Professional Registration

Who, why and how?

Lee L. Lowery, Jr., P.E.

These notes are available at http://lowery.tamu.edu/feinfo
REQUIREMENTS:

Bachelor of Science degree in Civil Engineering, plus EIT certification in the State of Texas, or attainable within 6 months of hire. Microsoft Office. Experience with AutoCAD or MicroStation preferred. Experience with HEC-HMS, HEC-RAS, StormCAD, Hydroflow or other drainage software a plus.
What is a licensed engineer?

The Professional Engineering license grants you the legal ability to perform engineering services for the public, take responsibility for your designs, reports, plans, professional opinions, etc., and allows you to place your state-authorized engineering “seal” on your engineering work.
Who Must be Licensed?

- Persons performing engineering services for the public.
- Persons supervising the design and construction of public works.
- Persons using the term “Engineer” or “Professional Engineer”.
- Anyone who violates these parameters is subject to legal penalties.

http://www.tbpe.state.tx.us/disciplinary_all.htm
Who Should be Licensed?

You should be licensed if you wish to work as an engineering consultant or to start your own engineering company.

Many Civil Engineers find that after a few years in industry they wish to start their own company. In most states it is illegal to start your own engineering business without being licensed or at least having a company officer in charge of engineering, who is licensed.

Licensure gives you the right to offer engineering services to the public.
Case Number: D-32686; Enrique Isidoro Tabak, Toronto, Canada.

Violation: It was alleged that Mr. Tabak, who is no longer licensed in Texas as a professional engineer, signed and affixed his Texas engineer seal, when he had a current Texas engineer license, to design plans for a manufactured covering system constructed over a sport practice field in Texas and certified that the structure was designed and manufactured in a careful and diligent manner. This structure later collapsed during a severe storm event injuring several people. A review of the original design documents prepared by Mr. Tabak, indicated that several design aspects of the structure had not been thoroughly analyzed prior to manufacturing and construction and did not appear to be in compliance with various manufacturing, design and building codes. Therefore, it appears that, when licensed in Texas as a professional engineer, Mr. Tabak signed and sealed design plans that were not prepared in a careful and diligent manner and that his certification was misleading. Resolution: Cease and desist from practicing engineering in Texas and from affixing his Texas engineer seal for any project in Texas until such time as he should become re-licensed in Texas as a professional engineer and a $12,040.00 administrative penalty.
What is a Licensed Engineer?

Under the Texas Engineering Practice Act, only duly licensed persons may legally perform, or offer to perform engineering services for the public.

Having an engineering license means more than just meeting a State’s minimum requirements. It means you have accepted both the technical and the ethical obligations of the engineering profession.
Licensing: the product of collaboration between Industry, Government & Education

INDUSTRY
Professional Associations

EDUCATION
Program Accreditation

GOVERNMENT
State Licensing Boards

ABET - Accreditation Board for Engineering and Technology
NCEES - National Council of Examiners for Engineering and Surveying
Background and History

♢ School explosion, New London, Texas (March 18th, 1937)

♢ Engineering Registration Act (May 28th, 1937)
  http://www.tbpe.state.tx.us/lic.htm

♢ Texas Engineering Practice Act (August 30, 1965)
  Again modified in 2006
In the mid-1930s, the Great Depression was in full swing, but the London school district was one of the richest in America. A 1930 oil find in Rusk County had boosted the local economy, and educational spending grew with it. The school was built on sloping ground, and a large dead-air space was contained beneath the structure. The school board had overridden the original architect's plans for a boiler and steam distribution system, instead opting to install 72 gas heaters throughout the building.[2]

Early in 1937, the school board canceled their natural gas contract and had plumbers install a tap into Parade Gasoline Company's residue gas line in order to save money. This practice, while not explicitly authorized by local oil companies, was widespread in the area. The natural gas extracted with the oil was seen as a waste product and was flared off. As there was no value to the natural gas, the oil companies turned a blind eye.

Untreated natural gas is both odorless and colorless, so leaks are difficult to detect and may go unnoticed. Gas had been leaking from the residue line tap, and built up inside an enclosed crawlspace that ran the entire 253-foot (77 m) length of the building's facade.

