.

12. Providing false testimony or information to the board.
13. Habitual intoxication or addiction to the use of drugs or alcohol.
14. Providing engineering, surveying, or land surveying services outside any of the licensee's areas of competence. Licensees must demonstrate by education or experience that they are competent to practice in their field.

B. In addition to or in lieu of any other penalty provided in this section, any licensee who violates a provision of this Act or any rule or regulation pertaining thereto, a civil penalty in an amount determined by the board of not more than $5,000 for each offense.
   1. Each day of continued violation may constitute a separate offense.
   2. In determining the amount of civil penalty to be assessed pursuant to this section the board may consider such factors as the following:
      a. Whether the amount imposed will be a substantial economic determent to the violation;
      b. The circumstances leading to the violation;
      c. The severity of the violation and the risk of harm to the public.

C. The board shall have prepared and shall adopt rules of professional responsibility for Professional Engineers and Professional Surveyors or Land Surveyors as provided for in Section 120.60, which shall be made known in writing to every licensee and applicant for licensure under this Act, and which shall be published in the roster provided for in Section 120.90. Such publication shall constitute due notice to all licensees. The board may revise and amend these Rules of Professional Responsibility for Professional Engineers and Professional Surveyors or Land Surveyors from time to time and shall forthwith notify each licensee in writing of such revisions or amendments.

D. In addition to any other penalty provided in this section, the board shall have the power to revoke, suspend, place on probation, fine and/or reprimand, or refuse to issue, restore or renew, the certificate of authorization of any firm where one or more of its officers, directors, partners, members, or managers have been found guilty of any conduct which would constitute a violation under the provisions of this section.

E. Before issuing an order under this section, the board shall provide the person written notice and the opportunity to request, within 30 days of issuance of notice by the board, a hearing on the record.

F. In connection with proceeding under Subsections A and B of this section, the board may issue subpoenas to compel the attendance and testimony of witnesses and the disclosure of evidence, and may request the attorney general to bring an action to enforce a subpoena.

150.20 Disciplinary Action Procedures

A. Any person may prefer charges of fraud, deceit, gross negligence, incompetence, negligence, misconduct, or violation of the Rules of Professional Responsibility for Professional Engineers and Professional Surveyors or Land Surveyors against any individual licensee or against any firm holding a certificate of authorization.

B. All charges, unless dismissed by the board as unfounded, trivial, or unless settled informally, shall be heard by the board.

[B. The time and place for the hearings shall be fixed by the board and a copy of the charges, together with a notice of the time and place of hearing, shall be personally served on or mailed to the last known address of such individual licensee or firm holding a certificate of authorization at least thirty days before the date fixed for the hearing. At any hearing, the accused individual licensee or firm holding a certificate of authorization shall have the right to appear in person or by counsel, or both, to cross-examine witnesses in their defense and to produce evidence and witnesses in their own defense. If the accused person or firm fails or refuses to appear, the board may proceed to hear and determine the validity of the charges.]

C. If after such hearing a majority of the board votes in favor of sustaining the charges, the board shall reprimand, fine in an amount not to exceed ..... dollars ($.....) for each count, refuse to issue, restore or renew, place on probation for a period of time, and subject to such conditions as the board may specify, suspend, revoke, or any combination thereof, the individual's certificate of licensure or a firm's certificate of authorization.
D. An individual licensee having a certificate of licensure or a firm having a certificate of authorization aggrieved by any action of the board in levying a fine, denying, suspending, refusing to issue, restore or renew, or revoking their certificate of licensure or a firm's certificate of authorization, may appeal therefrom to the proper court under normal civil procedures.
E. A penalty assessed pursuant to Section 150.10 B of this Act shall be assessed in a proceeding as provided in this section. Unless the amount of the penalty is paid within 50 days after the order becomes final, the order shall constitute a judgment and shall be filed and execution issued thereon in the same manner as any other judgment of a court of record.
F. The board may, upon petition of an individual licensee or firm holding a certificate of authorization, reissue a certificate of licensure or authorization, provided that a majority of the members of the board votes in favor of such issuance.

150.30 Civil Penalties for Non-Licensees

A. In addition to any other provisions of law, the board may enter an order assessing a civil penalty against any person, firm, partnership or corporation found guilty by the board of:
   1. Engaging in the practice or offer to practice of engineering or surveying or land surveying in this jurisdiction without being licensed in accordance with the provisions of this Act;
   2. Using or employing the words "engineer," "engineering," "surveyor," "land surveyor," "surveying," "land surveying," or any modification or derivative thereof in its name or form of business activity except as authorized in this Act;
   3. Presenting or attempting to use the certificate of licensure or the seal of another licensed engineer or licensed surveyor or licensed land surveyor;
   4. Giving false or forged evidence of any kind to the board or any member thereof in obtaining or attempting to obtain a certificate of licensure;
   5. Falsely impersonating any other licensed engineer or licensed surveyor or land surveyor of like or different name; or
   6. Using or attempting to use an expired, suspended, or revoked or non-existent certificate of licensure.
B. A civil penalty levied under this section may not exceed $5,000 for each offense.
C. Each day of continued violation may constitute a separate offense.
D. In determining the amount of civil penalty to be assessed pursuant to this section, the board may consider such factors as the following:
   1. Whether the amount imposed will be a substantial economic deterrent to the violation;
   2. The circumstances leading to the violation;
   3. The severity of the violation and the risk of harm to the public;
   4. The economic benefits gained by the violator as a result of non-compliance; and
   5. The interest of the public.
E. Before issuing an order under this section, the board shall provide the person written notice and the opportunity to request, within 30 days of issuance of notice by the board, a hearing on the record.
F. In connection with proceeding under Subsections A and B of this section, the board may issue subpoenas to compel the attendance and testimony of witnesses and the disclosure of evidence, and may request the attorney general to bring an action to enforce a subpoena.

G. A person aggrieved by the levy of a civil penalty under this section may file an appeal with the superior court for judicial review of the penalty aforementioned.
H. If a person fails to pay a civil penalty within 30 days after entry of an order under Subsection A of this section, or if the order is stayed pending an appeal, within 10 days after the court enters a final judgment in favor of the board of an order appealed under Subsection E of this section, the board shall notify the attorney general. The attorney general may commence a civil action to recover the amount of the penalty, plus attorney's fees and costs.
I. An action to enforce an order under this section may be combined with an action for an injunction.

