AC 2011-163: ENGINEERING LICENSURE LAWS AND RULES, TODAY AND TOMORROW

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A Primer on Engineering Licensure in the United States

Craig N. Musselman, P.E.; Jon D. Nelson, P.E.; Monte L. Phillips, Ph.D., P.E.

ABSTRACT The purpose of this paper is to provide a basic description of engineering licensure in the United States, including the education, experience, examination and continuing professional development qualifications required in order to acquire and maintain a license as a Professional Engineer, now and in the future. The paper also describes the legal context of engineering licensure, the form and function of state Boards of Licensure of Professional Engineers and selected current topics in engineering licensure. This is intended as a broad treatment for those who have not been exposed to the details of engineering licensure.

The qualifications required for licensure as a professional engineer in the United States are set by each jurisdiction through the state's engineering statute, and rules established by the state board of licensure of professional engineers implementing those statutory requirements. The law and the rules differ in each state.

The National Council of Examiners for Engineering and Surveying (NCEES) maintains a Model Law and Model Rules to be used as a guide by states when they update their individual law and rules. The NCEES Model Law and Rules were changed in 2006 to require additional engineering education after 2020. These requirements become applicable if and when individual states adopt the Model Law 2020 requirements.

Qualifications for licensure are based on what is often termed a "three legged stool" of education, examination, and experience.

Current qualifications required for licensure vary from state to state. All jurisdictions will provide a license to a "Model Law Engineer" who possesses Model Law attributes including: a baccalaureate degree in engineering from a program accredited by the Engineering Accreditation Commission of ABET ("EAC/ABET"); four years or more of acceptable and progressive engineering experience; documentation of having passed both the Fundamentals of Engineering (FE) examination and the Principles and Practices of Engineering (PE) examination, and; a record which is clear of violations of ethical standards. Most states have other additional pathways to engineering licensure for those with alternative education backgrounds, often accompanied by additional years of engineering experience.

The Model Law 2020 education requirements for engineering licensure specify: 1) a master's degree from a master's program accredited by EAC/ABET, or a baccalaureate degree from a program accredited by EAC/ABET plus either: 1) a master's degree in engineering from an

institution which offers EAC/ABET programs, or; 2) 30 additional semester credits of upper level undergraduate or graduate level coursework in engineering, math, science and professional practice topic areas. NCEES is currently considering additional pathways to licensure for the Model Law 2020 provisions. This paper will describe the Model Law 2020 requirements currently in place, and the alternatives currently being considered.

Engineering licensure requirements are subject to "industrial exemptions" which are present in the statutes in some but not all states. In general, the exemptions allow the practice of engineering without licensure in such areas as electrical or telecommunications utilities, and businesses which manufacture a product. Fourteen states have no such industrial exemptions. In response to recent oil spills and mining disasters, both the National Society of Professional Engineers ("NSPE") and NCEES have committees evaluating whether these industrial exemptions provide adequate protection of the public health, safety and welfare.

A Primer on Engineering Licensure in the United States

By: Craig N. Musselman, P.E.; Jon D. Nelson, P.E. and; Monte L. Phillips, Ph.D., P.E.

1.0 Introduction

The purpose of this paper is to provide a basic description of engineering licensure in the United States, including the education, experience, examination and continuing professional development qualifications required in order to acquire and maintain a license as a Professional Engineer, now and in the future. The paper also describes the legal context of engineering licensure, the form and function of state Boards of Licensure of Professional Engineers and selected current topics in engineering licensure. This is intended as a broad treatment for those who have not been exposed to the details of engineering licensure.

It should be recognized that the specific requirements of each state vary. This paper describes a variety of requirements or provisions applicable to "some" or "many" states, and presents "typical" requirements. For a definitive answer to any question regarding state licensure requirements, the specific statute and rules for that state should be reviewed. Full information is typically available on state Board of Licensure of Professional Engineers ("PE Board") websites.

2.0 History and Purpose of Engineering Licensure

As a result of well publicized construction failures with fatalities in the late 1800's and early 1900's, states began to adopt engineering licensure laws to provide protection of the public health, safety and welfare. Wyoming was the first state to adopt a licensure law, in 1907. It took approximately 40 years for each of the remaining states to adopt an engineering statute. Since the 1960's, all fifty states, four US territories and the District of Columbia have had engineering licensure laws in place.

