A Model for Engineering Practice In the Twenty-First Century

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In late 1995, a special task force organized by NSPE[1] published its version of the preferred model for licensing the practice of engineering. The model was controversial. It reflected only the ABET/EAC-accredited program degree as qualifying education. Under the task-force model, one would be recognized as a *Professional Engineer* (P.E.) after passing a fundamentals of engineering examination or, alternatively, after obtaining an advanced-level engineering degree. After obtaining a specified amount of qualifying experience, and passing a standards and ethics examination, the professional engineer would then be registered as a *Licensed Professional Engineer* (L.P.E.), whereupon the privilege to practice as a licensed professional would be granted.

The task force attempted to address the failings of our current system. It missed the mark. No attention was placed on the need to strengthen engineering education. No clear path for licensure was indicated for those arriving through programs other than EAC-accredited programs. The titles of P.E. and L.P.E. became confusing and ambiguous to many. After much debate and little support, the model has been put aside and largely forgotten. What we must not forget, however, are the issues which led to the creation of the engineering licensure task force — for these issues remain unresolved and continue to be a major concern for many within the engineering community.

Knowledge and Ethics

Scholastic standards for entry into the engineering profession today are the weakest of all the *learned* professions. Baccalaureate degree credit requirements have been driven down from the requirements in place less than a decade ago. Most courses in the schools of engineering are taught by non-licensed faculty. Few, if any, universities have a designated professional school of engineering. Engineering students are not ingrained with the philosophical commitment to and ethical obligations of professionalism. Sadder, the accredited engineering programs of our colleges and universities do not meet even minimal scholastic standards set by the U.S. government for recognition as a true profession.[2]

The rigors and responsibilities of professional practice today, and those of the next century, call for a strengthening of the educational model. Accredited programs at the *Professional Degree* level must become the standard for entry into the profession. Appropriate routes must be available for entry into the professional school from qualified non-accredited, non-traditional undergraduate programs. The faculty must come to embody the principles of licensed professional practice as they assume a greater role in developing within their students the principles of professionalism and commitment to those obligations which go with professional practice. The engineering community must press for these changes to happen and support its development through a model for professional licensure.

Professional Practice or Specialist?

Engineers are a diverse group. Within many jurisdictions, that diversity has resulted in fragmentation of the profession through a system of licensure by discipline practice. One wonders how such a licensure system can cope effectively with overlapping practice and the continuing expansion of engineering disciplines. More important, however, are the obstacles to cross-border mobility that arise, or can arise, with comity requests to those jurisdictions that license by discipline.

In the ideal world it should be an easy process for a fully credentialed engineering professional, having no record of enforcement sanctions, to move from one U.S. jurisdiction to another. Such movement can best be achieved through a more uniform system of credentialing standards and generic licensure. It would be presumptuous, however, to think that under certain circumstances one might not have to demonstrate justifiably a level of competence above that which would be satisfactory for a generic practice license.

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One alternative to discipline licensure, and an equally viable enhancement to generic licensure, is a model based upon the generic practice license with provision for board certification in specialty practice areas. Certification would be applied where there is a demonstrated public need for speciality credentials. The design of slender high-rise structures or long-span bridges are examples of engineering practice specialties which some jurisdictions may consider demanding of certification. But even where board certification is invoked for a specialty area, there would ideally be substantial uniformity of the certification standards among those jurisdictions requiring such credentials.

Exemptions

Perhaps the most frequently expressed complaint about engineering licensure is that only a small percentage of the engineering population elects licensure. The largest employers of engineering graduates are the manufacturing, chemical process, and utility industries. In most jurisdictions, engineers in these *non-service* sectors are excused from licensure. In those jurisdictions where industrial exemptions are not statutorily granted, the exemptions exist largely as a matter of practice because of the impracticality of enforcement.

An effective licensure model would be one which best resolves the objection by industry leaders to professional licensure. Many attempts have been made, with little success.

A concept which deserves consideration is a model which mandates licensure for those in responsible charge of engineering service units. The model law would define the term *engineering service unit*. ESUs would exist in all private practice engineering organizations and within many of the industrial organizations, governmental agencies, and utility companies. The professional license would not be mandatory for direct employees in industrial manufacturing and process operations, but it would be encouraged for those employees in responsible charge of such operations, including related research and development activities.