At some time between 3:05 and 3:20PM Central (local) time, Lemmie R. Butler (an "instructor of manual training") turned on an electric sander. It is believed that the sander's switch caused a spark that ignited the gas-air mixture.

Reports from witnesses state that the walls of the school bulged, the roof lifted from the building, and then crashed back down and the main wing of the structure collapsed. The force of the explosion was so great that a two-ton concrete block was thrown clear of the building and crushed a 1936 Chevrolet parked nearby.[5]

Estimates of the number dead vary from 296 to 319, but that number could be much higher, as many of the residents of New London at the time were transient oilfield workers, and there is no way to determine for certain how many of these roughnecks collected the bodies of their children in the days following the disaster, and returned them to their respective homes for burial.
Engineering Practice Act

Engineers shall:

- Protect the public.
- Be objective and truthful.
- Be competent.
- Maintain the confidentiality of clients.
- Act in a responsible manner.
- Maintain competency through continuing education.
Engineering Practice Act

Establishes:

- That the privilege of practicing engineering be entrusted only to those persons duly licensed.
- Ethical guidelines and rules of conduct.
- Texas Board of Professional Engineers.
State Board of Professional Engineers

- They are authorized to license those individuals qualified to practice engineering.
- They regulate the practice of engineering in Texas.
- They make and enforce rules dealing with licensing, compliance and enforcement, and standards of conduct and ethics.
Licensing Board

- Nine members appointed by Governor.
- Six licensed professional engineers.
- Three from the general public.
- Staggered six year terms.
- Currently meets four times per year.
- Only compensation is per diem and transportation expenses.
Requirements for Licensing

1. Formal Education
2. Practical Experience
3. F.E. and P.E. Examinations
4. Continuing Education

http://www.tbpe.state.tx.us/lic_basic.htm
Idealized Engineering Licensure Model

ABET Accredited Engineering Bachelor of Science Degree [or a substantially equivalent engineering degree]

FE Exam

Pass

Engineer-in Training

4 Years of Acceptable Experience*

PE Exam

Pass

“Licensed Professional Engineer”

Mandatory Continuing Professional Competency

Yes

No

Inactive

* Note: The number of years of acceptable experience depends on the academic career and highest earned degree.

If fail, you can retake it.
When you pass, it’s good forever.
## Requirements for P.E.

<table>
<thead>
<tr>
<th>Type of Education</th>
<th>Experience Requirement</th>
<th>Examination Requirement</th>
<th>Reference Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accredited engineering degree (usually bachelor's)</td>
<td>4 years</td>
<td>Must pass FE, PE and ethics exams; may be eligible for waiver of FE exam with additional experience.</td>
<td>Three (3) references are required, all must be currently licensed P.E.’s. If requesting exam waiver, then five (5) references are required from currently licensed P.E.’s. The P.E. references not licensed in Texas must provide a copy of their current pocket card to verify licensure.</td>
</tr>
<tr>
<td>Accredited engineering degree and MS or PhD in engineering</td>
<td>3 years for MS or PhD only; 2 years for MS and PhD</td>
<td>Same as above.</td>
<td>Same as above.</td>
</tr>
</tbody>
</table>
Key Elements of Experience for P.E.

- It must demonstrate the use of engineering knowledge, education, and judgment.
- It must be progressive and of increasing standard of quality and responsibility.
- Should be obtained while working under the supervision of a licensed engineer.
Acceptable P.E. Experience

- Design experience - selection and use of recognized engineering principles and methodologies.
- Analysis experience - use of mathematical modeling and acceptable data collection techniques.
P.E. References

- At least 3 references.
- References must be current PE’s with personal knowledge of the applicant’s engineering experience.
- They verify your experience.
- They attest to your character, reputation, and general suitability to hold a license.
Examinations

Applicants for licensure must, in general, pass three examinations

- Fundamentals of Engineering (FE)
- Principles and Practice of Engineering (PE)
- Texas Ethics of Engineering
More information on registration

- [http://engineeringregistration.tamu.edu](http://engineeringregistration.tamu.edu)
- [http://www.tbpe.state.tx.us/lic.htm](http://www.tbpe.state.tx.us/lic.htm)
FE Exam at TAMU

- Offered several times per year. NCEES has partnered with Pearson VUE to administer the FE and FS, which are computer-based exams.
- Review sessions - math, science, engineering science, and civil engineering found at http://engineeringregistration.tamu.edu.
- TAMU CVEN pass rate – 75% to 98%.
- Exam coverage - http://ncees.org/exams/fe-exam/
- Calculator must come from an approved list.
- Reference manual and pencils are supplied.
Which exam should I take?