Engineering is typically defined as the creative application of science and mathematics in the evaluation, planning, design or operation of engineered projects which have the potential to impact the public health, safety and welfare. The purpose of regulating the practice of engineering through statutes and rules is to provide assurance to the public of a minimum level of competence of all engineers who provide engineering services which have a potential impact on the public health, safety and welfare. To accomplish that purpose, licensure laws stipulate minimum levels of engineering education and experience, and require that applicants pass examinations intended to assess technical competence. The state laws and rules also provide codes of professional conduct, requiring among other things that engineers hold paramount the

protection of the public health, safety and welfare, and stipulate disciplinary processes for those licensed professional engineers who are determined, following due process, to have not complied with the professional conduct requirements.

The state statutes and rules generally prohibit those who are not professional engineers in that state from offering to practice, or practicing, engineering as professional engineering is defined. Some states grant jurisdiction over non-licensed practice to their respective state boards; however, some do not and opt to leave such enforcement to the legal arms of the state. Some states also exempt certain types of engineering practice from regulation.

2.0 Legal Context of Engineering Licensure

In the US political system, states, and not the Federal government, have the right to regulate professions. States have licensure requirements in place to regulate the practice of medicine, law, engineering, architecture, pharmacy, accountancy, and many other professions. In our system, the Federal government has the authority and responsibilities accorded to the Federal government under the provisions of the US constitution, and the regulation of professions is not one of those functions. Thus, engineering licensure is a state function, subject to the provisions of each individual state statute, and the rules adopted by each state to implement that statute. Conversely, states cannot require licensure of Federal employees in engineering or other professions or require licensed practitioners to be licensed while working on Federal facilities. This concept goes back to Federal court precedence in 1920 determining that a state could not require of a Federal employee something as basic as a driver's license (JOHNSON V. MARYLAND, 254 U. S. 51 (1920) See... http://supreme.justia.com/us/254/51/case.html).
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Each state (or jurisdiction as they are commonly called because five US territories also regulate engineering practice) maintains its own engineering statute which has a 60 to 100 year legislative history. State engineering statutes typically define engineering, establish the form and function of the PE Board, and specify the broad qualifications required for licensure. The statute is modified only by action of the state legislature with the signature of the governor. The details required to implement the statute are provided in Rules which are adopted and implemented by the PE Board, typically following a formal rule setting procedure set forth by the legislature.

The National Council of Examiners for Engineering and Surveying (NCEES), which consists of the PE and Surveying Boards in all of the jurisdictions, maintains a Model Law (http://www.ncees.org/About_NCEES/Publications/Publications/Model_Law.php) and Model Rules (http://www.ncees.org/About_NCEES/Publications/Publications/Model_Rules.php) which provide guidance to each PE Board when they consider changes to their state law and rules. Because each state has a long and unique legislative history, no state statute mirrors the NCEES Model Law verbatim, and no state's rules are strictly in accordance with the NCEES Model Rules. States have made significant efforts to assure that their statute and rules are reasonably

consistent with the Model Law and Model Rules such that duly qualified professional engineers who are residents in that state will be able to be licensed in other states. In addition to the qualifications specified in the NCEES Model Law and Model Rules, many states provide alternate pathways to licensure for applicants who do not meet the educational requirements of the Model Law. These alternate pathways apply in that state, but do not necessarily apply in other states.

Each jurisdiction's statute specifies the form and function of the PE Board. Many PE Boards are combined engineering and surveying boards, while other states maintain separate boards of licensure for engineering and for surveying. PE Boards typically consist of a majority of PE's (or professional engineers and professional surveyors on a combined board), with one or more public members who are typically required to not be part of the engineering profession. Some PE Boards include other design-related professions such as architecture or landscape architecture. Board members are typically gubernatorial appointments. In some states professional societies have formal input in making recommendations to the governor; however, it is more common for the selection of PE Board members to be solely at the discretion of the governor. PE Board members typically serve for one or two terms, with terms generally ranging from 3 to 6 years. Some states have term limits while others do not.