150.40 Criminal Offenses

Any person who shall practice or offer to practice engineering or surveying or land surveying in this jurisdiction being licensed in accordance with the provisions of this Act, or any person, firm, partnership, organization, association, corporation, or other entity using or employing the words "Engineer" or "Engineering" or "Surveyor" or "Land Surveyor" or "Surveying" or "Land Surveying," or any modification or derivative thereof in its name or form of business activity except as authorized in this Act, or any person presenting or attempting to use the certificate of licensure or the seal of another, or any person who shall give any false or forged evidence of any kind to the board or to any member thereof in obtaining or attempting to obtain a certificate of licensure, or any person who shall falsely impersonate any other licensee of like or different name, or any person who shall attempt to use an expired, suspended or revoked, or non-existent certificate of licensure, or who shall practice or offer to practice when not qualified, or any person who falsely claims that they are licensed or authorized under this Act, or any person who shall violate any of the provisions of the Act, shall be guilty of a (highest degree of) misdemeanor for the first offense and a (lowest degree of) felony for the second or any subsequent offenses.

It shall be the duty of the attorney general of the jurisdiction to enforce the provisions of this Act and to prosecute any person violating same.

The attorney general of the jurisdiction or the assistant shall act as legal adviser to the board and render such legal assistance as may be necessary in carrying out the provisions of this Act. The board may employ counsel and necessary assistance to aid in the enforcement of this Act and the compensation and expenses therefore shall be paid from the funds of the board.

160 Miscellaneous

160.10 Certificates of Authorization

A. The practice of, or offer to practice engineering or surveying or land surveying through a firm by individuals licensed under this Act, is permitted, provided that the persons in responsible charge of such practice and all personnel who act on behalf of the firm in professional matters are licensed under this Act; and further that the firm has been issued a certificate of authorization by the board.
B. An engineering or surveying or land surveying firm desiring a certificate of authorization must file with the board an application using a form provided by the board and provide all the information required by the board. A form as provided by the board shall be filed with the board upon renewal or within thirty days of the time any information contained on the application form is changed or differs for any reason. If in the judgment of the board the application meets the requirements of this Act, the board shall issue a certificate of authorization for said firm to practice engineering or land.
C. This section shall not require a certificate of authorization for a firm performing engineering or surveying or land surveying for the firm itself or a parent or subsidiary of said firm.

D. No firm shall be relieved of responsibility for the conduct or acts of its agents, employees, officers, partners, members, or managers by reason of its compliance with the provisions of this section. No individual practicing engineering or surveying or land surveying under the provisions of this Act shall be relieved of responsibility for engineering or surveying or land surveying services performed by reason of employment or other relationship with a firm holding a certificate of authorization.
E. The secretary of state of this jurisdiction shall not accept organizational papers nor issue a certificate of incorporation, licensure, or authorization to any firm which includes among the objectives for which it is established or within its name, any of the words "engineer," "engineering," "surveyor," "land surveyor," "surveying," "land surveying," or any modification or derivation thereof unless the board of licensure for this profession has issued for said applicant a certificate of authorization or a letter indicating the eligibility of such applicant to receive such a certificate. The firm applying shall supply such certificate or letter from the board with its application for incorporation, licensure, or authorization.
F. The secretary of state of this jurisdiction shall decline to license any trade name or service mark which includes such words, as set forth in the above article, or modifications or derivatives thereof in its firm name or logotype except those firms holding certificates of authorization issued under the provisions of this section.
G. The certificate of authorization shall be renewed as hereinbefore provided in Section 140.20.
H. An engineer or surveyor or land surveyor who renders occasional, part-time, or consulting engineering or surveying or land surveying services to or for a firm may not, for the purposes of this section, be designated as being in responsible charge of the professional activities of the firm unless the engineer or surveyor or land surveyor is an officer or owner of the firm.

160.20 Exemption Clause

This Act shall not be construed to prevent the practice by:
A. Other Professions – The practice of any other legally recognized profession.
B. Contingent Permits – A contingent license may be issued by the board or its Executive Officer to an applicant for comity licensure if the applicant appears to meet the requirements for comity licensure. Such a contingent license will be in effect from its date of issuance until such time as the board takes final action on the application for comity licensure. If the board determines that the applicant does not meet the requirements for issuance of a comity license, the contingent license shall be immediately and automatically revoked and no comity license will be issued.
C. Employees and Subordinates – The work of an employee or a subordinate of a person holding a certificate of licensure under this Act, or an employee of a person practicing lawfully under Subsection B of this section, provided such work does not include final engineering or surveying or land surveying designs or decisions and is done under the direct supervision of and verified by a person holding a certificate of licensure under this Act or a person practicing lawfully under Subsection B of this section.

160.30 Duties of Recorders

It shall be unlawful for the recorder of deeds or the registrar of titles of any county or proper public authority to file or record any map, plat, survey, or other documents within the definition of land surveying *as set forth in this Act* which do not have impressed thereon and affixed thereto the personal signature and seal of a professional surveyor or land surveyor by whom or under whose direct supervision the map, plat, survey, or other documents were prepared.

160.40 Invalid Sections

If any of the provisions of this Act or if any rule, regulation, or order thereunder or if the application of such provision to any person or circumstance shall be held invalid, the remainder of this Act and the application of such provision of this Act or such rule, regulation or order to persons or circumstances, other than those as to which it is held invalid, shall not be affected thereby.

160.50 Repeal of Conflicting Legislation

All laws or parts of laws in conflict with the provisions of this Act shall be, and the same are hereby repealed.

160.60 Grandfathering of Photogrammetrists

A. Licensure of Professionals Currently Practicing Surveying or Land Surveying as defined in the *Model Law,* Section 110.20 B.5.a. – Any person presently practicing surveying in the jurisdiction of ....., as defined in Section 110.20 of (the *Model Law*), using photogrammetric technologies with at least eight years' experience in the profession, two or more of which shall have been in responsible charge of photogrammetric mapping projects meeting ASPRS Aerial Photography and Mapping Standards, or U.S. National Mapping Standards, shall, upon application, be licensed to practice surveying and/or mapping in the jurisdiction of ....., provided:
   1. The applicant submits certified proof of graduation from high school, high school equivalency, or a higher degree.
   2. The applicant, optionally, submits: certified proof of a baccalaureate degree in surveying or a related field of study approved by the (Board), which may be substituted for four of the above required years of experience; or certified proof of a master's degree in surveying or a related field of study approved by the (Board), which may be substituted for a maximum of five of the above required years of experience.
   3. The applicant submits proof of employment in responsible charge of photogrammetric surveying and/or mapping projects, practicing within any of the fifty United States, including itemized reports detailing methods, procedures, amount of the applicant's personal involvement, and the name, address, and telephone numbers of the client for five projects completed under the supervision of the applicant within the United States. A final map for each of the five projects shall also be submitted.
   4. The applicant submits five references as to the applicant's character and quality of work, three of which shall be from professional surveyors, mappers, or engineers currently practicing within the scope of their license in an area of surveying and/or mapping.
   5. Said application is filed with the Board within two years, next after _____ 20__. Thereafter, no photogrammetric surveyor or mapper shall be licensed without meeting the requirements for education, length of experience, testing, or reciprocity criteria, as set forth by the Board for all applicants.

160.70 Effective Date

This law shall take effect ..... days from and after the date of passage.