- NCEES says “you will be asked to select the module that best corresponds to your undergraduate degree.”
- Since there is a Civil version, that is probably what you should take, rather than “Other”.
- It is rumored that some states are not giving, or may not give, reciprocity for Civil Engineering unless you take the Civil version.
- Pass rates are better on the Civil version.
FE Exam Format

- The computer-based FE exam will be administered only at approved Pearson VUE testing centers. One is on campus.
- There will be four testing windows for the FE exam annually. Each will last two months, with a month between them. The open windows will be January–February, April–May, July–August, and October–November.
- Candidates may take the exam only one time per testing window and no more than three times in a 12-month period.
- The FE exam will be six hours in length, which will include a tutorial, breaks, the exam, and a brief survey at the conclusion of the exam.
- The FE exam will continue to be closed book. Supplied reference material for the exam will be provided on the computers at the testing centers and will also be available on the NCEES website.
- 110 multiple-choice questions, utilizing both SI and USCS
Typical details (Statics)

- Resultants of force systems
- Equivalent force systems
- Equilibrium of rigid bodies
- Frames and trusses
- Centroid of area
- Area moments of inertia
- Static friction

Principles and Practice Exam

After 4 years experience

• Morning Session ("Breadth" - same for all civil engineers) with forty multiple choice questions.

• Afternoon Session (you select a "Depth" area) with forty multiple-choice questions.
Principles and Practice Exam
After 4 years experience

 Discipline Specific

Civil: Construction
Civil: Geotechnical
Civil: Structural
Civil: Transportation
Civil: Water Resources and Environmental

Environmental
Structural

For specifications, see
http://ncees.org/exams/pe-exam/
Ethics of Engineering Exam

- Open book exam over the law and rules of the Texas Engineering Practice Act
- Assures the applicant is familiar with state law and board rules
- Gives the applicant experience in applying the law and board rules
Continuing Professional Competency

- Requires engineers to continue their engineering training and education.
- Must obtain 15 Professional Development Hours (Continuing Education) each year as a requirement for license renewal.
- Course/Activity - Any qualifying course or activity with the clear purpose and objective of maintaining, improving, or expanding the skills and knowledge relevant to the license holder's field of practice.
- One hour must deal with engineering ethics.

http://engineeringregistration.tamu.edu/ContinuingEducation/index.htm
Why Should I Become Licensed?

- **Job requirements** -- Only a licensed engineer may prepare, sign and seal, and submit engineering plans and drawings to a public authority for approval, or seal engineering work for public and private clients.

- **Aids in promotion** -- sets you apart from others. Employers look to licensure in evaluating the advancement potential of their employees.

- **Prestige** -- Licensed engineers achieve enhanced status in the eyes of the public
Why Should I Become Licensed?

➢ Public Recognition:

As a licensed engineer you achieve an enhanced status in the eyes of the public, your employer, and your peers, which equates you with professionals licensed in other fields such as physicians, attorneys, etc.
Why Should I Become Licensed?

- **Private Practice:**
  If you want to pursue a career as a consulting engineer, or start your own engineering firm, or be in responsible charge of engineering work for the public, you must be licensed.
Why Should I Become Licensed?

➢ Public Practice:

Many federal, state, and municipal agencies now require that certain responsible engineering positions, particularly those considered “higher level,” be filled only by licensed engineers.
Why Should I Become Licensed?