PE Boards, and PE Board members, have several basic functions. The primary and most time consuming function is the review of applications for licensure and the qualifications of the applicants. Those applying to take the Fundamentals of Engineering examination (the "FE exam") who are students or graduates of EAC/ABET engineering programs are typically approved without much review. The educational qualifications of those with alternate education backgrounds are typically reviewed in detail by PE Board members. Board members typically split up the task of detailed review of the education and experience of each individual application for initial licensure as a professional engineer, and follow it with a full board review to ensure the applicant is qualified for licensure and to sit for the Principles and Practices of Engineering examination (the "PE exam"). Applicants who are denied the opportunity to sit for the PE exam have due process rights, including the right to a hearing, and appeal processes.

A second basic function of PE Boards is the adjudication of complaints regarding licensed professional engineers, and, in some jurisdictions, complaints regarding the practice of engineering by those who are not licensed as professional engineers. This process involves investigation of a complaint, typically by PE Board enforcement staff or attorney general's staff, with the involvement of one PE Board member. Based on an investigation report, the PE Board decides whether the complaint has merit and any disciplinary actions which might be deemed appropriate. Professional engineers have due process rights in disciplinary cases, including a right to a hearing before the Board and subsequent appeals typically through the PE Board first and then through the courts. PE Boards share information on the results of disciplinary cases.

Discipline in one state can preclude an engineer from being licensed, or continuing to be licensed, in other states.

A third basic function of the PE Board involves periodic review and modification of the Rules, and, in many states, involvement in the legislative process if and as modifications to the state engineering statute are considered by the legislature.

PE Boards and its members play a legal and regulatory role in protecting the public health, safety and welfare, by assuring that those who are licensed as professional engineers and authorized to provide engineering services to the public possess the minimum set of qualifications required to practice engineering, and that their conduct in the practice of engineering meets established and legally enforceable codes of professional conduct.

3.0 Qualifications for Licensure as a Professional Engineer

The basis of engineering licensure is often characterized as a "three-legged stool", consisting of the "three E's": Education; Experience and Examination. As time goes on, and as more and more states require continuing education as a prerequisite for renewal of a PE license, the "three-legged stool" may be turning into a "four-legged stool" of education, experience, examination and continuing professional development. The requirements for each of these, as they stand today and as they may stand in the future, are described in the following sections. These four qualifications act independently and together. Each is important in providing assurance of minimum qualifications to protect the public health, safety and welfare.

3.1 Engineering Education Qualifications

The current NCEES Model Law and Model Rules require a bachelor's degree in engineering from a program accredited by the Engineering Accreditation Commission (EAC) of ABET ("BS ABET EAC" herein). The laws and rules in all engineering licensure jurisdictions currently list a BS ABET EAC degree as the basic educational qualification for licensure. Also, most states accompany this basic qualification by an "or equivalent" qualifier. Some degrees from foreign institutions may be deemed equivalent by the Board. NCEES provides a foreign degree evaluation service that is used by many jurisdictions to provide a basis for that determination.

In addition to the BS ABET EAC degree required by all jurisdictions, some states allow for pathways to licensure for those possessing alternate educational backgrounds. A detailed listing of the alternate requirements in each state may be found at this link: http://community.nspe.org/blogs/licensing/archive/2010/01/04/table.aspx. In summary, 30 states provide a pathway to licensure for an applicant with a BS degree in engineering technology from a program accredited by the Technology Accreditation Commission (TAC) of ABET, typically

with one to four additional years of experience (a total of 5 to 8 years of engineering experience). Thirty five states allow a pathway for graduates with a BS in Engineering from non-ABET EAC accredited programs (domestic or foreign), and twenty states provide an alternate pathway, also with additional experience requirements, for those with a baccalaureate degree in science. Eight states provide a pathway to engineering licensure without a baccalaureate degree, with many of those requiring 12 to 25 years of engineering experience. This last pathway is not commonly used in those states where it is allowed.

In 2006, and with subsequent votes and amendments, NCEES modified the Model Law to require, as of the year 2020, additional engineering education beyond the baccalaureate level as a prerequisite for licensure. These changes are part of the Model Law and the Model Rules, which provide guidance as jurisdictions consider changes to their engineering statute and rules in the future. These requirements do not become applicable in any jurisdiction until adopted as a modification of the state statute and the PE Board's rules. To date, as of 2010, no jurisdictions have adopted these additional requirements.