International Mobility

Current state laws envision cross-border practice as the movement of engineers across state lines. Future laws must accommodate the international movement of engineers. For global movement, licensure models must establish appropriate standards of substantial equivalency for all or a major portion of the licensure process. These standards would need to consider alternative methods of credential assessment — methods which might be different from those we now use, but which would provide a degree of credential verification equivalent to methods used in the U.S. for licensing domestic engineers. For qualified foreign citizens seeking unrestricted practice privileges in the United States, the ideal model might contain reasonable methods for verification of technical credentials, confirmation of communication skills, and a demonstration to show knowledge of U.S. customs and practices. Also, the practice statute might require evidence that such practitioners have appropriate resources within reach of the U.S. judicial system to cover practice liabilities arising as a result of their engineering services in this country.[3]

A Model for the Twenty-First Century

My proposed engineering-license model for the twenty-first century is introduced here after careful consideration of the preceding concerns. The basic model is presented diagrammatically in *Figure 1*. The centerpiece of this model calls for advancing threshold engineering education to the professional-degree level through establishment of ABET-accredited professional schools. Under this model, the gateway to licensure becomes the professional school. The screening mechanism for graduates of non-EAC programs comprises professional-school entrance requirements and entrance examinations, with both being subject to ABET criteria guides. The proposed model also provides paths for licensure of graduates from foreign degree programs and for foreign country practitioners seeking a license to practice in the United States.

Basic Precepts

All states would grant a generic license as a professional engineer. There would be no discipline-specific license. Where circumstances warrant, board certification in specialty practice areas might be a requirement for practice privileges in those particular areas.

Those licensed under the model, and without any record of sanction, would have automatic portability of the P.E. license across state borders — subject only to registering with the host board and obtaining a practice permit. For states requiring board certification for a specialty practice area, the licensee would be required to meet host board certification requirements to practice in the *specialty* area.

The concept for board certification is based upon a precept that certain practice areas, because of the exceptional risk to public safety, may warrant confirmation of practice skills at a level above minimal competency.

All instructors in the professional school would have to be licensed. Instructors teaching upper-level courses in the pre-engineering program would be encouraged to be licensed.

The P.E. license would be mandatory for those in responsible charge of engineering service units. The model law would define an engineering service unit. Engineering service units would definitely exist in all private practice engineering organizations and in many industrial organizations, governmental agencies, and utility companies.

A P.E. license would not be mandatory for direct employees in manufacturing and industrial process operations but would be encouraged for those employees in responsible charge of such operations, including related research and development groups.

Anticipated Benefits

Education Model

(a) The federal government does not view or recognize any four-year program as adequate preparation for a professional degree. The model would bring this needed recognition to engineering.

(b) Engineering is the only professional practice area that has not yet moved to advanced academic study as a prerequisite for entrance into the profession. The growth of engineering knowledge warrants this advanced-study requirement for entrance into the engineering profession.

(c) The pre-engineering B.S. degree programs would provide well-trained graduates for those industrial, governmental, and utility employers who may not desire or require those skills taught in the professional school. Such graduates would not technically be considered engineers.

(d) The model provides an equitable path to licensure for technology and engineering-related science program graduates by providing access to the professional school and a screening mechanism for entry into the school.

Licensure Model

(a) The proposed model would ease the path to licensure by permitting access to the principles and practice examination immediately upon graduation from the professional school and by eliminating the fundamentals (entrance) examination for graduates of EAC/ABET pre-engineering degree programs.

(b) It would facilitate board enforcement of title restrictions by eliminating the recognition of an engineering degree at the four-year program level. Only those graduating from the professional school would have an engineering degree.

(c) The model would help differentiate between the profession of engineering and a career in engineering-related roles.

(d) Mechanisms for true portability of P.E. licenses across state borders would be established, along with the creation of board certification where credentialing higher competency skills might be appropriate.

(e) Provision would be made for recognition of global movements within the international community of engineers, and a mechanism is introduced for states to regulate admission requests from engineering service providers domiciled in foreign countries.

Education Assessments

(a) EAC/ABET would accredit pre-engineering (four-year) programs.

(b) EAC/ABET is proposed as the accrediting body for engineering schools in much the same way that law schools and medical schools are accredited.