APPENDIX B

SUMMARY OF OTHER RELATED NCEES ACTIVITIES

Charge 5 of ELQTF was to review the NCEES member survey results and the charges and reports from ACCA, the Special Committee on Experience Evaluation, the Committee on Examinations for Professional Engineers (EPE), the Committee on Examination Policy and Procedures (EPP), and the FE Effectiveness, Licensure Promotion, Mobility, and NCEES/ACEC Joint Task Forces and consider this information during the committee deliberations. This appendix provides the information covering the years 2000–2001 and 2001–2002.

A.1 Advisory Committee on Council Activities (ACCA)

- *Desirability of waiving the FE examination requirement for Ph.D. professors.* The committee was split on this issue. Some members were adamant that there should be no exemptions. Others felt that the waiver would be appropriate for all Ph.D.'s who could demonstrate that their academic activities include qualification exams substantially equivalent to the FE. There was some feeling that as use of the FE examination for outcome assessment becomes common, the issue will be moot. It was recommended that ELQTF continue study of this issue.
- *Review Canada's concern that professional references be residents of the state where application is being made.* The NCEES Model Law for engineering licensure shows no requirement for residency for references. No alterations are necessary.
- *Provide support to the Licensure Promotion Task Force.* This is ongoing.
- *Review recommendations from the NCEES/ACEC Joint Task Force.* The NCEES/ACEC Joint Task Force did not have any recommendations concerning mobility of firms. ACCA recommends that NCEES evaluate the Model Law regarding licensure of firms to determine the need for such laws. In 2002, the Individual and Business Comity Task Force made a series of recommendations about proposed policies and position statements intended to facilitate mobility of engineering firms between jurisdictions. Since this task force was discontinued at the 2002 Annual Meeting, individual and firm mobility issues will be addressed by appropriate committees in the future.

A.2 Special Committee on Experience Evaluation

- *Review experience evaluation guidelines.* The Special Committee on Experience Evaluation developed an extensive list of suggested experience. This included practical application of theory, management, communication skills, and social implications. For a more complete listing of experience, see the committee's final report. At the 2002 Annual Meeting, the Uniform Procedures and Legislative Guidelines Committee recommended that the two-page Suggested Guidelines for Progressive Engineering Experience be referenced in the experience section of Model Rules and Regulations.
- *Mentoring program benefits*. The committee recommended exploring a mentoring program. It believes that such a program would be beneficial and that the records of the program should be archived at the national level, such as at NCEES. NCEES subsequently voted against instituting a formal mentoring program.
- *Review NCARB Intern Development Program.* The committee felt that the NCARB program was too rigid and that the Canadian model was better.

A.3 Committee on Examinations for Professional Engineers (EPE)

- EPE addressed the need for practice questions in its 2001 committee report. It was concluded that if practice questions were to be added, it would likely require a separate examination because of the eight-hour test limit on the PE exam.
- An evaluation was completed of the concept of moving to a modular approach with respect to PE examinations wherein candidates could take and pass either the breadth or depth module and retake the module not passed. A number of complications were raised, including the need for time limitations, the acceptability of passing modules in various fields, and the paperwork and tracking required for such a program. The primary detractor is the documented fact that pass rates would decline dramatically in all engineering disciplines with a modular approach since some test-takers pass by doing very well on either the breadth or the depth module while not doing as well on the other.

A.4 Committee on Examination Policy and Procedures (EPP)

In 2001, the EPP Committee addressed the need to add more practice items in the PE examinations. The practice questions were recommended to be in two areas: questions of a practical nature within one's area of technical expertise and knowledges related to such areas as ethics, business practices, contract law, insurance requirements, and bidding practices.

A.5 Law Enforcement Committee

In 2002, the Law Enforcement Committee conducted a survey of Member Boards to ascertain the severity and number of specific instances in which disciplinary action against licensees involved practice issues. Responses from 43 Member Boards indicated that 54 percent of disciplinary cases opened were practice-related matters. Of all disciplinary cases, the top five categories were those involving (1) incompetence/negligence, (2) unlicensed practice/offer, (3) ethics/professional conduct/misconduct, (4) fraud, deceit, misrepresentation, and (5) sealing of work not prepared under the direct supervision and control of the licensee. The Law Enforcement Committee recommended further consideration of the incorporation of practice items in the PE examination.

A.6 FE Examination Effectiveness Task Force/Licensure Promotion Task Force (LPTF)

The FE Examination Effectiveness Task Force stated that the "purpose of the FE examination is to assist state boards in determining if a candidate possesses the minimum competency needed to enter into an engineering internship that can lead to licensure. In addition, portions of the FE examination data may be used in the assessment of engineering education program outcomes." The Licensure Promotion Task Force recommended that the "Council approve in concept the establishment of a long-term outreach program designed to educate students and those who influence them on the value of licensure and the potential use of the FE as an outcomes assessment tool."

A.7 Strategic Planning Survey

The following points are from the 2000–2001 strategic planning survey:

- The majority of the respondents believe the exams are relevant to public safety.
- Academia, private practitioners, and societies provide the most useful input into FE and PE examinations.

- Almost half the respondents indicated that exams should have more questions devoted to practice issues.
- Most respondents believe their boards are committed to improving interstate mobility.
- Half the respondents indicated a willingness to adapt the Model Law requirements for education and experience.

A.8 Board Presidents Assembly

The strategic planning survey was discussed in depth at the Board Presidents Assembly, held in February of 2001 in Phoenix. The group discussed engineering licensure qualifications and determined that the greatest priority was establishing alliances with other organizations.

APPENDIX C

SUMMARY OF MEMBER ORGANIZATION POSITIONS ON LICENSURE

AMERICAN ACADEMY OF ENVIRONMENTAL ENGINEERS (AAEE): The Academy's position on licensure is codified in its Articles of Incorporation and Bylaws and in its descriptions of its membership and affiliate requirements published in annual editions of *Who's Who in Environmental Engineering*. Excerpts of applicable sections of each of these documents follow.

Certificate of Incorporation as Amended September 17, 1973

Article III, Paragraph b. (relates to the business of the Corporation)

b. To grant and issue to engineers duly licensed or registered by law to practice engineering and who meet the rules and regulations, standards, and qualifications as provided in the Bylaws, certificates of special knowledge in environmental engineering or in any specialty field thereof, and to revoke certificates so granted or issued; but no certificate granted or issued by the Corporation shall, of itself, confer or propose to confer, upon any person any legal qualification or privilege or license or registration to practice environmental engineering or any other profession; or shall purport to be issued under or in pursuance of, or by virtue of, any governmental sanction or authority.