The Model Law 2020 provisions as adopted by the NCEES Council to date require, after the year 2020, the following educational qualifications:

A BS ABET EAC plus a master's in engineering from an institution which offers programs accredited by EAC/ABET, or;

A BS ABET EAC plus 30 additional semester credits of upper level undergraduate or graduate level coursework in acceptable topic areas from approved providers, or:

A master's degree in engineering from a graduate program accredited by EAC/ABET, regardless of the nature of the baccalaureate degree.

In the second pathway above, "acceptable topic areas" refers to engineering topics, which can constitute half to all of the additional coursework, or mathematics, science or broadly defined professional practice topics which can comprise from 0 to 15 credits of the additional coursework. "Approved providers" refers to institutions which offer EAC/ABET accredited programs, and other education providers including engineering societies, companies, for-profit continuing education providers, or others which are individually approved by an NCEES-approved accrediting body as offering coursework equivalent in intellectual rigor and learning assessment to that provided by programs accredited by EAC/ABET.

The third pathway listed above refers to an EAC/ABET accredited graduate engineering program ("MS ABET EAC"), which, by ABET's graduate level accreditation criteria, requires that each

graduate meet the criteria applicable to both the graduate level and the baccalaureate level criteria applicable to the related engineering discipline.

As of 2010, NCEES is in the process of considering two additional pathways to licensure for the Model Law 2020 provisions. An extensive baccalaureate program consisting of at least 150 credits, of which at least 115 credits would be in engineering, science and mathematics, and of which at least 75 credits would be in engineering topics. At present, this would apply only to very few (less than 10) engineering programs in the US. A second alternate set of provisions under consideration would provide an alternate pathway to licensure based on a more rigorous engineering experience component and continuing education. This pathway would consist of at least six years of engineering experience, some of which would need to be under the detailed guidance of a professional engineer serving as a mentor, coupled with a specified number of days (perhaps 30) of "advanced learning" continuing education. The details of mentoring and the continuing education requirement are in the process of being defined.

The Model Law 2020 engineering education provisions are controversial within the engineering profession and among state PE Boards. Although the ratio of master's degrees to baccalaureate degrees in the engineering profession has been increasing, and exceeded 50% for the first time several years ago, there are some engineering disciplines with low percentages of practitioners having master's degrees, including mechanical and chemical engineering, where the percentage is historically in the low 20's. The alternate pathway described above stressing additional experience and advanced continuing education is being formulated by NCEES primarily at the urging of the societies representing mechanical and chemical engineers.

3.2 Engineering Experience Qualifications

The NCEES Model Law and Model Rules require four years of progressive engineering experience for an applicant to be approved to sit for the PE exam. The experience must be "engineering" as defined in the law and the rules to qualify; thus it must be creative work, applying principles of mathematics and science in applications which have potential impact on the public health, safety and welfare. The experience must also be "progressive", which means increasing in complexity over the four years, and thus not repeating one year of experience four times. Typically, experience begins to accrue after receiving a BS ABET EAC degree. Most states do not allow any experience prior to the date of the degree to qualify. Some states require that the experience begins only after completion of the BS ABET EAC and the passage of the NCEES Fundamentals of Engineering examination.

The engineering experience is typically required to be under the direct supervision of a licensed professional engineer. Some, but not all, states provide flexibility for engineers who work in

industry or other settings where supervisors or other colleagues may not necessarily be licensed professional engineers.

The NCEES Model Law and Rules allow that one year's experience credit is provided for a master's degree in engineering, and that two years of experience credit is provided for a BS ABET EAC or an MS ABET EAC combined with an earned Ph.D. in engineering. The master's degree experience credit is common among state requirements while the Ph.D. experience credit is less common.

The Model Law 2020 provisions requiring a BS ABET EAC plus a master's in engineering or 30 additional acceptable credits, or an MS ABET EAC, stipulate that the experience begins when the BS ABET EAC degree is conferred. Three years experience is stipulated for the two pathways incorporating a master's degree, while four years experience is stipulated for the pathway involving a BS ABET EAC plus 30 additional acceptable credits.