Changing Workplace:

Today’s workplace is rapidly changing: restructuring, downsizing, privatization, and outsourcing (where firms terminate employees and then hire them back as consultants) are common. You should be prepared to face a possible transition into a consulting or contract relationship with a former employer in the event of corporate outsourcing. Such a relationship requires an engineering license.
What are my chances of passing the FE Exam? 
A&M vs. National Pass Rate 

<table>
<thead>
<tr>
<th>Month</th>
<th>TAMU CE Pass Rate</th>
<th>National CE Pass Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr-90</td>
<td>76%</td>
<td></td>
</tr>
<tr>
<td>Apr-91</td>
<td>72%</td>
<td></td>
</tr>
<tr>
<td>Apr-92</td>
<td>74%</td>
<td></td>
</tr>
<tr>
<td>Apr-93</td>
<td>69%</td>
<td></td>
</tr>
<tr>
<td>Apr-94</td>
<td>83%</td>
<td>80%</td>
</tr>
<tr>
<td>Apr-95</td>
<td>92%</td>
<td>92%</td>
</tr>
<tr>
<td>Apr-96</td>
<td>96%</td>
<td>95%</td>
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<tr>
<td>Apr-97</td>
<td>95%</td>
<td>94%</td>
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<tr>
<td>Apr-98</td>
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<tr>
<td>Apr-00</td>
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<tr>
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<td>95%</td>
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</tr>
<tr>
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<td>Apr-03</td>
<td>81%</td>
<td>81%</td>
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<td>Apr-04</td>
<td>80%</td>
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<tr>
<td>Apr-05</td>
<td>98%</td>
<td>98%</td>
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<tr>
<td>Apr-06</td>
<td>84%</td>
<td>84%</td>
</tr>
<tr>
<td>Apr-07</td>
<td>90%</td>
<td>81%</td>
</tr>
<tr>
<td>Apr-08</td>
<td>90%</td>
<td>81%</td>
</tr>
</tbody>
</table>

Monthly pass rates from Apr-90 to Apr-08 are shown in the graph.
When should I take the exam?

- If you take it one semester before you graduate, you have learned less of the material that will be on the exam.
- If you take it your last semester, you will have learned far more of the material that will be on the exam. You have a better chance of passing it your last semester.
- You can take it as many times as it takes, and it never “dies” with age once you pass it.
What you should start doing now?

- Go to [http://engineeringregistration.tamu.edu](http://engineeringregistration.tamu.edu)
- Look over those materials, including what is on the exam.
- Click on “Reference Manual” and print one out (free).
- Look over the materials covered and see how they relate to the classes you are now taking. Chemistry, math, projectile motion, statics, strength of materials, steel design, etc.
- Fully understand the difference in notation used between your text and that used in the reference manual.
- Try and work your homework problems using the reference manual.
- **Make copies of any of your homework problems which correspond to equations in the reference manual and keep copies of them in a tabbed notebook.**
Example: Math
The formula for solving an investment problem is:

\[ (P \times I) + f + I = P \]

Where:
- \( P \) is the principal amount.
- \( I \) is the interest rate.
- \( f \) is the future value.
- \( I \) is the investment period.

To account for inflation, the dollars are defined by the general inflation equation:

\[ \text{Inflation} = \frac{P \times I + f + I}{P} \]

Example: Engineering Economics

<table>
<thead>
<tr>
<th>Break-Even Analysis</th>
<th>Formula</th>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 1 - \left(1 + \frac{m}{100}\right) )</td>
<td>( m )</td>
<td>Annual Rate</td>
<td>Number of years of expected return</td>
</tr>
<tr>
<td>( \frac{P \times I + f + I}{P} )</td>
<td>( P )</td>
<td>Projected Value</td>
<td>Present Worth Value of an Investment</td>
</tr>
<tr>
<td>( \frac{P \times I + f + I}{P} )</td>
<td>( I )</td>
<td>Projected Worth</td>
<td>Present Worth Value of an Investment</td>
</tr>
<tr>
<td>( \frac{P \times I + f + I}{P} )</td>
<td>( f )</td>
<td>Projected Future</td>
<td>Future Worth Value of an Investment</td>
</tr>
<tr>
<td>( \frac{P \times I + f + I}{P} )</td>
<td>( \text{Inflation} )</td>
<td>Projected Inflation</td>
<td>Effective Rate of Inflation</td>
</tr>
</tbody>
</table>

**Note:**
- \( P \) is the principal amount.
- \( I \) is the interest rate.
- \( f \) is the future value.
- \( I \) is the investment period.