Academy Bylaws

Article I, Corporation, Section 1.6 Affiliate Classes

b. ASSOCIATE ENVIRONMENTAL ENGINEER: A person who has received a B.S. or higher degree in engineering from an institution accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET); who holds a valid license to practice engineering issued by any state, territory, possession, or district of the United States; and is employed in the environmental engineering field, but who does not have the required years of experience to qualify for Diplomate (Active) status. Affiliation as an Associate Environmental Engineer shall be limited to a period of five (5) years from and after the date of issue of the person's first license to practice engineering.

c. INTERN ENVIRONMENTAL ENGINEER: A person who has received a B.S. or higher degree in engineering accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology; (ABET); holds a valid Engineer-in-Training (EIT) certificate issued by the licensing Board of any state, territory, possession or district of the United States; and who is employed in the environmental engineering field. Affiliation as an Intern Environmental Engineer shall be limited to a period of five (5) years from and after the date of admission as an Intern Environmental Engineer.

Article IV, Certification, Section 4

4.4.1.c. "The applicant must hold a valid license or a valid certificate of registration to practice engineering issued by the lawfully constituted registration board of any State, territory, possession or district of the United States, or from a foreign country, provided that said valid licenses or valid certificates of registration from foreign countries shall be evaluated by the Board on a case-by-case basis to determine if they meet the minimum standards set by the Board."

Membership and Affiliate Requirements—*Who's Who In Environmental Engineering*

Membership

- Those persons who possess a valid certificate of special knowledge in one or more of the specialties of environmental engineering as granted by the Academy are designated "Diplomates" and, as a consequence of their certification, are granted membership in the Academy.
- All members, except honorary members, must maintain a valid license or certificate of registration to practice engineering for placement and continuance in any membership class.

Affiliation

Membership in the Academy is a consequence of specialty certification and limited to those who maintain their specialty certificate. Affiliate status has been developed by the Academy to permit the inclusion in the professional environmental engineering community it represents of others who long to be a part of this community, but who are not board-certified. It is primarily intended for those who do not yet possess the necessary practical experience requirements for specialty certification described in the front of this book and for those who have retired from active practice. The Affiliates program, together with specialty certification, enables the Academy to serve the needs of all environmental engineers—from the college graduate to the retired engineer.

ACCREDITATION BOARD FOR ENGINEERING AND TECHNOLOGY, INC. (ABET): ABET has no formal policy or position statements on licensure at this time, but engineering licensure is referenced at various locations in their accreditation procedures and criteria.

AMERICAN COUNCIL OF ENGINEERING COMPANIES (ACEC): ACEC has no formal policy or position statements on licensure at this time.

AMERICAN SOCIETY FOR ENGINEERING EDUCATION (ASEE) and ASEE ENGINEERING DEANS COUNCIL (EDC): No formal policy or position statements on licensure were provided by ASEE or EDC, and none were found on the ASEE Web site.

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS (ASHRAE): ASHRAE has no formal policy or position statements on licensure at this time.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME): The following is the ASME policy on engineering licensure.

Preamble
ASME recognizes engineering in the varied disciplines as a learned profession that affects each individual and the public at large to a continuously increasing extent. This Society Policy is intended to recognize both the rapid changes taking place in the utilization of engineers and changes in the organization of engineering service groups. ASME regards the work and service performed by engineers to include responsibility for contributing to the betterment of the human experience, including the health, safety, welfare, and property of the public, and in so doing, engineers accept their share of responsibility on any project or design with which they are involved.

Policy
ASME endorses licensing as being in the best interest of the public and the profession. ASME encourages licensed engineers to identify themselves with the appropriate title in all communications and acknowledges that such identification is in the public and professional interest. The awareness by the public and by the engineering community engendered by licensing will enhance engineering as a single and noble profession.

Recommendations
ASME recommends:
- That any person in responsible charge of the practice of engineering be a legally licensed engineer.
- That legally licensed engineers be addressed or referred to in all written communications or publications as such by use of the appropriate title.
- That ASME members that practice engineering become licensed as soon as qualified so as to join members of other societies in enhancing engineering as one, single profession.
- That all qualified engineers who are educators become licensed and that they include in the engineering education curricula material concerning professional licensing.
- That each section of ASME present one program annually at a section meeting on the subject of engineering licensing and cooperate with authorized licensing bodies and other Professional Societies in offering courses for examination preparation.

Implementation
- ASME encourages all practicing members of other professional and technical societies to become licensed as soon as qualified.
- ASME encourages all engineers to continue to update their own competence to keep pace with the growing demands for professional and responsible leadership. The Board of Governors of ASME, having endorsed the concept of engineering licensing by all those who practice the art and science of mechanical engineering, further supports the concept that a regular program of technical and professional renewal, generally termed Continuing Professional Competency, be required for the continuation of licensure. While the specific requirements for Continuing Professional Competency remain the province of legally authorized bodies, ASME is supportive of the Model Rule written by the National Council of Examiners for Engineering and Surveying for implementing this position.
- ASME encourages all engineers to accept the responsibility for their work and their portion of any design or product as a distinct mark of their professionalism.

- ASME offers its facilities, liaison, encouragement and financial support to the efforts to obtain the maximum possible uniformity in licensing procedures and requirements, including assistance in preparation of professional examinations.
- ASME charges its Board on Professional Practice and Ethics to prepare or select annually an information article on licensing to be published in the MECHANICAL ENGINEERING Magazine.
- ASME directs the attention of all its members and other engineers to the need for thoughtful concern with licensing problems in the future.
- The ASME Constitution states that appropriate engineering licenses issued by legally authorized bodies may be deemed equivalent to eight years of active practice toward any grade of Society membership.
- Society Policy P-14.12 indicates specific licenses that are recognized as equal to the eight years of active practice requirement for any grade of Society Membership and to the five years of responsible charge requirement for Member grade.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE): ASCE has the following policy statements and resolutions regarding licensure.

ASCE Policy Statement 130

Policy

The American Society of Civil Engineers (ASCE) endorses, supports and promotes the licensure of professional engineers and land surveyors with necessary standards for education, experience, examination and continuing professional development. ASCE also supports the establishment of rules of professional conduct for engineers and land surveyors consistent with the Society's Code of Ethics to guide licensees in their practice.

Issue

The intent of licensure is to identify those individuals who possess the necessary qualifications to practice engineering and land surveying. Licensure is essential to the protection of the public health, safety, and welfare in matters pertaining to engineering or surveying. Because of the licensing process, the public can have confidence in the professional competency and conduct of engineers and land surveyors.

Rationale

ASCE is dedicated to the enhancement of the welfare of humanity. Licensure of engineers and land surveyors is an imperative element in the protection of the public health and safety. ASCE is committed to effective licensure.

ASCE Policy Statement 369

Policy

The American Society of Civil Engineers (ASCE) asserts that the primary purpose of the Fundamentals of Engineering Examination (FE) is to measure the preparedness of the engineering candidate for progress through the registration process.