3.3 Examinations

NCEES formulates and administers the Fundamentals of Engineering examination (commonly called the "FE exam") which is taken by about two thirds of engineering graduates in the United States each year. The FE exam tests broad knowledge of mathematics, science and engineering science, as well as basic engineering topics pertinent to major engineering disciplines. The exam content is established by a survey process consulting hundreds of both educators and practitioners. The "content surveys" as they are called are repeated approximately every 7 years and the exam specifications are modified in response to the survey results. The examination is currently given twice per year, in October and April, although NCEES recently initiated a change over the next several years to a computer-based examination which will be administered more frequently at many more sites.

The FE exam is an eight-hour, closed-book exam with 180 multiple-choice questions covering mathematics, chemistry, physics, and engineering science. The only reference allowed in the exam is an NCEES developed manual which provides the various equations needed for the exam. The morning portion of the exam contains items generic to all disciplines while the afternoon portion of the exam addresses junior/senior-level basic engineering knowledge specific to either chemical, civil, electrical, environmental, industrial, or mechanical engineering. There is also an afternoon module that addresses general engineering topics for those graduating in disciplines not listed above. Examinees must select from one of the distinct engineering areas for the afternoon portion of the FE exam.

Pass rates for the FE exam vary by discipline, and are typically in the 60 to 80 percent range. Pass rates for repeat takers are in the 30 to 50 percent range and typically decline with each

subsequent attempt. Pass rates for the FE exam for each major engineering discipline, by afternoon module taken, are summarized as follows:

Average NCEES FE Exam Pass Rates, 2005 through April, 2010 (2)

Engineering Discipline	Discipline-Specific Module Pass Rate
Chemical	85%
Civil	74%
Electrical	70%
Environmental	79%
Industrial	66%
Mechanical	81%

The FE exam has been used effectively by engineering educators to assess performance relative to the required educational outcomes and the program objectives. The exam has also been an effective tool in evaluating a program's continuous improvement efforts. Reports are provided by NCEES to each state PE Board and to each EAC/ABET program following each exam administration outlining the performance of students by engineering discipline on groupings of questions by topic area. This information can provide insight on program strengths and weaknesses by topic area, particularly when evaluated over the course of a number of administrations. Results may be skewed for individual classes in small programs, but over the course of several years, performance patterns can become apparent. ABET accreditation requirements necessitate effective outcomes assessment by each engineering program, and the FE exam is a readily available tool which can provide nationally normed and quantified, topic-focused insight on student performance.

The Principles and Practice of Engineering exam (the "PE exam") is currently an eight-hour written, multiple choice, open book examination testing the applicant's technical knowledge in a chosen engineering discipline. Some of the PE exams (the Group I exams) are administered twice annually at present, in October and April. The balance of the exams (the Group II exams) are only offered once per year in October. Applicants for all exams must be approved by a state PE Board prior to being allowed to sit for the examination. Most states allow the examination to be taken only after the required progressive engineering experience is gained and documented. Some states, notably California, Nevada, Arizona and Illinois, allow the PE exam to be taken earlier but they do not grant a license to those who pass until the required years of engineering experience are accrued. NCEES has discussed converting the PE exam format to computer based testing in the future, but such a change is not being implemented for the PE exams at this time.

As of 2010, the list of PE exams is as follows:

Group I Exams
Chemical
Civil with afternoon modules including:
- Geotechnical
- Structural
- Transportation
- Water Resources and Environmental

Electrical and Computer with afternoon modules including:
- Computer Engineering
- Electrical and Electronics
- Electrical and Computer: Power

Environmental
Mechanical with afternoon modules including:
- HVAC and Refrigeration
- Mechanical Systems and Materials
- Thermal and Fluids Systems

Structural (16 hour two day examination)

Group II Exams
Agricultural
Architectural
Control Systems
Fire Protection
Industrial
Metallurgical/Materials
Mining/Mineral
Naval Architecture/Marine
Nuclear
Petroleum

As of 2010, a PE exam for software engineering is in development. The initial administration of this examination is anticipated in several years.

