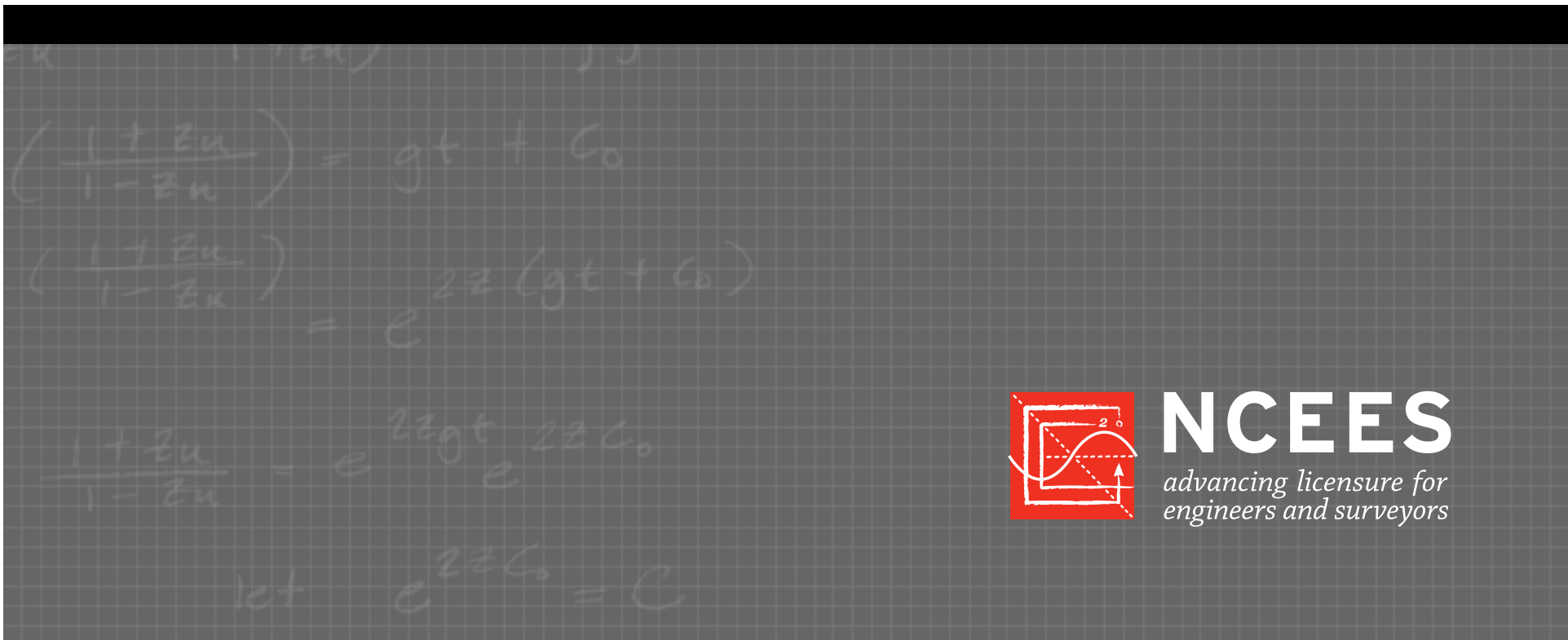
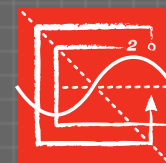


P.E.: The Regulation of Engineering in the United States

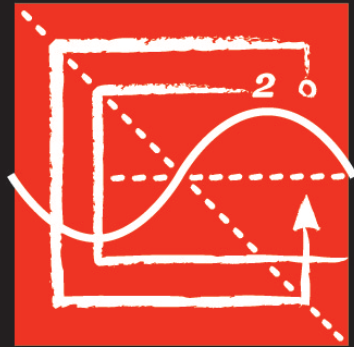
NAE Convocation of Professional Engineering Societies
April 16, 2012



The image shows a grid background with handwritten mathematical derivations in white ink. The derivations are as follows:

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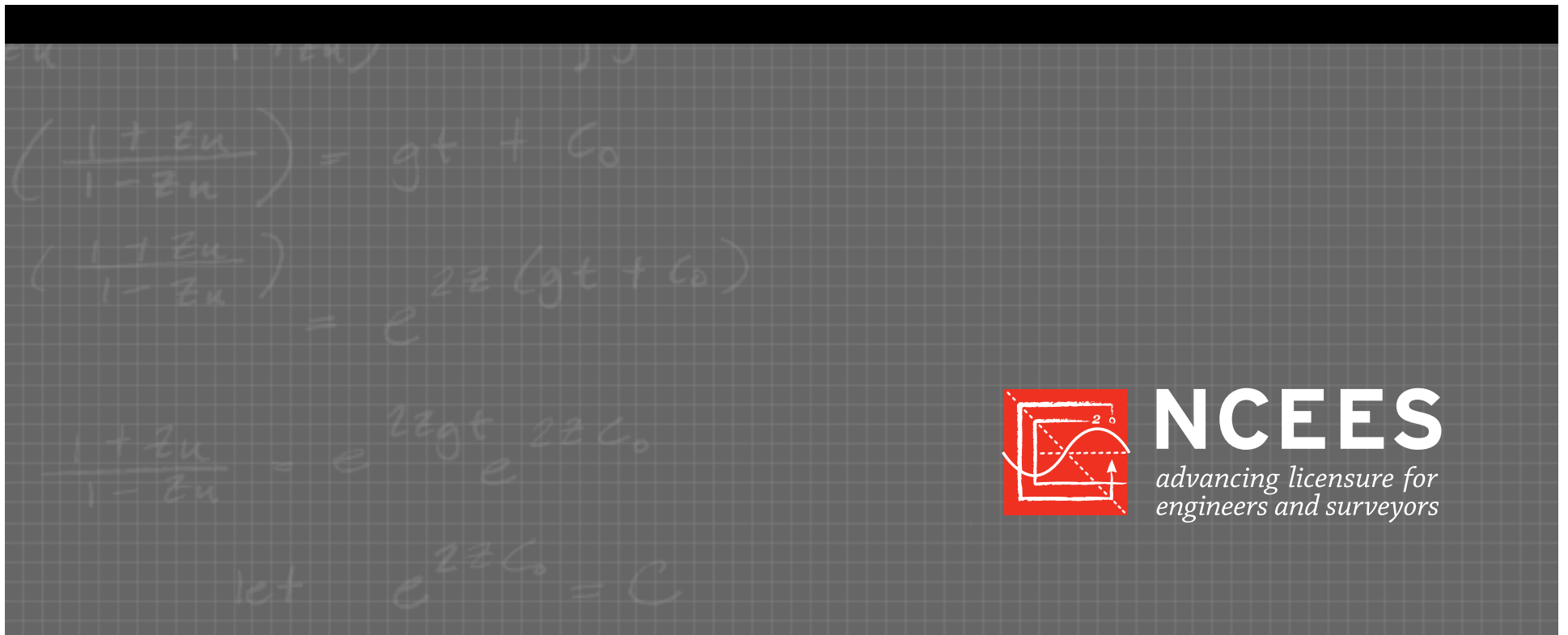


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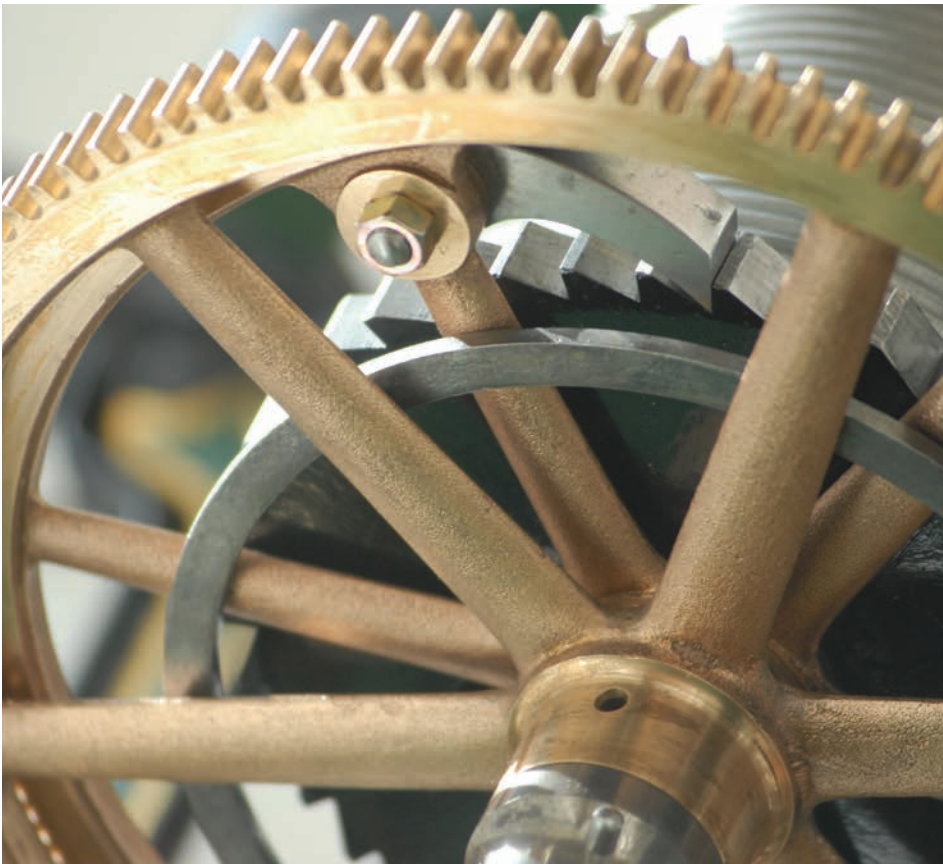
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Protecting the Public: A Brief Overview of the History of Engineering Licensure and the Process of Regulation in the United States

NCEES Past President
Jon D. Nelson, P.E.



History of engineering licensure in the United States



The first state law regulating the practice of engineering was passed in 1907.

For the past 105 years, professional engineering licensure has served to protect the public health, safety, and welfare.

History of engineering licensure in the United States

- Late 1800s–early 1900s: Agricultural, industrial, and public works were becoming more complex.
- Such works were increasingly being designed by unqualified people.
- Many were failing because of poor (or no) engineering.