Issue

Debate and discussion ranging from content, format, to purpose have surrounded the FE exam in recent years. Serious proposals have been put forth by various bodies advocating the expansion of the FE examination as a multi-purpose tool that would:

- Serve as an exit examination from engineering programs;
- Require passage as an engineering program degree requirement; and
- Serve to assess the competency of graduates of schools of engineering.
- This is in addition to the original and existing purpose of demonstrating preparedness for the goal of professional registration.

Rationale

- The professional registration process exists to ensure engineers have met minimum established standards. The FE exam should confirm that a candidate is ready to continue the registration process.
- To meet additional objectives, modifications to examination specifications would certainly be required. Resulting modifications for multiple purpose use may compromise the FE exam's fundamental purpose of achieving registration by diluting the FE exam subject matter. The FE examination should be limited in purpose because in trying to meet the needs of many purposes, it may not meet the needs of any one.
- It is not disputed that FE exam results could provide valuable information to educators. In fact, reviewing FE exam results by educators should be encouraged. State licensing boards should make results of the examination available to universities. Further, all accredited civil engineering degree programs should consider requiring students take, but not necessarily pass, the FE exam before graduation.

ASCE Policy Statement 376

Policy

The American Society of Civil Engineers (ASCE) encourages all state boards of engineering registration to institute a take-home examination on professional ethics for professional registration. The take-home exam should be based upon the State's Fundamental Canons of Professional Conduct and other appropriate administrative rules or regulations, and designed to demonstrate a working knowledge of professional ethics. Passage of the exam as established by the board of registration should be a requirement for professional registration.

Issue

Professional ethics is the cornerstone of engineering practice. Adherence to an ethical code ensures that practitioners will not practice in an area in which they are not competent. The majority of complaints referred to state boards of engineering for investigation and possible penalty action involve ethics and, often, a lack of understanding of the Fundamental Canons of Professional Conduct.

Rationale

A take-home exam based on the Fundamental Canons of Professional Conduct and other appropriate administrative rules will allow the Board to ensure familiarity and understanding on the part of the candidate for registration. Causing the candidate to become familiar with this material helps to eliminate ignorance as a cause of unethical behavior. Obvious difficulty in passing the exam can warrant further investigation of the candidate by the Board.

ASCE Policy Statement 385

Policy

- The American Society of Civil Engineers (ASCE) encourages government agencies at the local, state and federal levels to require registration of civil engineers who have responsible charge for preparing, supervising and/or approving public projects. Any prepared document should be sealed and signed by a registered professional engineer in accordance with the legal professional requirements of the jurisdiction within which the project is to be constructed.
- Government agencies are encouraged to pay registration fees of their engineering employees. Should multi-state registration be required, registration cost should be paid for by the employer.

Issue

States and other jurisdictions normally require professional engineers to seal and sign plans for which they have design responsibility. Such plans and specifications, whether prepared by consultants or in-house, normally are reviewed by a supervising engineer of the administering public agency. The engineer who has responsible charge should be a registered professional engineer in order to appropriately conduct such a review. When the engineer has responsible charge for designs in more than one state, multiple registrations may be required to enable the professional to meet legal requirements.

Rationale

- Engineers are employed by federal, state and local units of government. The duties of these engineers cover a broad range of engineering responsibilities including, but not limited to, the following: field inspection and supervision; review and approval of project reports; supervision or preparation of project designs, contract plans and specifications; review and approval of plans and specifications prepared by others; review and approval of shop drawings and preparation and approval of design changes.
- While government engineers may be augmented by consultants, the long-term responsibilities for the constructed project remain with the government agency, and this responsibility cannot be transferred to the private sector. It logically follows that the government engineer should be equally if not more professionally qualified and should at least meet the same requirements as those consulting engineers being managed. A staff of registered professional engineers should be maintained by government agencies to provide the continuity of professional services needed to uphold the public safety, health and welfare interests involved with government projects.
- The government engineer can assist in legal matters which must be adjudicated, or in policy matters being promulgated by the entity being represented. Additionally, the government engineer may, from time to time, be asked to appear as an expert witness on behalf of that entity. Foremost in any deposition or testimony is the determination of the qualifications and special experience of the individual appearing. In engineering matters, the professional registration and active practice in the profession would be important factors to be considered in establishing credibility as an expert. Registration of the government engineer would attest to the engineer's competence.
- Engineers responsible for designs in more than one state may be required to obtain professional registration in all those states in which the projects are to be constructed. Accordingly, the registration requirements should be included in the engineer's job description, and appropriate compensation or reimbursement should be provided in recognition of this requirement.

ASCE Policy Statement 425

Policy

The American Society of Civil Engineers (ASCE) supports documented continuing professional development as a condition for maintaining status as a licensed Professional Engineer.

Issue

It is essential that practicing civil engineers remain current with issues and advancements in technology. In recent years state boards and their state legislators have also placed increasing importance on continuing professional development to ensure that practicing professionals maintain their competence. In addition, increased opportunities for international practice may require engineers to conform to an objective measure of competence.

Rationale

- ASCE has a Fundamental Canon in its Code of Ethics that states engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.
- ASCE is dedicated to the advancement of the profession of engineering to enhance the welfare of mankind. Continuing professional development can help ensure that practicing professionals maintain their competence. ASCE is committed to providing leadership, encouragement, and opportunities to achieve this continuing professional development.

ASCE Policy Statement 432

Policy

The American Society of Civil Engineers (ASCE) supports licensing examinations that recognize the breadth of civil engineering practice by providing the candidates with the opportunity to demonstrate their unique competency covering a reasonable range of problems from several different discipline subsets.

Issue

The accepted accreditation criteria for civil engineering programs include education in subjects required for competence in the performance of tasks required for civil engineering projects. The practice of civil engineering may require performance of tasks within specialty areas. However, the successful completion of civil projects requires comprehensive knowledge, experience and judgment in all the related elements of said practice. Licensure as a professional engineer requires the civil engineer to assume responsibility for competency in the broad area of practice. Therefore, the examination taken for licensure should measure the civil engineer's ability in specialty areas and require demonstration of the civil engineer's ability to merge project elements into a unified whole.

Rationale

ASCE strongly supports the traditional concept of civil engineering as the integrated practice of engineering embracing a number of related specialty areas including, but not limited to, transportation, structures, water resources, environmental and geotechnical. The preliminary examination specifications provided by the Civil Engineering Subcommittee of the Examinations for Professional Engineers (EPE) Committee of the National Council of Examiners for Engineering and Surveying (NCEES) recognize this goal.