Each examination is formulated, and re-formulated periodically, based on the results of comprehensive Professional Activities and Knowledges Studies (PAKS) which consist of surveys of practicing engineers in the specific engineering discipline to determine activities and knowledges which should be demonstrated by an individual capable of practicing as a professional engineer. PAKS are typically updated every 5 to 10 years, and are based on the detailed review of thousands of survey responses in the larger engineering disciplines. The PE exams test technical knowledge, but do not address professional practice or ethics topics. Many jurisdictions require passage of a separate ethics exam or a statute/rules exam after passing the PE exam, to assure that the applicant understands the professional conduct and practice requirements of that state.

Pass rates for the October, 2010 PE exam administration were as follows (2):

Exam	First-time takers	Repeat takers
Agricultural	68%	50%
Architectural (April 2010)	75%	47%
Chemical	82%	36%
Civil	62%	27%
Control Systems	69%	47%
Electrical and Computer	66%	35%
Environmental	77%	48%
Fire Protection	52%	29%
Industrial	80%	44%
Mechanical	73%	37%
Metallurgical and Materials	64%	50%
Mining and Mineral Processing	79%	46%
Naval Architecture and Marine Engineering (April 2010)	85%	75%
Nuclear	57%	50%
Petroleum	80%	44%
Structural I*	47%	21%
Structural II*	54%	24%

*Note, the sixteen hour structural engineering exam has replaced the previous Structural I and Structural II examinations.

Although there is significant variation among engineering disciplines, in total, about 2/3 of first time exam takers pass the PE exam, and somewhat less than 50% of repeat takers pass the exam, with success rates typically declining with subsequent exam takings.

Exam takers are allowed to bring books to the examination for reference. For exam security purposes, there is a short and specific list of makes and models of calculators which are allowed into the examination rooms.

NCEES relies on volunteers to develop both the FE and PE exams, in all engineering disciplines. Group I exams are sponsored and developed by NCEES with assistance from professional engineers in each discipline. Group II exams are sponsored and developed by individual engineering societies with assistance by NCEES. The exam development process follows specific rules established by the NCEES Committee on Examinations for Professional Engineers which reflect the recommendations of the *Standards for Educational and Psychological Testing* as published by the American Educational Research Association and the National Council on

Measurement in Education. Exam item writers are both practitioners and academicians, and more volunteers are always needed.

3.4 Continuing Professional Development

As of 2010, 37 states had programs in place to require documentation of Continuing Professional Development ("CPD") as a prerequisite for renewal of professional engineers' licenses. Such renewals are typically required every other year. State requirements vary, but most follow the continuing professional development provisions of the NCEES Model Rules, providing a variety of different activities which can be used to comply with the requirements. Typically, 30 professional development hours ("PDH's") are required every other year. A PDH is the equivalent of one contact hour. The first state to require Continuing Professional Development requirements, Iowa, began doing so about thirty years ago. It took over forty years to initiate engineering licensure requirements in all states, and the adoption of Continuing Professional Development requirements is proceeding on the same pace.

The NCEES Model Rules recommend that the CPD requirements be deemed met in any state if the individual has met the CPD requirements in their home state. That provision has been incorporated in many, but not all, state rules. Some states still maintain requirements which are unique to that state and this requires careful attention on the part of those professional engineers who hold licenses in multiple states.

3.5 The Licensure Process

For an individual with a baccalaureate degree from an EAC/ABET accredited program, the process to obtain a license is summarized as follows:

a. Obtain a BS ABET EAC degree;
b. After registering for the exam with a state PE Board, take and pass the FE exam, typically taken in the senior year or shortly after graduation;
c. Obtain four years or more of progressive engineering experience under the supervision of a licensed professional engineer;
d. Apply to a state PE Board for licensure as a professional engineer providing documentation of education, experience and passage of the FE exam, and references from professional engineers and others, all in accordance with the rules of that State.
e. Receive approval from the state PE Board to sit for the PE exam;
f. Take and pass the Principles and Practices of Engineering (PE exam) examination.
g. Practice as a Professional Engineer and comply with Continuing Professional Development requirements in all states in which licenses are held, typically listing the CPD activities upon each license renewal, as directed by the individual state.