History of engineering licensure in the United States

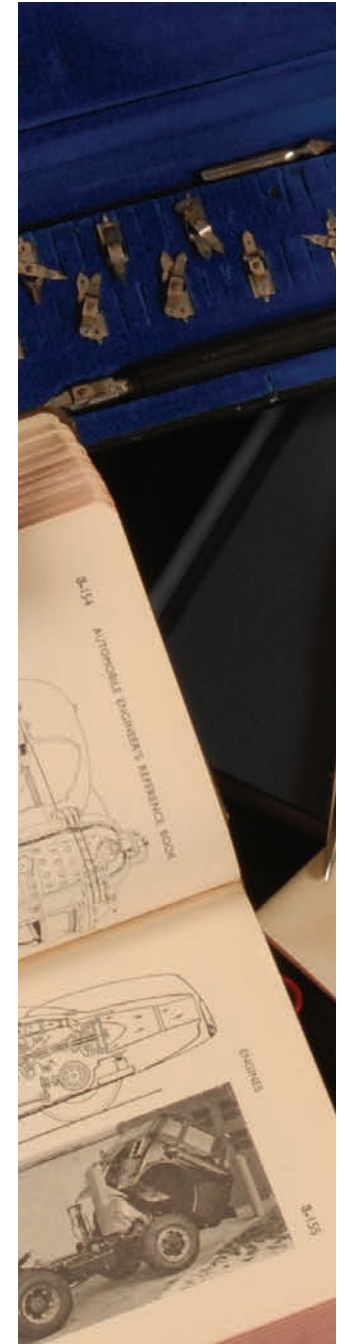
- Engineering licensure emerged as a means of regulation.
- 1907—Wyoming legislature passed a bill requiring registration for anyone representing themselves to the public as an engineer or land surveyor and creating a state board of examiners for the profession.
- Other states had similar problems and followed suit.

History of engineering licensure in the United States

- By 1920, 10 states had engineering licensure laws.
- Problem developed: None of the state boards accepted out-of-state licenses. The language of the new laws and licensure requirements differed greatly.

History of engineering licensure in the United States

- 1920: Iowa State Board of Engineering Examiners called for the 10 state boards to develop procedures for interstate registration.
- Seven of the 10 boards met that year, and the forerunner of NCEES was formed—the Council of State Boards of Engineering Examiners.
- Purpose: To recommend ways states could improve uniformity and promote reciprocal relations.



History of engineering licensure in the United States

- 1932: Council ratified a model law.
- Established uniform licensing guidelines for state boards and recordkeeping procedures to assist engineers needing to work in other states.
- From the start, licensure qualifications took the form of the “three-legged stool” of education, experience, and examination.

History of engineering licensure in the United States

- By 1947: All states and the District of Columbia had enacted engineering licensure laws.
- They all had their own exams, and the exam requirements differed greatly from state to state.

History of engineering licensure in the United States

- The Council stepped in and developed national exams.
- By 1965: 30 states administered first NCEES FE exam.
- By 1966: National uniform PE exam first offered.
- By 1984: All boards of examiners were administering the national FE and PE exams.

Engineering licensure today

- All exams are nationally normed (although there are some additional state-specific exams).
- Education and experience qualifications are similar from state to state and are becoming more homogenous.
- All jurisdictions include licensed engineers in the regulatory process.
- State laws regulate who can be licensed to practice and how licensees are to conduct themselves in practice.

Engineering licensure today

- Over the last 105 years, the number of licensed professional engineers has grown from 1 to nearly 470,000, representing about a third of the 1.5 million engineers working in the United States.
- The rest work under the responsible charge of licensed engineers or practice in areas that are exempt from licensure, primarily in industry.

Licensure exemptions

- The “industrial exemption” surfaced early in the regulatory movement.
- Engineers in disciplines more engaged in industrial settings objected to the regulation of their practice.
- By the 1930s, explicit exemptions had been added to some state laws, then World War II presented a national emergency that required the formality of licensure to be set aside, and the concept was solidified.

Engineering licensure today



Licensed engineers continue their commitment to protecting the health, safety, and welfare of the public through demonstrated competency and subjecting themselves to a code of conduct backed by the force of law.

How does licensure work?

- Individual states and territories are responsible for regulating the professions.
 - The states have not delegated this power to the federal government, so it resides with the states (per 10th Amendment).
- Requirements can differ by state.
 - But not to a large degree.

Why are there differences?

- Conditions peculiar to a region or state
- Type of jurisdiction and nature of its formational documents
- Jurisdiction's approaches to regulation
- Politics
- Manner that legislation and regulations are promulgated in the U.S.
 - by open debate
 - with both political and public participation

Uniformity of licensing standards

- State licensing boards still aim for more-uniform licensing standards
- Want to aid comity licensure—transferring a P.E. to additional states.
 - P.E.s must be licensed in each state they practice.
 - Process of applying for licensure by comity is easier if state requirements are the same.
- U.S. engineering licensing boards work together as members of NCEES to improve uniformity.

Uniformity of licensing standards

- Primary method:
Maintaining *Model Law*
and *Model Rules*
 - Reflect a consensus of what U.S. licensing boards believe licensure laws and rules should be
 - Are available for the jurisdictions (states) to use when revising their laws and rules

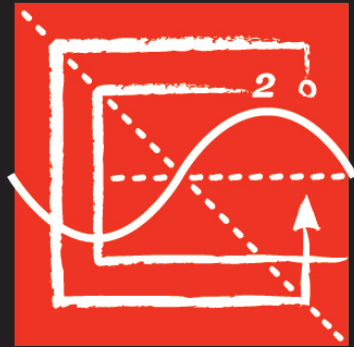


Uniformity of licensing standards

- Licensure requirements are more uniform, and state licensing boards continue to work to improve uniformity.
- Boards also continue to work toward greater uniformity in other areas
 - Continuing professional competency requirements
 - Enforcement policies

Conclusion

- Engineering licensure has been in place for over 100 years in the United States.
- It is used by *all* states to regulate the practice of engineering in the interest of the public health, safety, and welfare.
 - The states include the engineering profession in the regulatory process.
 - It has been effective in its mission, and it ensures a measure of competency and integrity that holds public protection paramount.