ASCE Policy Statement 433

Policy

- The American Society of Civil Engineers (ASCE) believes that the following standards are the only basis on which any title or designation should include the term "engineer".
- Graduation from an accredited engineering program with a degree in engineering.
- Registration as a professional engineer or engineer-in-training under a state engineering registration law.
- An official ruling designating an individual or a group in an engineering capacity as meeting the definition of "Professional Engineer" under the Taft-Hartley Act, or the Fair Labor Standards Act.
- Only persons in one of these categories should be designated by an appropriate title "engineer" or "professional engineer". This policy shall not be construed to prohibit using the word "engineering" as a modifier in titles such as "engineering assistant", "engineering aide" and "engineering technologist" where the title clearly implies that the duties of the position are not those of professional engineer.
- ASCE further encourages registered professionals to always use their P.E. title on any professional correspondence and communication.

Issue

Improper use of the term "engineer" can be misleading to the public. Employers and employees misuse the term in titles and resumes. This casual misuse of the title by groups and people who should be knowledgeable tends to belittle the title which should be applied only to people qualified professionally by accepted standards of law and/or engineering practice.

Rationale

There is a need within ASCE as well as within government and other organizations with practicing professional engineers to provide employee titles and/or classifications that properly identify the individual's position within that organization. A title such as "designer" is not proper for a graduate engineer with two to three years experience; "junior engineer" or similar title as used by ASCE in designating professional grades is more appropriate.

ASCE Policy Statement 450

Policy

- The American Society of Civil Engineers (ASCE) endorses, supports, and promotes the following:
- The majority of each state licensure board consist of licensed professional engineers and land surveyors;
- At least one public member serve on each state licensure board;
- At least one engineering educator on each state licensure board;
- The state boards of registration work closely with the state legislators in maintaining appropriate licensure laws that affect the practice of engineering or land surveying;
- The state licensure boards maintain a continuing surveillance over the technical competence of licensed professional engineers and licensed professional land surveyors;
- The state licensure boards administer and regulate licensure by comity/reciprocity for those licensed professional engineers and land surveyors meeting the necessary criteria for that state;
- Licensure and renewal fees imposed by the state licensure boards be consistent with the cost of services involved in the administration and enforcement of the appropriate regulatory acts, and that all fees be used implementing the licensure act; and
- Elimination of special or general-purpose taxes as a condition of licensure or professional practice.

Issue

- It is the right and responsibility of government to protect the health and safety of its citizens. The sole purpose of state status requiring licensing of engineers is to protect the health, safety and welfare of the public by identifying individuals that have met certain education, experience and competence standards for licensing and have agreed to the ethical practice of their profession.
- The public interest is best served when the judgment of technical qualifications and evaluation of professional competence are made by state licensure boards with members who are themselves licensed professional engineers and land surveyors.
- While it is essential for the states to exercise their authority through the legislatures and the courts and to view the consequences of their laws, these bodies are not in a position to set standards of technical competence or to control the various levels of practice; nor is the general public able to exercise this responsibility. This responsibility is, therefore, delegated to the individual state boards of registration. It is incumbent upon the members of the state licensure boards to demonstrate that they are capable of setting standards of education, experience and examination for licensure; that they can impose and enforce rules of professional conduct; and that they are in the best position to maintain a continuing watch over the technical competence of practicing engineers and land surveyors, in the best interest of the public.

Rationale

ASCE is dedicated to the enhancement of the health, safety and welfare of humanity. ASCE is committed to effective involvement in the licensing process for professional engineers and land surveyors by the individual state licensure boards which are essential to protection of the public health, safety and welfare.

ASCE Policy Statement 464

Policy

The American Society of Civil Engineers (ASCE) supports the concept of a mobility agreement for transfer of professional licensure among states.

Issue

Civil engineers represent the largest component of licensed professional engineers in the United States. At the time professional engineering laws were being adopted by states, civil engineering was usually practiced within a limited geographic area. Advances in transportation speed and communications technology, coupled with a population-wide trend of increased mobility, have caused consequential changes in the marketplace for civil engineers. Today's civil engineers often relocate in response to shifts in emphasis on infrastructure development in different parts of the country. Engineers often work for several firms during their careers. Today's engineering projects often involve a team approach involving several firms in multiple locations. Based upon these and similar issues, ASCE sees a need for rapid licensure of its already licensed members in additional states as employment and project opportunities arise. Where a member already holds licensure in one state and has demonstrated professional competence through years of successful practice, that member should be able to secure licensure in additional states through some uniform, prompt process. However, at the current time, cumbersome procedures and administrative regulations of some state licensure boards delay acquisition of a license by reciprocity for a professional already licensed in another state.

Rationale
Inasmuch as the future will require wider vision on the part of engineers, rapid response to infrastructure and other public needs, and a diminished importance of state boundary lines in engineering work, ASCE supports adoption of criteria for a national licensure mobility agreement.

ASCE Policy Statement 465
Policy
- The American Society of Civil Engineers (ASCE) 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.
- ASCE encourages institutions of higher education, governmental units, employers, civil engineers, and other appropriate organizations to endorse, support, and promote the concept of mandatory post-baccalaureate education for the practice of civil engineering at a professional level. The implementation of this effort should occur through establishing appropriate curricula in the formal education experience, appropriate recognition and compensation in the workplace, and congruent standards for licensure

Issue
The practice of civil engineering at the professional level means practice as a licensed professional engineer. Admission to the practice of civil engineering at the professional level means professional engineering licensing which requires the following:
- A body of specialized knowledge as reflected by a combination of a baccalaureate degree and a master's or equivalent (MOE)
- Appropriate experience
- Commitment to life-long learning

The required body of specialized knowledge includes a technical core, technical electives, a non-technical core and technical and non-technical courses to support individual career objectives. The current baccalaureate civil engineering degree is an entry-level degree that may no longer be adequate preparation for the practice of civil engineering at the professional level.

The civil engineering profession is undergoing significant, rapid, and revolutionary changes that have increased the body of knowledge required of the profession. These changes include the following:

- Globalization has challenged the worldwide geographic boundaries normally recognized in the past, primarily as a result of enhanced communication systems.
- Information technology has made, and continues to make, more information available; however, the analysis and application of this information is becoming more challenging.
- The diversity of society is challenging our traditional views and people skills.
- New technologies in engineering and construction are emerging at an accelerating rate.
- Enhanced public awareness of technical issues is creating more informed inquiry by the public of the technical, environmental, societal, political, legal, aesthetic, and financial implications of engineering projects.
- Civil infrastructure systems within the United States are rapidly changing from decades of development and operation to the renewal, maintenance and improvement of these systems.
- These changes have created a market requiring civil engineers to have simultaneously greater breadth of capability and specialized technical competence than that required of previous generations. For example, many civil engineers must increasingly assume a different primary role from that of designer

to that of team leader. The knowledge required to support this new market is found in the combination of an appropriate baccalaureate education and the completion of post-graduate courses sufficient to attain a master's degree or its equivalent.