(c) ABET (preferably with contract to NCEES) would be the preferred responsible party for development of an engineering school entrance examination. NCEES would develop (to ABET specs) and score the standardized entrance examinations.

(d) ABET would continue to evaluate and recognize foreign engineering programs that meet its criteria.

(d) ABET would provide services to evaluate individual transcripts of applicants with foreign degrees — as a service to state boards (via NCEES) and as an available service (if requested) to professional schools of engineering.

(f) Individual colleges and universities would evaluate transcripts of foreign applicants and non-EAC/ABET-program domestic applicants to an engineering school, based upon general guidelines associated with university and engineering school accreditation policies.

Post-Education Assessments

(a) NCEES would continue to prepare and score P. & P.E. examinations based upon approved specifications that may or may not be parallel to those now existing.

(b) NCEES would prepare guidelines to be used by member boards for the process and documentation of portfolio reviews. If authorized, NCEES could establish panels to facilitate portfolio reviews.

(c) NCEES would prepare exams to test foreign practitioners' knowledge of U.S. customs and practices.

(d) Member boards (or NCEES as a facilitator and certification body) would use one or more of the TOEFL examinations to confirm language proficiency for foreign candidates seeking an individual, unrestricted practice license. These examinations may be waived for applicants from English-speaking countries.

(e) NCEES would establish guidelines for board certification standards. The certification process would be conducted by sponsoring technical societies to these specifications, and NCEES would audit compliance.

(f) NCEES would establish standards and evaluate and recognize substantially equivalent foreign credentialing systems.

(g) NCEES would provide a voluntary record system for license holders and for CPD credits earned by license holders.

Portfolio Review Concepts

(a) The portfolio review should be simple and expedient for applicants who enter the system via the engineering school and P. & P.E. examination (perhaps certified statements from licensed supervisors, and little else, based upon experience guidelines established by NCEES).

(b) Reviews should be more rigorous for applicants who seek admittance through an alternate path — where, for example, education and practice experience were obtained predominantly outside the U.S.

Corporate Registration

No discussion of a licensure model for the twenty-first century would be complete without mention of corporate registration. In many jurisdictions, a certificate of authorization is currently a requirement for the practice of engineering through business structures other than individual proprietorships.

Laws regulating corporate registration vary widely. In a number of jurisdictions, licensing boards have enacted corporate registration laws in an effort to control,