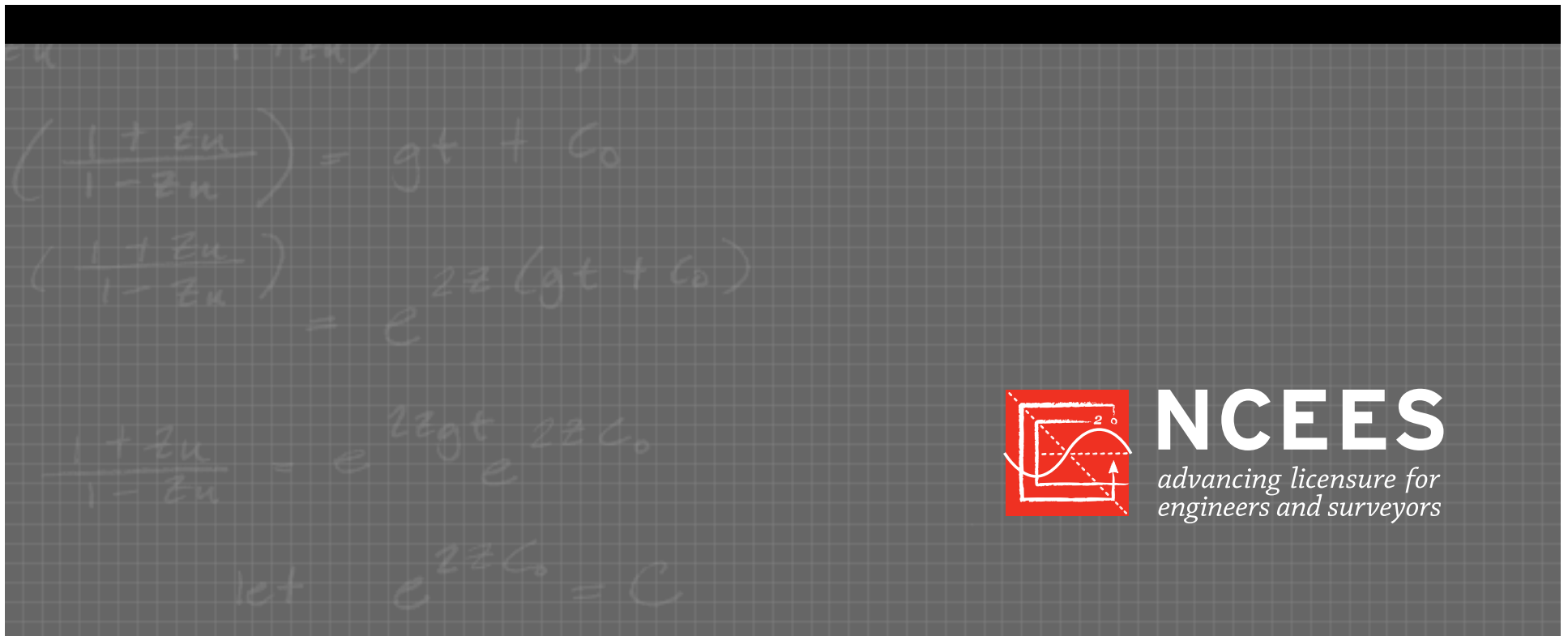
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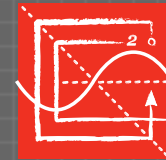
Determining Minimum Competency: Education, Examination, and Experience

NCEES Past President

David L. Whitman, Ph.D., P.E.



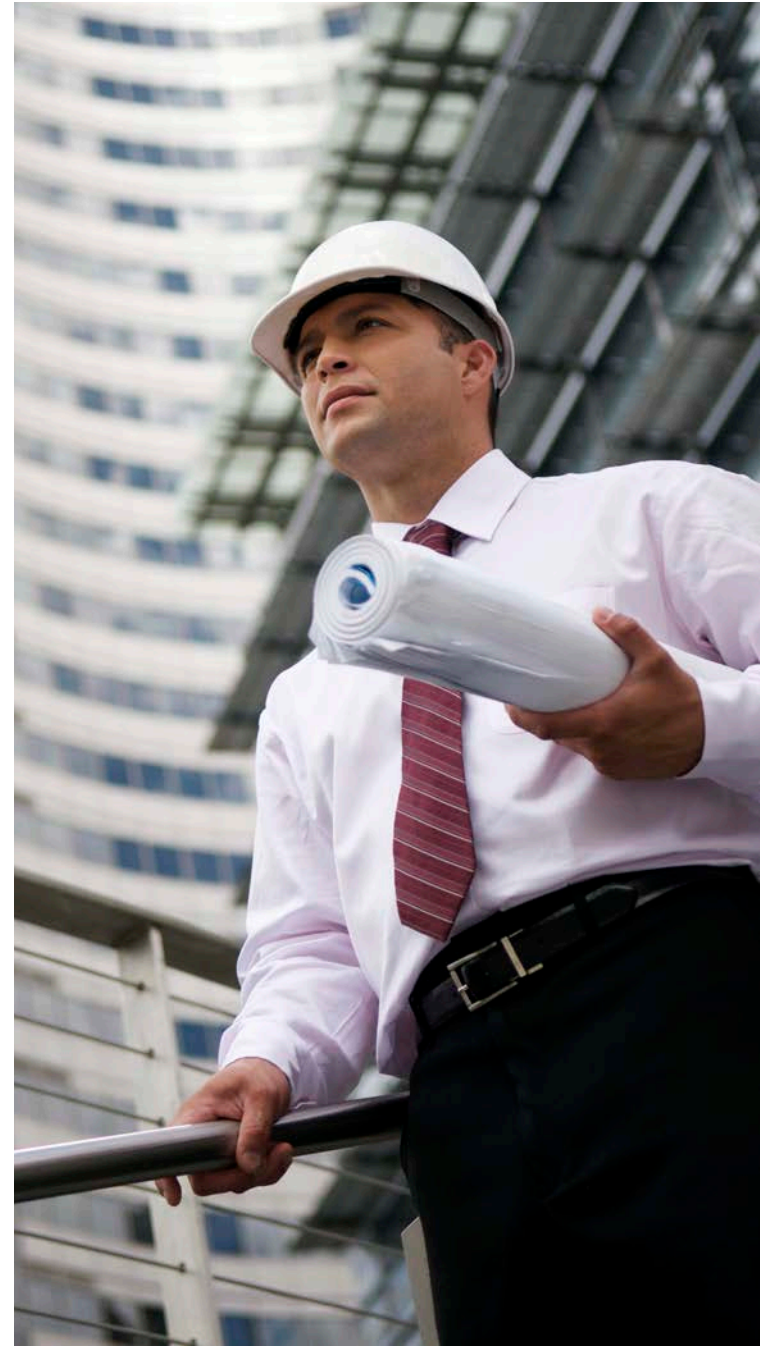
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Goal of licensing requirements