Rationale

- Requiring education beyond the baccalaureate degree for the practice of civil engineering at the professional level is consistent with other learned professions. The body of knowledge gained, and the skills developed in the formal civil engineering education process, are not significantly less than the comparable knowledge and skills required in these other professions. It is not reasonable in such complex and rapidly changing times to think that we can impart the specialized body of knowledge and skills required of professional engineers in four years of formal schooling while other learned professions take seven or eight years. Four years of formal schooling were considered the standard for three professions (medicine, law, and engineering) 100 years ago, and while medicine and law education lengthened with the growing demands of their respective professions, engineering education did not. Perhaps this retention of a four-year undergraduate engineering education has contributed to the lowered esteem of engineering in the eyes of society, and the commensurate decline in compensation of engineers relative to medical doctors and lawyers.
- Current baccalaureate programs, while constantly undergoing review and revisions, still retain a nominal four-year education process. This length of time limits the ability of these programs to provide a formal education consistent with the increasing demands of the practice of civil engineering at the professional level. There are diametrically opposed forces trying to squeeze more content into the baccalaureate curriculum while at the same time reducing the credit hours necessary for the baccalaureate degree. The result is a production line baccalaureate civil engineering degree satisfactory for an entry-level position, but maybe inadequate for the professional practice of civil engineering. The four-year internship period (engineer-in-training) after receipt of the BSCE degree cannot make up for the formal educational material that would be gained from a master's degree or equivalent program.
- The implementation of this concept will not happen overnight. While ASCE cannot mandate that it be done in a specified time period or manor, ASCE will be an active partner with other groups and organizations to accomplish this policy. The ultimate full implementation may not occur for 20 or more years. Appropriate grandfathering for existing registered and degreed engineers would be a part of the implementation process. This concept is a legacy for future generations of civil engineers. However, perhaps the most important aspect of the implementation of this policy is already in place. Within the U.S. system of higher education, high quality, innovative and diverse master's degree programs currently exist in colleges and universities to support this concept. A growing number of organizations now offer high quality on-site and distance learning educational opportunities. The active support of this policy by all of the stakeholders in this process, such as the educational institutions, the registration boards, and the various employers of civil engineers, will be required to develop and promote the elements necessary to eventually implement this concept.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS—USA (IEEE): IEEE–USA has the following policy statements regarding licensure.

IEEE Policy 7.6—Protection of the Public

The IEEE recognizes the obligation of the profession to protect the health, welfare, and safety of the public. Where legislation, regulations, codes, or customs impact on electrical and electronics

engineering, the Institute shall interface whenever and wherever appropriate with legislative and regulatory bodies. In particular, legislation may include the establishment of qualifications of engineers and the registration and/or licensure of engineers. In furtherance of this policy, the IEEE:

- Offers advice and assistance to legislative and regulatory entities;
- Encourages the establishment of uniform laws as being in the public interest;
- Recommends that there be a minimum of restrictions of a legal nature in the functioning of qualified engineers;
- Offers advice and assistance to Boards of Engineering Examiners and similar agencies;
- Recommends that, upon request, committees of IEEE members cooperate with appropriate agencies in the development of sound registration examinations which will adequately protect the public interest.

IEEE Policy 7.100—Registration of U.S. Engineers
The IEEE, in furtherance of IEEE Policy 7.6 (Protection of the Public) and IEEE Policy 7.8 (Code of Ethics), as they apply to the United States, recognizes that licensure and registration contributed to the professions' efforts to protect the health, safety, and welfare of the public by ensuring that practitioners meet minimum recognized levels of education, experience, and competence. In support of this position, the IEEE:

A. Aggressively represents the interests of IEEE members in the licensure and registration process;
B. Actively participates in the development of sound engineering licensure and registration procedures on a continuing basis;
C. Strives to promote the adoption of uniform engineering licensure and registration requirements among all states and territories;
D. Participates in developing content and specifications for national examinations that are used to evaluate engineering competence; and
E. Strongly encourages individuals to pursue engineering licensure and registration, not only as a means of meeting the legal requirements for protecting the health, welfare, and safety of the public, but also to ensure that they can be prepared to meet the needs of international, national, and state engineering practices.

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS (NSPE): The licensing or registration of engineers in the United States and its jurisdictions has been a key goal of NSPE since its founding in 1934. The following Position Statement is made to expand and detail the thinking which undergirds NSPE's Professional Policy No. 152, Licensure and Qualifications to Practice (also shown below).

Position Statement
Engineering Licensure
"Licensure as a professional engineer" is the statutory process through which a person meets the legal requirements sufficient to be permitted by law to practice engineering in that jurisdiction. Licensing and registration are the terms used, often interchangeably, in the state statutes to establish these requirements.

State licensure laws for design professionals are predicated upon and justified only as a means to protect the public health, safety, and welfare. The public interest is best served by the licensure of all qualified individuals within the engineering profession.

Licensure Law
NSPE endorses enactment of uniform licensure laws in all jurisdictions. The National Council of Examiners for Engineering and Surveying (NCEES) has developed Model Laws as guides for use by engineering licensure (registration) boards and legislatures in the interest of achieving uniform laws for the licensure of engineers in all jurisdictions.

NSPE endorses the NCEES Model Law definitions of the "practice of engineering" and the "practice of land surveying" and encourages enactment of Model Law provisions.

NSPE endorses and supports the concept of licensure of engineers only as a "Professional Engineer" and opposes licensure status by designated branches or specialties.

Qualifications
NSPE encourages the adoption of the following provisions in all jurisdictions:

a. Establish the bachelor's degree in engineering from a program accredited by the Accreditation Board of Engineering and Technology/Engineering Accreditation Commission (ABET/EAC) or one assessed by ABET/EAC as substantially comparable, as the minimum educational requirement for licensure.
b. Pass the Fundamentals of Engineering and Principles of Practice examinations as prepared and administered by NCEES. NSPE encourages all eligible students to take and pass the NCEES Fundamentals of Engineering examination prior to graduation.
c. Obtain at least four years of professional experience after the degree described above, with experience credit allowed for graduate study of engineering or teaching of advanced engineering subjects in an ABET/EAC-accredited engineering curriculum.
d. Permit a nonlicensed individual who holds both an ABET/EAC-accredited undergraduate degree or its equivalent and a Ph.D. from an engineering program that is ABET/EAC accredited at the undergraduate level, to be excused from taking the Fundamentals of Engineering examination.
e. Engineering faculty who hold an ABET/EAC accredited undergraduate degree, or hold a Ph.D. in engineering from an institution that offers an ABET/EAC accredited undergraduate degree should be excused from taking the Fundamentals of Engineering exam.

Licensure Boards
Appointment of public members to licensure boards is supported in recognition of their many valuable contributions to nontechnical aspects of the licensing process; however, the public interest is best protected when a majority of the boards are licensed professional engineers. Both the evaluation of technical qualifications of applicants and evaluation of professional practice should be made only by those members of the board who are licensed professional engineers.