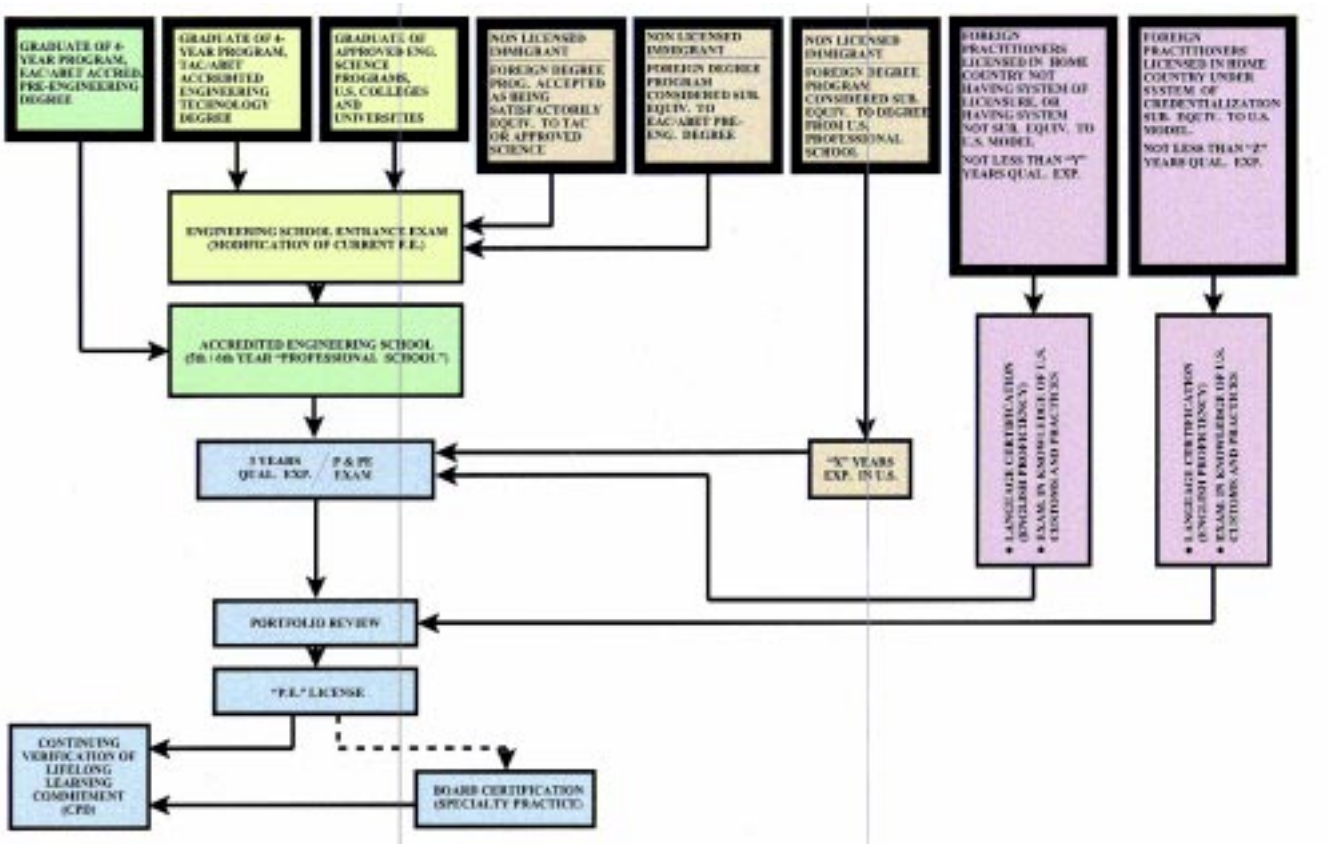

Figure 1. Proposed engineering licensure model for the twenty-first century.

statutorily, the ownership of professional service firms. Laws created for this purpose have met with limited success and have generated much legal paperwork, as non-qualifying entities create alternative organizations to satisfy the letter of the law. For other jurisdictions, the requirement for corporate registration might appear to have no purpose other than that of taxation in the form of a professional services business license.

Justification exists, however, for corporate registration of business entities. It has nothing to do with ownership control or alternative forms of revenue generation. In the proposed licensure model for the twenty-first century, the option for corporate registration would continue. It would exist for the principal purpose of imposing upon corporate bodies the same responsibility and accountability as that placed upon individual practitioners for conforming to statutory rules, including the rules of professional conduct.

For jurisdictions requiring corporate registration, expectations for corporate moral leadership can be clearly articulated, and the power to discipline corporate misbehavior can be quite persuasive.

Conclusion

Arguments for strengthening engineering education and refining the engineering licensure model are convincing to many within the engineering community. This author is equally convinced that any meaningful reform must involve the establishment of professional schools and professional degree programs.

If reform is to occur, consensus must bring us to a licensure model which can be embraced by the profession, regulatory agencies, engineering academe, and the public-at-large. A model has been presented. Whether or not it meets the test of acceptance will be determined only through presentation, study, and debate. Elements within the model are not new. Arguments for the establishment of professional schools have been advanced for at least 25 years. If such schools are to materialize, they must be born of ABET with support and encouragement by the academic community, the engineering societies, and the practice community.

Changes of the magnitude suggested by this paper must allow time for transition. A realistic minimal time line is in the 15- to 20-year range. Can we afford to wait any longer to begin?

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[1]*Although organized and chaired by NSPE, the engineering education/licensure model task force also included representatives from ABET, ASEE, NCEES, and the Engineering Deans Council.*

[2]*For additional information on this subject, refer to the April 1998 paper "Engineering — Is It a Profession?" by Ernest T. Smerdon,* Missouri Alpha '51, *P.E., president of the American Society for Engineering Education. It was prepared as a background discussion document for a meeting of engineering societies on May 4-5, 1998, at the National Academy of Engineering; copies should be available upon request to the ASEE.*

[3]*The most appropriate form of liability coverage for international service providers may well be professional liability insurance written with world-wide coverage or U.S. practice endorsements. Such coverage can be evidenced by the filing of COIs with the P.E. license applications and renewals.*