- To determine whether an individual is minimally competent to practice engineering
 - They must demonstrate that they have the basic knowledge required to practice without endangering the health, safety, and welfare of the public.



P.E. license requirements

3-legged Stool

- Education
- Examinations
- Experience



Education

- Degree from EAC/ABET-accredited program or the equivalent
 - Equivalent: As compared to NCEES Engineering Education Standard
 - Bachelor's or master's degree may be acceptable, depending on jurisdiction
- The education requirement exists so that state boards can verify that an individual has the knowledge base for entering the profession.

Examination



- Provides for a uniform measure of competence
- Multiple exams required
- NCEES develops, administers, and scores these licensing exams.

Exams

- NCEES licensing exams are used by all 50 states, D.C., Guam, Puerto Rico, and the U.S. Virgin Islands.
- The exams are also administered in several other countries.
 - Canada, Egypt, Japan, Saudi Arabia, and South Korea
 - April 2012: Will begin offering exams in Turkey and the Emirate of Sharjah.

Fundamentals of Engineering exam (FE)

- Tests academic knowledge
 - Usually taken just before or after graduation.
 - Most states allow college seniors within one year of graduation to take the exam.
- Currently offered in April and October
 - Will be more frequent when exam moves to computer-based testing in January 2014.

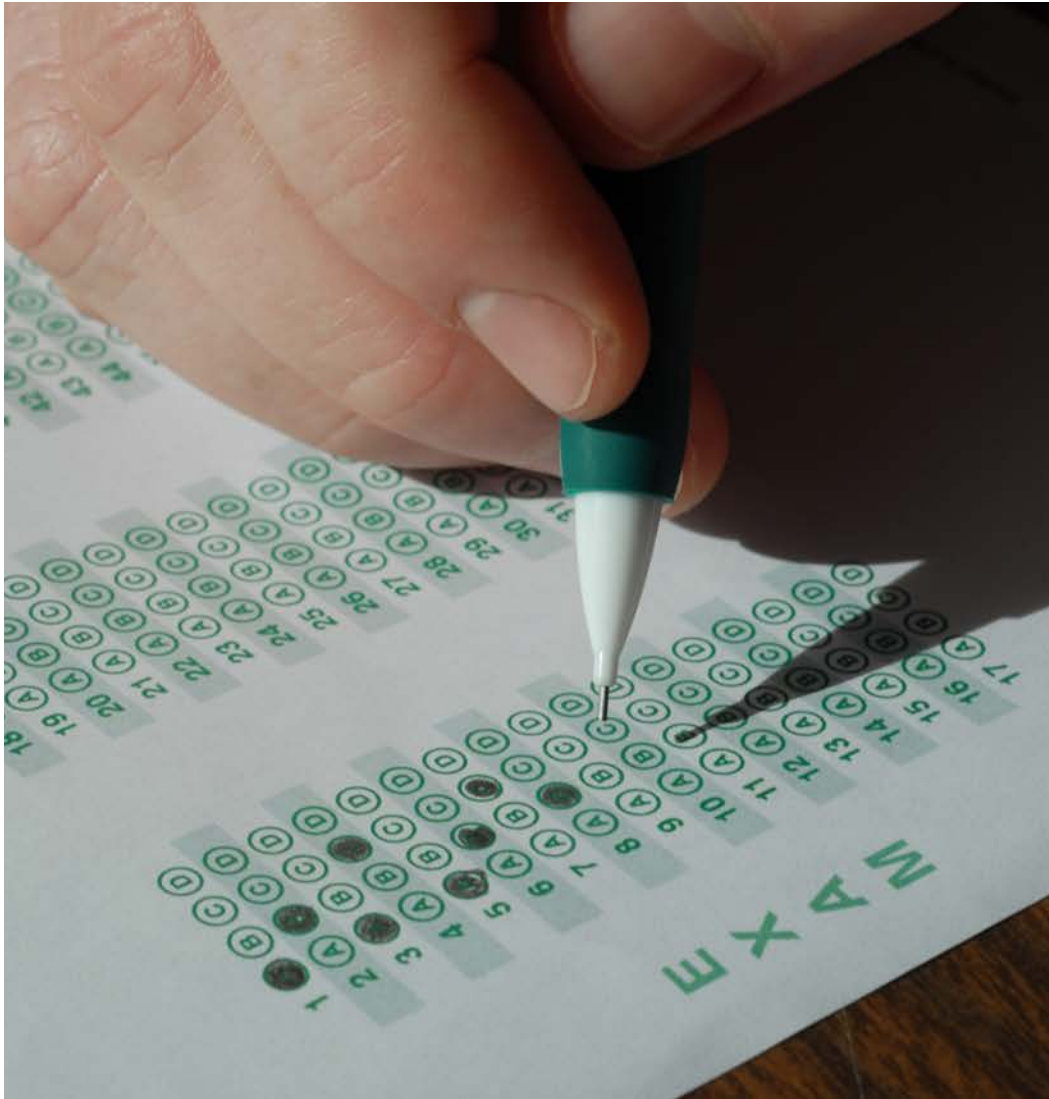
FE exam format

- 8-hour, multiple-choice exam
- Closed-book except for supplied reference manual
- Morning and afternoon sessions
 - 120 questions in morning
 - 60 questions in afternoon

FE exam morning session

- General questions covering science, math, and engineering basics
 - 15%: Mathematics
 - 10%: Engineering Mechanics (Statics, Dynamics)
 - 9% each: Chemistry, Electricity & Magnetism
 - 8%: Engineering Economics
 - 7% each: Engineering Probability & Statistics, Computers, Ethics & Business Practices, Strength of Materials, Material Properties, Fluid Mechanics, Thermodynamics

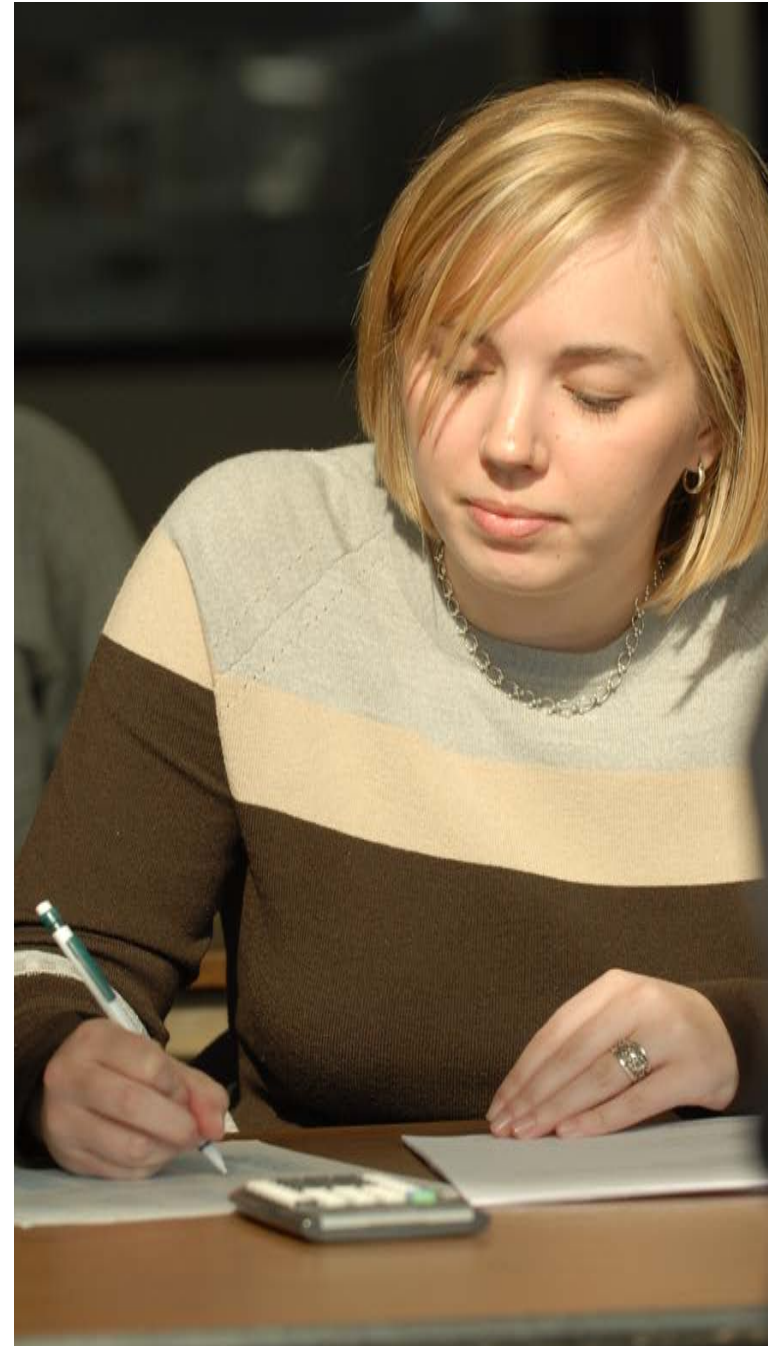
FE exam afternoon session



- Choose from 7 modules
 - Chemical
 - Civil
 - Electrical
 - Environmental
 - Industrial
 - Mechanical
 - Other Disciplines

FE exam

- 50,000 examinees each year
- Once you pass, you are an engineer intern, or E.I.
 - Ready to begin professional training



Experience

- Generally, need to work under the supervision of a P.E.
- Four years of progressive experience
 - Increasing quality
 - Requiring greater responsibility
- Most states require you to complete this experience before applying for the final licensing exam.