Detailed documentation of each CPD activity is typically requested only if the applicant's renewal application is randomly or otherwise selected for an "audit".

A license to practice is required from each individual state in which a professional engineer practices, or offers to practice, engineering. A PE license in one state is not applicable in another state in which an individual is not licensed. An engineer who is not licensed in a given state cannot sign a proposal offering to provide engineering services, or sign engineering reports or engineering correspondence, or otherwise practice engineering in that state, unless the work is under the direct supervision, responsible charge, signature and seal of a professional engineer who is licensed in that state.

4.0 Mobility

Significant progress has been made in the past ten years in fostering mobility of engineering licensees among states. A Model Law Engineer is a Professional Engineer with qualifications meeting the NCEES Model Law requirements of education, experience and examinations. An engineer who applies for a "Council Record" with NCEES, and satisfactorily documents a BS ABET EAC, passage of both the FE and PE exams, documented progressive engineering experience under the supervision of Professional Engineers, supporting references and a record clean of disciplinary action by state boards, will be deemed a Model Law Engineer and receive "expedited comity" in about 2/3 of the states currently. This expedited comity allows a Model Law Engineer with a Council Record to become licensed in a new state quickly, varying by state from between several days to two weeks.

After 2020, the Model Law provides a definition of both a Model Law Engineer, who meets current Model Law requirements and would receive expedited comity in those states which have not yet adopted additional engineering education requirements, and a Model Law Engineer 2020, who has met all Model Law 2020 provisions including the additional engineering education requirements, and who would receive expedited comity in all states after 2020.

An engineer who is not deemed a Model Law Engineer, or who does not have an NCEES Council Record, may apply to each individual state for licensure. This requires providing the full documentation of qualifications in each state, and requires typically two to 4 months, or more, to obtain a P.E. license.

5.0. Exemptions to Licensure Requirements

Many individual state statutes provide exemptions to engineering licensure requirements for engineers who work for electrical or telecommunications utilities, or who work for companies which manufacture a product. These exemptions were incorporated in some state statutes in or

prior to the 1950's at the urging of utilities and manufacturers. This is one of many reasons why there are estimated to be about 1.7 million Americans with baccalaureate degrees in engineering, but only an estimated 475,000 engineers are licensed as professional engineers.

The background of the implementation of these industrial exemptions is described in detail at the following link: http://community.nspe.org/blogs/licensing/archive/2009/10/01/the-industrial-exemption-what-if-anything-should-the-profession-do.aspx.

Information on which states have industrial exemptions, and which states do not, is presented at the following link: http://community.nspe.org/blogs/licensing/archive/2010/10/06/the-industrial-exemption-what-states-have-them-and-what-states-do-not.aspx.

The following states appear not to have industrial exemptions for engineers who are employees of manufacturing firms: Alabama; Arkansas; California; the District of Columbia; Hawaii; Minnesota; Montana; Nevada; New Hampshire; Oklahoma; South Carolina; South Dakota; Tennessee and West Virginia. In those states, engineers who work for manufacturing companies in a capacity which meets the state's definition of engineering, in a fashion which potentially impacts the public health, safety and welfare, are required by statute to be licensed as a professional engineer. In addition to those states, Maine and Washington State have clauses that require each manufacturing facility to have a professional engineer in responsible charge of engineering, and New Jersey's law requires licensure if the practice of engineering by an engineer in industry potentially impacts the public health and safety. To be certain of these requirements, one should consult the specific state statute and the state's PE Board.

Industrial exemptions in some states do not apply in the instance where engineers later in their careers may find the need to consult to exempt industries, rather than to function as an employee. Such consulting may not fall under the language of the industrial exemption, requiring a PE license for such consulting work.

Federal employees who are practicing as engineers are typically not required by state statute to be professional engineers. In some states, this exemption is described in the statute, but in many states it is not; yet the constraint on enforcement of state licensing laws on Federal employees exists, even where it is not provided in the state statute. The qualifications for Federal professional employees are outlined in personnel policies which differ for each profession, and for each agency. The US Army Corps of Engineers and other armed services agencies have personnel policies in place which encourage engineers to be licensed as a professional engineer in at least one jurisdiction. Certain positions are required to be filled by professional engineers. These requirements vary significantly, and are typically less stringent, among other Federal agencies.

