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Assessing Preparation for Professional Engineering Licensure in U.S. Construction Engineering Programs

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This study examines the effectiveness of Construction Engineering programs in preparing students to obtain Professional Engineering (PE) Licensure. While ABET-accredited programs are required to demonstrate compliance with established student outcomes, they are not always aligned with the technical content emphasized in the Fundamentals of Engineering (FE) and Principles and Practice of Engineering (PE) Exams. Using public curriculum data from the 24 U.S. ABET-accredited Construction Engineering Bachelor's Degrees, this study examines the required coursework and the topic areas specified for the relevant FE and PE examinations. The analysis highlights discrepancies between required coursework and exam coverage. National data on FE and PE participation and licensure are also reviewed to highlight the importance of these findings. The results suggest that while Construction Engineering programs provide students with adequate engineering problem-solving and managerial skills, additional emphasis on FE/PE-aligned fundamentals could strengthen professional licensure readiness and career success among Construction Engineering graduates.

Keywords: Construction Engineering, ABET (Accreditation Board for Engineering and Technology), NCEES (National Council of Examiners for Engineering and Surveying), Fundamentals of Engineering (FE) Exam, Principles of Practice of Engineering (PE) Exam

Introduction

Professional engineering licensure has long served as a fundamental element of professional credibility. In 2024, there were 986,562 licensed professional engineers in the United States across all industries (NCEES, 2025). Just under 1 million people is substantial; however, in 2024, there were 8,237,000 people employed by nonresidential construction companies in the United States, which creates approximately \$1.24 trillion worth of structures each year (U.S. Bureau of Labor Statistics & Associated General Contractors of America, 2025). The Licensure distinguishes an engineer's competence, accountability, and commitment to public safety. The necessity for professional engineers in the construction industry continues to grow as infrastructure becomes increasingly complex and risk-driven, making it imperative that ABET-accredited engineering programs fully prepare their students to pursue licensure. The ability to stamp, draw, make educated engineering judgments, and lead integrated project teams sets Professional Engineers apart from their non-licensed counterparts. Construction Engineering programs teach at the intersection between design and construction management. These programs integrate civil and structural engineering principles with construction management practices such as project planning, scheduling, and cost control to ensure that construction projects are built efficiently and safely. Despite the industry's growing reliance on

licensed engineers, there remains a limited understanding of the Construction Engineering programs' preparation of their students for the licensure process. This study examines the effectiveness of U.S. Construction Engineering programs in preparing students to obtain Professional Engineering Licensure. Specifically, it evaluates the relationship between ABET-accredited Construction Engineering Curricula and the content set forth by NCEES in the FE and PE exams, which are most closely aligned with the Construction Engineering Programs. The prevailing theory is that Construction Engineering programs should actively encourage and support licensure preparation through structured academic preparation. This includes faculty lecturing about the importance and process of licensure, integrating FE and PE practice problems into coursework, and potentially offering a one-credit FE preparation course to encourage students to take the first step. These initiatives aim to bridge the gap between ABET student outcomes, which emphasize overall professional competence, and the technical learning outcomes assessed in the FE and PE exams.

Background

FE and PE Examinations Options for Construction Engineers

The FE and PE Examinations are administered by NCEES and are just two of the four criteria necessary for obtaining professional licensure. The FE exam is typically taken during or immediately after college, due to its coverage of college-related topics. The PE exam is typically taken any time after passing the FE exam and gaining four years of experience, depending on the licensing state's requirements. There are no requirements for which exams engineers must take to receive licensure – it is purely the choice of the examinee to determine which exams they feel the most comfortable and knowledgeable in. In the major engineering disciplines, there is a dedicated examination for the FE exam, and the PE exams focus on a more technical industry practice. Construction Engineering graduates often face the decision to take either the Civil Engineering or the Other Disciplines FE exam, as there is no dedicated Construction Engineering exam. Since there is no exam specifically designed for these students, it may deter them from taking the examination or leave them less prepared when they do take it. There remains the question of whether Construction Engineering students are being put in a position to succeed in these examinations. To understand this, it is essential to examine the requirements for professional licensure. Although the licensing board and requirements differ from state to state, the four main requirements are as follows:

1. Obtain a bachelor's degree in engineering from an ABET-accredited program
2. Take and pass the Fundamentals of Engineering exam
3. Accumulate at least four years of relevant work experience under the supervision of a licensed Professional Engineer
4. Take and pass the Principles and Practice of Engineering exam

After an engineer completes those steps, they can receive professional licensure. Engineering program curricula are dictated by ABET to ensure they meet the requirements to receive accreditation. As a result, ABET requirements do not require programs to evaluate students on all the same topics that the NCEES exams cover.