Licensing Fees

- NSPE supports adequate fees by the states to cover the cost of examination, periodic license renewal, administration, and effective enforcement of the licensure act. Fees for licensed professionals should support the full cost of administering the licensing program, but should not become a source of general taxation.
- Since many engineers maintain licenses in multiple jurisdictions, but only infrequently need them for active practice in all jurisdictions, NSPE supports an inactive status license at a reduced fee for those not actively performing work in a jurisdiction. Provisions for returning to active status should include a reasonable fee structure and demonstration of continuing competence or active practice in another jurisdiction.

Engineering Practice

- The National Society of Professional Engineers is vitally interested in the concerns of engineers to practice engineering within their technical competence for the continued betterment of society. Such practice is subject to disciplinary control by and through the state boards of engineering licensure and by the appropriate committees on engineering conduct.
- As to the relationship between the engineer and other design professionals on building projects, it is the prerogative of the client to select and designate the prime professional. Professionals so retained should perform only those services for which they are competent and should utilize the services of other qualified professionals as required to provide a proper and complete professional service to the client, consistent with applicable law. The various design professions should remain separate but continue to cooperate and work together in a joint effort of service for the good of the public.

Engineers in Education

- The National Society of Professional Engineers recognizes the responsibility of engineering faculty in formulating curricula and teaching students to prepare them for the practice of engineering. To fulfill this responsibility as it relates to the public health, safety, and welfare, engineering faculty teaching advanced engineering subjects should be licensed professional engineers. An engineering educator who heads an engineering department or division or who is dean of an engineering college should be a licensed professional engineer at the time of appointment.
- This practice should be mandatory in engineering school administration and a part of the criteria for accrediting engineering programs as administered by the Accreditation Board for Engineering and Technology (ABET).
- All engineering institutions are urged to properly identify the licensed professional engineer faculty members as "PE" in the catalog of the school and in other publications where names of faculty appear.

Engineers in Research

Individuals performing applied engineering research which meets the definition of the practice of engineering should be licensed professional engineers.

Exemptions

The National Society of Professional Engineers believes strongly that state engineering licensure laws should apply to all individuals who practice engineering as defined in the NCEES Model Law. All employers are urged to promote professional licensure of all qualified individuals and to utilize licensed professional engineers in performing engineering work. NSPE will assist and cooperate with employers in the development of programs which encourage the licensure of qualified employees.

Land Surveying
The model law for licensure of land surveyors as prepared by NCEES is endorsed. Cadastral and topographic surveying and mensuration and the preparation of maps, plats, and profiles depicting topography, property boundaries, and the location of certain other surface features is within their appropriate area of practice. Accordingly, NSPE supports land surveyors having the lead or primary role for the preparation and certification of documents pertaining to such work, consistent with state law.

Certification Programs
Following licensure as a professional engineer, individuals may voluntarily have their expertise in a specified field of engineering recognized through an appropriate specialty certification program. Such certification must not imply that other licensed professional engineers are less qualified for practice in a particular field of specialty. Professional engineering licensure is the only qualification for engineering practice. NSPE and its state societies will actively oppose attempts to enact any local, state or federal legislation or rule that would mandate certification in lieu of or beyond licensure as a legal requirement for the performance of engineering services.

Professional Engineer Intern
To more adequately reflect the educational achievement of candidates for licensure and their progression toward professional engineer status, NSPE supports the use of the title Professional Engineer Intern (PEI), formerly Engineer in Training (EIT), and will exercise its influence to secure appropriate changes in the statutes and literature of the profession to include the new title.

Enforcement
NSPE and its state societies should take an active role in assisting state licensure (registration) boards in the enforcement and disciplinary provisions assigned by statute.

Professional Policy No. 152—Licensure and Qualifications for Practice

- It is NSPE's policy that "licensure as a professional engineer: is the appropriate statutory process by which an individual meets the legal requirements to practice engineering in any jurisdiction. Further, NSPE endorses and supports the enactment of uniform licensure laws in all jurisdictions."
- NSPE endorses the National Council of Examiners for Engineering and Surveying (NCEES) Model Law as a guide for use by engineering licensure (registration) boards and legislatures in the interest of achieving uniform laws for the licensure of engineers in all jurisdictions. NSPE encourages its state societies and jurisdictions to utilize the NCEES Model Law. NSPE supports the concept of licensing engineers only as a "Professional Engineer" rather than licensure by designated branches or specialties. NSPE endorses and supports the adoption in all states of expedited comity licensure procedures.
- With respect to qualifications to practice, NSPE encourages the adoption of the provisions, noted below, in all jurisdictions.

    1. Establish the bachelor's degree in engineering from a program accredited by the Accreditation Board of Engineering and Technology/Engineering Accreditation Commission (ABET/EAC) or one assessed by ABET/EAC as substantially comparable, as the minimum educational requirement for licensure.
    2. Pass the Fundamentals of Engineering and Principles of Practice examinations as prepared and administered by NCEES. NSPE encourages all eligible students to take and pass the NCEES Fundamentals of Engineering examination prior to graduation.

3. Obtain at least four years of professional experience after the degree described above, with experience credit allowed for graduate study of engineering or teaching of advanced engineering subjects in an ABET/EAC-accredited engineering curriculum.
4. Permit a nonlicensed individual who holds both an ABET/EAC-accredited undergraduate degree or its equivalent and a Ph.D. from an engineering program that is ABET/EAC accredited at the undergraduate level, to be excused from taking the Fundamentals of Engineering examination.
5. Engineering faculty who hold an ABET/EAC accredited undergraduate degree, or hold a Ph.D. in engineering from an institution that offers an ABET/EAC accredited undergraduate degree should be excused from taking the Fundamentals of Engineering exam.
6. Permit a nonlicensed individual who holds an ABET/EAC accredited undergraduate degree and who has fifteen years or more of acceptable engineering experience to be excused from taking the fundamentals of engineering examination.
7. Engineer-Intern—To more adequately reflect the educational achievement of candidates for licensure and their progression toward professional engineer status, NSPE supports the use of the title "Engineer-Intern or such other recognized designation" in lieu of the formerly used title "Engineer-in-Training", and will use its influence to secure appropriate changes in the statutes and literature of the profession to include the title "Engineer Intern."

Professional Policy No. 168—Engineering Education Requirements

- With the continuing rapid expansion of knowledge required to practice in the basic as well as the many specialized areas of engineering, NSPE believes that additional engineering education, beyond the four year ABET/EAC degree, will be required in order to meet the formal academic preparation necessary for the practice of engineering at the professional level (licensure) in the 21st century.
- Therefore, NSPE supports the concept of engineering students meeting additional academic requirements as a prerequisite for licensure and practice of engineering at the professional level. Possible additional requirements could include a master's degree or equivalent.
- In addition, NSPE supports the near term implementation of specialty certification programs beyond engineering licensure in appropriate engineering disciplines. Such specialty certification programs should require a master's degree or equivalent, additional specialized experience and documentation of technical proficiency in that discipline.