Principles and Practice of Engineering exam (PE)



- Final licensing exam
- Tests knowledge gained through experience
- Currently, exams offered every April and October
 - Some only offered once a year
- 22 different exams currently offered
- Other exams can be added

PE exam disciplines

- Agricultural
- Architectural
- Chemical
- Civil
 - Construction
 - Geotechnical
 - Structural
 - Transportation
 - Water Resources and Environmental
- Control Systems
- Electrical and Computer
 - Computer Engineering
 - Electrical and Electronics
 - Power
- Environmental
- Industrial

PE exam disciplines

- Mechanical
 - HVAC and Refrigeration
 - Mechanical Systems and Materials
 - Thermal and Fluids Systems
- Metallurgical and Materials
- Mining and Mineral Processing
- Naval Architecture and Marine
- Nuclear
- Petroleum
- Software Engineering (starting in 2013)

PE exam format

- 8-hour, multiple-choice exam
- Morning and afternoon session
 - 40 questions in each session
- Open book, with some restrictions on reference material allowed
 - In anticipation of moving to computer-based testing, working toward changing some exams to allow only supplied reference manuals

Structural Engineering exam (SE)



- Some jurisdictions require specialized structural engineering licensure.
- In 2011, NCEES introduced a new exam that could be used by any of these jurisdictions, including areas with high seismic activity.

SE exam format

- 16-hour exam with two 8-hour components
 - Vertical Forces component (Friday)
 - Gravity loads and lateral earth pressures
 - Lateral Forces component (Saturday)
 - Wind/earthquake loads
- Morning session: 40 multiple-choice questions
- Afternoon session: 3-4 essay questions (choose buildings or bridges module)

SE exam

- Must receive an acceptable score on both Vertical and Lateral components to pass the SE exam
 - Doesn't have to be in the same weekend, but must be within a 5-year window

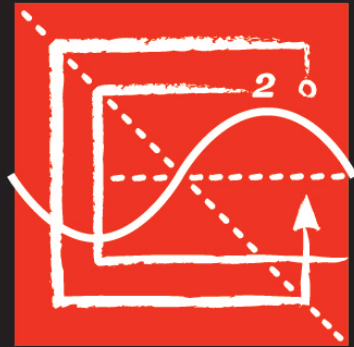
P.E. license requirements

1. Education
2. FE exam
3. Experience
4. PE exam



Joining the engineering profession

- Once you complete licensure requirements and get licensed by a U.S. state or territory, you are a professional engineer (P.E. or S.E.)
 - Ready to assume privileges and responsibilities of being a licensed professional

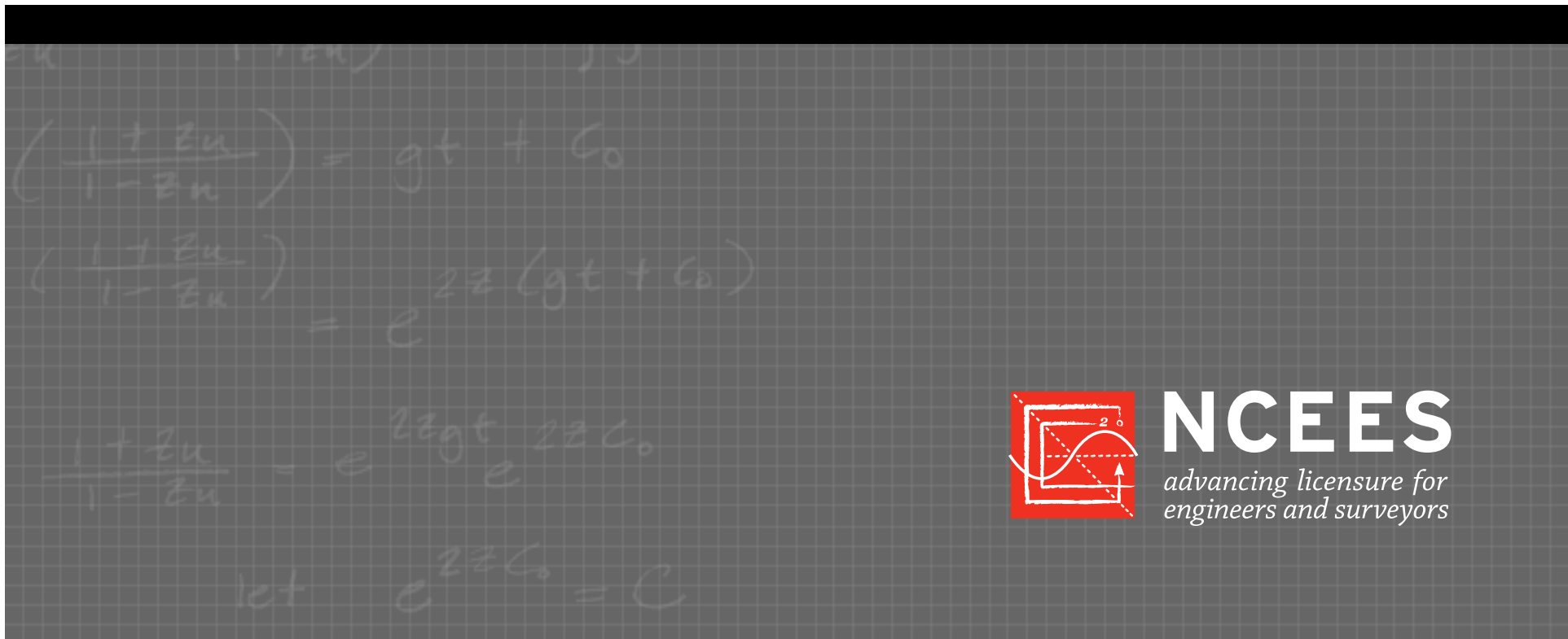


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Ethics—Standard of Professional Behavior Required to Ensure the Public Health, Safety, and Welfare

NCEES Past President W. Gene Corley,
Ph.D., P.E., S.E., NAE



Licensure: setting the standard

- A license acts as a public guarantee that an individual has met the required standards.
- The licensure system prevents incompetent or unethical persons from practicing.



