Professional Engineer Licensing: Do I Really Need One?

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Origin of the Word “Engineer”

• Latin ingenium, meaning cleverness
• Latin ingeniare, meaning to contrive or devise
• Reference to someone who creates machinery dates back to 1300s
Military Engineering
Civil Engineering
Some History

• By the Middle Ages, an engineer was a devisor and constructor of military roads, bridges, towers, ladders, catapults, & siege engines

• They worked alongside other military specialists such as muleteers, grenadiers, and musketeers

• When not at war they satisfied civilian needs for roads, dams, and bridges, hence “civil engineering”

• Egyptian pyramids and Roman aqueducts are ancient examples
Stationary Engineers
Stationary Engineering

• Arose during the industrial revolution and steam power
• Today Stationary Engineers work in factories, large buildings, hospitals, warehouses, etc.
• They operate and maintain boilers, heat exchangers, HVAC, turbines, etc.
19th Century Engineering
Railroad Engineers

• 19\textsuperscript{th} Century designers of motive power, tracks, tunnels, coal and water stations, rolling stock, and routing and signaling systems

• Complexity meant the designers often also operated the machinery, which is why we still refer to train drivers as engineers

• Today, the 19\textsuperscript{th} century types of engineers are still around, but they are operators, not designers

• Basic qualification is a high school diploma
A Huge Shift in Engineering

• The rise of engineering as an academic discipline happened at the end of the 19th century and beginning of the 20th

• In roughly three decades we invented or implemented commercial electricity generation, electric motors and lighting, the phonograph, the telephone, motion pictures, early radio, automobiles, and heavier-than-air aviation

• The rapid rise in the importance of technology outstripped the ability of the scientists of the day to address needs beyond research
The New Engineering
The 20th Century Paradigm

• Mechanical and electrical engineering are applied physics
• Substantial academic preparation is required
• Colleges and universities added programs alongside civil engineering
• The 20th century academic approach is a thing of a different kind from the historical reliance on empirical methods
Design versus Engineering

• “Anyone” can design
• Floral designers, landscape designers, fashion designers, website designers, graphics designers
• Generally restricted to available tools and materials
• Largely empirical and artisinal, uses “cut and try” methods
Engineering (Modern Sense)

• Theoretical understanding is the most definitive attribute
• Designs most often work first time or with minimal tweaking
• Engineers can conceive things that never existed before
• Can devise new methods and materials
• Creates designs that are optimal in some manner: highest performance, exceptional reliability or durability, high maintainability, least initial cost, lowest life cycle cost, etc.
• Aircraft and modern communications systems cannot be “designed”, they must be engineered
The Rise of Regulation

• Deemed necessary whenever there are potentially serious health, safety, or financial consequences and...
• Users lack the ability to judge the competence of providers, or
• Users lack choice regarding usage (how many drivers stop to inspect a bridge before driving over it?)
• The State intervenes to protect the public through qualifying exams and provider licensing
• 1st bar exam in 1773, doctors and dentists mid 19th century
• Engineers first licensed 1907
St. Francis Dam
Failure of the St. Francis Dam

• Part of the water system for Los Angeles
• Construction began in 1926
•Leaks were deemed normal for a dam of its size
• Catastrophic failure just before midnight on March 12th, 1928
• Wall of water was initially ~140 feet high
• At least 450 people died
• Deluge traveled 54 miles to the Pacific Ocean, with bodies washing up as far south as Mexico
The Result
1929

• Given the demonstrated public hazard, the California legislature passed laws to regulate Civil Engineering
• Municipal exemption was eliminated
• Created the predecessor to the Board for Professional Engineers, Land Surveyors, and Geologists
• Engineers are regulated and licensed along with CPAs, architects, doctors, lawyers, also barbers, cosmetologists, and automobile drivers
Who is (legally) an Engineer?