**Definitions:**
- **Future Worth:**
  - \( P \):
  - \( I \):
  - \( f \):
- **Present Worth:**
  - \( P \):
  - \( I \):
  - \( f \):
- **Inflation:**
  - \( m \):
  - \( P \):
  - \( I \):
  - \( f \):
Example: Statics
Example: Steel Design
What if I don’t take the F.E. exam before I graduate?

- You should take it as soon as possible.
- You won’t ever know any more of the material than you do just before graduation, and will forget most of it once you go to work and start to specialize, through lack of practice with basic math, chemistry, etc. You will become an expert on designing steel buildings, but will forget all the dynamics you ever learned.
- If you need help getting back up to speed on the basics, there are several short courses that have an excellent track record helping people pass both the F.E. and P.E. exams. See http://engineeringregistration.tamu.edu. They cost about $2000 or more to attend, another reason to take the exam while you are here.
- Many free review sites are also available, but paying $2000 is definitely an incentive to buckle down and get it done, plus trying to find time to sit in front of your computer and watch a review is never as likely to happen as leaving the office and going to a classroom.
Miscellaneous Questions

- What if I am an international or other non-traditional student?
  
  In Texas you can check your eligibility by contacting the Board of Registration at [http://engineers.texas.gov/contact.htm](http://engineers.texas.gov/contact.htm)

- For other states see [http://www.ncees.org/Licensure/Multistate_and_international_practice.php](http://www.ncees.org/Licensure/Multistate_and_international_practice.php)

- Can I take the F.E. exam here if I intend to practice in another state?
  
  Yes, the exam is standard across the country.

- I hear that the F.E. exam format will be changing.
  
  True. Rather than holding it in specific locations across the country twice a year, they will start giving the exam four times a year at [Pearson VUE](https://www.pearsonvue.com) testing center locations during two-month “windows”. Click here for additional information. The P.E. exam will remain in its current format for the foreseeable future.
What should I do once I go to work?

- Keep a daily log of your activities.
- State your work in terms of the engineering involved – inspection, design, analysis, …
- Seek out and work with a licensed professional engineer in your company. If they don’t have one, see if their parent company has one, or someone they are very close to and work for, or who works for them.
- List that person in your daily log along with who they are, their title, contact information, etc.
- When they quit, get with another one, but seriously hang on to your previous mentor’s contact. Call them every now and then, keep in email contact, how’s the job going, like some advise on a problem I am having with a design, like to take you to lunch, …
- You need to develop engineering references who are willing to confirm your qualifications and character, both in and out of house.
Where to get more information

- http://engineeringregistration.tamu.edu
Job Outlook - Opinions

Estimated Investment Needed by 2020:

$3.6 Trillion

Projected Employment Growth by 2022 is 20%

This means 53,700 More Jobs

VIA BLS.GOV
## Job Outlook - Facts

<table>
<thead>
<tr>
<th></th>
<th>Spring</th>
<th>Summer</th>
<th>Fall</th>
<th>Totals</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>NA</td>
<td>NA</td>
<td>55</td>
<td>146</td>
<td>&lt;---- Probably</td>
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<tr>
<td>2009</td>
<td>51</td>
<td>17</td>
<td>28</td>
<td>96</td>
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<td>2010</td>
<td>47</td>
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<td>65</td>
<td>13</td>
<td>54</td>
<td>132</td>
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<td>2012</td>
<td>78</td>
<td>15</td>
<td>53</td>
<td>146</td>
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</tr>
<tr>
<td>2013</td>
<td>85</td>
<td>16</td>
<td>67</td>
<td>168</td>
<td></td>
</tr>
</tbody>
</table>

![Bar chart showing job outlook trends from 2008 to 2013]
Opportunities

- [http://Lowery.tamu.edu/CEJobs](http://Lowery.tamu.edu/CEJobs)