Licensure: Blacks Law— dictionary definition

A revocable permission to commit some act that would otherwise be unlawful.

State law and engineering practice

- Only a P.E. can practice engineering.
- Most states have licensure exemptions.

State law and engineering practice

- What does “practice” include?
 - Owning a firm
 - Consulting
 - Signing/sealing a design
 - Bidding for public works projects
 - Advertising services to the public
 - Calling yourself a professional engineer

Privileges and responsibilities of licensure

- P.E.s have additional career opportunities.
- P.E.s have an obligation to protect the public.

Responsibilities of licensure

- Rules of Professional Conduct outline P.E.'s obligations to
 - Society
 - Employers and clients
 - Other licensees
- NCEES includes these in its *Model Rules*.
- Individual states have similar rules

P.E.'s obligations to society

- Protect the public
 - Licensees, in the performance of their services for clients, employers, and customers, shall be cognizant that their first and foremost responsibility is to the public welfare.

P.E.'s obligations to society

- Protect the public
 - Licensees shall approve and seal only those design documents that conform to accepted engineering standards and safeguard the life, health, property, and welfare of the public.

P.E.'s obligations to society

- Protect the public
 - Licensees shall notify their employer or client and such other authority as may be appropriate when their professional judgment is overruled under circumstances where the life, health, property, or welfare of the public is endangered.

P.E.'s obligations to society

- Be objective and truthful
 - Licensees shall be objective and truthful in professional reports, statements, or testimony. They shall include all relevant and pertinent information in such reports, statements, or testimony.

P.E.'s obligations to society

- Be objective and truthful
 - Licensees shall express a professional opinion publicly only when it is founded upon an adequate knowledge of the facts and a competent evaluation of the subject matter.

P.E.'s obligations to society

- Disclose relationships
 - Licensees shall issue no statements, criticisms, or arguments on technical matters which are inspired or paid for by interested parties, unless they explicitly identify the interested parties on whose behalf they are speaking and reveal any interest they have in the matters.

P.E.'s obligations to society

- Uphold ethical practice
 - Licensees shall not permit the use of their name or firm name by, nor associate in the business ventures with, any person or firm which is engaging in fraudulent or dishonest business or professional practices.

P.E.'s obligations to society

- Uphold ethical practice
 - Licensees having knowledge of possible violations of any of these Rules of Professional Conduct shall provide the board with the information and assistance necessary to make the final determination of such violation.

P.E.'s obligations to employers and clients

- Stick to areas of competency
 - Licensees shall undertake assignments only when qualified by education or experience in the specific technical fields of engineering involved.



P.E.'s obligations to employers and clients

- Only seal plans, documents under your direct supervision and control
 - Licensees shall not affix their signatures or seals to any plans or documents dealing with subject matter in which they lack competence, nor to any such plan or document not prepared under their responsible charge.

P.E.'s obligations to employers and clients

- Only seal plans, documents under your direct supervision and control
 - Licensees may accept assignments for coordination of an entire project, provided that each design segment is signed and sealed by the licensee responsible for preparation of that design segment.

P.E.'s obligations to employers and clients

- Avoid conflicts of interest—and appearance of conflicts
 - Licensees shall make full prior disclosures to their employers or clients of potential conflicts of interest or other circumstances which could influence or appear to influence their judgment or the quality of their service.

P.E.'s obligations to other licensees

- Honestly describe qualifications, experience
 - Licensees shall not falsify or permit misrepresentation of their, or their associates', academic or professional qualifications. They shall not misrepresent or exaggerate their degree of responsibility in prior assignments nor the complexity of said assignments. Presentations incident to the solicitation of employment or business shall not misrepresent pertinent facts concerning employers, employees, associates, joint ventures, or past accomplishments.

P.E.'s obligations to other licensees

- Refuse inducements
 - Licensees shall not offer, give, solicit, or receive, either directly or indirectly, any commission, or gift, or other valuable consideration in order to secure work, and shall not make any political contribution with the intent to influence the award of a contract by public authority.

P.E.'s obligations to other licensees

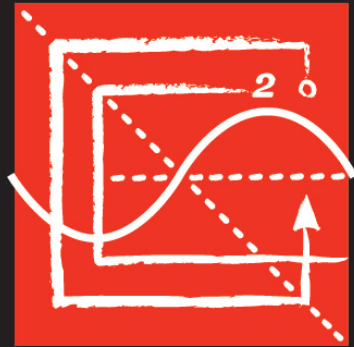
- Respect the reputation of others
 - Licensees shall not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other licensees, nor indiscriminately criticize other licensees' work.

Rules of professional conduct

- P.E.s who violate rules are subject to disciplinary action by their state licensing boards, including
 - Fines, reprimands, or probation
 - Suspension or revocation of license
- P.E.s must continue to practice engineering in a way that protects the public.

P.E. license = competence + accountability

- P.E.s demonstrate technical competence during the licensure process.
- P.E.s are bound by state regulations to take responsibility for their actions.
- Licensure system is instrumental in protecting the American public from incompetent or unethical practice.



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