6.0 Faculty Licensure

The number of engineering faculty who are licensed professional engineers varies significantly by engineering discipline and by institution. Licensure is more common for civil and environmental engineering faculty than other engineering disciplines where licensure of practitioners is less prevalent. ABET program criteria for civil, construction and environmental engineering require that faculty teaching design courses be qualified to teach the subject matter by virtue of professional licensure, or by education and equivalent design experience. Some, but not most, state PE Board Rules define the teaching of upper level undergraduate design courses as the practice of engineering, requiring licensure. Most states allow teaching of upper level undergraduate engineering design courses to qualify for engineering experience requirements. To be certain of faculty licensure requirements, one should consult the specific state statute and the state's PE Board.

7.0 Codes of Professional Conduct

Perhaps the most significant benefit to the public of engineering licensure is the existence of codes of professional conduct in almost all state statutes and rules. These codes of professional conduct are legal requirements, are enforceable, and there are prescribed disciplinary processes and actions that apply when a professional engineer acts outside of the code of professional conduct. What may be of greater importance to the public interest than the enforceability of these provisions is the fact that these codes of conduct apply to all professional engineers, including the vast majority of PE's who practice responsibly and ethically. These ethical standards become an integral part of professional practice.

The NCEES Model Law and Model Rules present guidelines for the adoption of ethical standards. Since each state has a 60 plus year history of unique modifications to its state statutes and rules, the code of conduct in each state has its own unique provisions. Some of the common provisions of state PE Board codes of professional conduct for professional engineers can be briefly summarized as follows:

a. Holding paramount the public health, safety and welfare in all activities;
b. Performing services only in the individual's areas of competence;
c. Issuing public statements and reports only in an objective and truthful manner, and including all relevant and pertinent information;
d. Acting as a faithful agent or trustee for each employer and client;
e. Avoiding deceptive acts;
f. Exercising direct supervisory control and maintaining responsible charge over project activities for which the individual is responsible;

g. In addressing matters of public policy, clarifying where appropriate, the identity and interests of parties represented by the individual;
h. Not falsely maligning or indiscriminately criticizing other professional engineers;
i. Reporting observed misconduct of other professional engineers to the state PE Board;
j. Not accepting financial or other valuable compensation from contractors or equipment suppliers;
k. Not accepting remuneration from more than one party on the same project without the knowledge and acceptance of all parties;
l. Not accepting remuneration from any party which might influence the professional engineer's judgment without divulging such remuneration to appropriate parties;
m. Not misrepresenting qualifications, experience and capabilities;
n. Not knowingly associating with others who are engaging in business or professional practices which are dishonest or fraudulent in nature.
o. Not accepting project remuneration from a public entity for which the individual serves in a public service role;
p. Conducting themselves responsibly, ethically and lawfully in order to enhance the honor, reputation and usefulness of the engineering profession.

In each state, the specific code of conduct sets forth specific requirements which are commonly variations on the above themes. This list is extensive, and the ethical conduct requirements are significant. Each professional engineer is aware that at any time, any citizen can question their professional conduct and that they can be held accountable for their conduct by the state PE Board for any of the issues outlined in the state's code of professional conduct.

8.0 Benefits to the Public of Licensure Requirements for Professional Engineers

The benefit to the public of the licensure of professional engineers is essentially twofold:

- The educational, experience, examination and continuing professional development qualifications required for licensure provide assurance to the public that a minimum level of competency is required to practice engineering in order to protect the public health, safety and welfare, and;
- The professional codes of conduct provide the state the ability to discipline, including to suspend or revoke the license of, professional engineers who commit professional misconduct and, perhaps as important, provide an extraordinary set of professional conduct requirements for all professional engineers, including the vast majority who practice responsibly, ethically and lawfully in protecting the public health, safety and welfare.

REFERENCES

1. NCEES website, www.ncees.org
2. NCEES Licensure Exchange Newsletter
3. NSPE website, www.nspe.org
4. Stone, Christopher M., “The Process of PE Licensure in the US”, January, 2011, NSPE.