• In Canada, it is illegal to call yourself an engineer without being licensed
• Both Canada and the USA base their legal systems on English Common Law
• The US states have the same restriction, but offer an industrial exemption for tech employers
• The employer is assumed able to judge the competence of prospective employees without the assistance of the State
• Many products lack compelling public health or safety concerns
Things You Can and Cannot Do

• You can work your heart out for a tech employer, but...
• You **may not** sign or seal documents that require a PE signature
• You **may not** offer, advertise, or provide services to the public
• You **may not** use “engineer” or “engineering” in the name of a business
• You **may not** assert that you are an engineer in a court of law or in a legal document
Licensing Boards

• ...are quick to jump on anyone who calls themselves an engineer without licensure, in advertising, business names, public offers to provide consulting, etc.

• Will issue fines, seek court orders, etc.

• If someone is injured as a result of work that should have involved licensed engineering, they can sue the bejabbers out of you and your employer
California Practice Acts and Title Acts

• Practice Acts cover mechanical, electrical, and civil engineering
• Only licensed persons may practice or offer to practice these branches of engineering
• Title Acts do not limit the work of individuals, but only licensed persons may refer to themselves as engineers in any manner
• Titles Acts cover agricultural, chemical, control systems, fire protection, industrial, metallurgical, nuclear, petroleum, and traffic engineering.
How to Obtain a License

• Obtain a four year college degree
• Pass the Fundamentals of Engineering (FE) exam
• Work at least four years under supervision of a PE
• Pass the Professional Engineering (PE) exam
• Alternative path (CA): at least twelve years of applicable experience allows skipping the FE exam and supervisory requirement to go right to the PE exam
• Four reference letters required
The Exam

• Paper and pencil format held twice per year
• Computer based format held year round at approved test centers
• High security, no programmable calculators or cell phones, ID checked thoroughly
• Open book (like employment)
• Timed, eight hours
• Rigorous and demanding
Question Format

• Multiple choice

• Formulated to filter those who understand the concepts at a sufficiently deep level from those reliant upon simplifying assumptions, shortcuts, rules-of-thumb, and cookbook methods

• Wrong answers include shortcuts and rules-of-thumb results

• The intent is to separate 19th century approach from 20th century approach, i.e. design from engineering
Test Results

• Notification takes about three month for paper tests, one to two weeks for computer-based testing
• If you fail you get your score, if you pass you don’t
• Pass rate varies by branch of engineering, 40 to 80%, 60% average
• Second attempt pass rate more like 40% average
Ongoing Responsibilities

• Annual renewal fee is currently $180 (CA)
• Many states have continuing education requirements
• Out-of-state work that requires a license can use the principle of comity to get permission or a second license
• This is similar to the ability of attorneys to participate in out-of-state trial work with court permission, or of doctors to practice out-of-state with permission from local licensing boards
Why Should it Matter to Me?

• It didn’t matter to me at first
• I was already a competent engineer
• I knew it and didn’t need to take any test to prove it to myself
• No prospective employer ever asked about a license
• I felt insulted that anyone could say that I wasn’t an engineer
• I was living in the industrial exemption cocoon
• Consulting does not offer a safe place!
Why I Took the Plunge

• My employer made licensure a condition for promotion into a division-level role
• The employer paid for study materials and time, application and test fees, and required travel
• I enjoyed brushing up on and expanding my skillset
• Employer tuition reimbursement benefits should apply to pursuit of licensure
• A license will make you stand out for challenging assignments and promotion
Since Then...

- Got the license in January, was laid off in February!
- The license walked out the door with me
- A lot of subsequent consulting work has not per se required a license, but a license is a credential for finding work
- It has been formally required for seeking regulatory approval for medical devices
- I have legally accepted work from the general public
- It is important for establishing credibility as an expert witness
- Some Federal and State contracts require PE oversight
This Happens Too...

- Credibility with contractors and architects
- Requests to apply for employment from municipal utility districts, makers of critical instrumentation, and others who need PEs
- These positions are stable and pay very well
- If I wanted to pivot exclusively to PE-required work, I could totally do that
The Bottom Line

• When licensure is important, it can be really, really important

• Licensure has unshackled me from legal boundaries. I can pursue engineering however employers or clients want within my personal limits of inclination and expertise

• You can keep it unimportant to your career or make it everything, but this should be an informed and deliberate choice

• ...and I’ve been pleased with my choice!