ABET Student Outcomes versus FE/PE Exam Content

Accreditation through ABET represents the standard for quality assurance in engineering and technology education. Much like the obligation that NCEES has made to professional licensure, ABET accreditation ensures that programs produce graduates who are competent in engineering, show ethical integrity, and have the ability for collaborative innovation. However, the criteria that identify ABET compliance differ substantially from the technical expectations set forth by NCEES to obtain professional licensure. While both learning outcomes aim to produce competence and

readiness, they approach “engineering preparedness” from different perspectives. ABET requires competency-based outcomes, supplemented by some baseline coursework requirements, as shown in Table 1, while NCEES requires topic-based knowledge assessments, as shown in Table 2 (ABET and NCEES, 2025).

Table 1. ABET Program Criteria 2025-2026: Construction and Similarly Named Engineering Programs

A.	Application of:
i.	Mathematics through differential and integral calculus, probability , and statistics , general chemistry , and calculus-based physics
ii.	Knowledge of construction methods , materials , equipment , planning , scheduling , safety , and cost analysis
B.	Analysis and design of construction processes and systems in the Construction Engineering specialty field
C.	Explanation of:
i.	Basic legal and ethical concepts and the importance of professional engineering licensure in the construction industry
ii.	Basic concepts of management topics such as economics, business, accounting, communications, leadership, decision and optimization methods, engineering economics , engineering management, and cost control

Table 2. NCEES Exam Content

Other Disciplines FE	Civil FE	Civil: Construction PE
1. Mathematics	1. Mathematics and Statistics	1. Soil Mechanics
2. Probability and Statistics	2. Ethics and Professional Practice	2. Site Layout and Development
3. Chemistry	3. Engineering Economics	3. Material Properties
4. Instrumentation and Controls	4. Statics	4. Estimating Quantities and Costs
5. Engineering Ethics and Societal Impacts	5. Dynamics	5. Project Planning and Scheduling
6. Safety, Health, and Environment	6. Mechanics of Materials	6. Material, Production, and Execution Quality Control
7. Engineering Economics	7. Materials	7. Structural Mechanics
8. Statics	8. Fluid Mechanics	8. Hydraulics and Hydrology
9. Dynamics	9. Surveying	9. Construction Operations and Methods
10. Strength of Materials	10. Water Resources and Environmental Engineering	10. Design for Support of Construction Loads
11. Materials	11. Structural Engineering	11. Health and Safety
12. Fluid Mechanics	12. Geotechnical Engineering	
13. Basic Electrical Engineering	13. Transportation Engineering	
14. Thermodynamics and Heat Transfer	14. Construction Engineering	

While ABET requires coursework to explain the importance of professional licensure, it does not require all the coursework necessary for students to be fully prepared for the material covered on the FE and PE exams. The distinction lies in how each entity defines readiness. The ABET topics emphasized in Table 1 only emphasize a portion of the exam topics expected for evaluation on NCEES exams, as shown in Table 2. These two systems approach the concept of engineering preparedness from fundamentally different perspectives – one being centered on performance-based competency, and the other being comprehensive technical knowledge.

This difference can produce meaningful gaps for Construction Engineering students. For example, ABET allows programs to satisfy outcome criteria through applied coursework such as construction courses and baseline engineering courses. While these courses are essential to industry success, they may replace or minimize courses that the FE and PE exams heavily test, such as core civil engineering topics or other fundamental engineering concepts. Consequently, students graduating from ABET-accredited Construction Engineering programs may meet all accreditation requirements but still find themselves underprepared for licensure examinations that assume a broad familiarity with traditional engineering fundamentals.

These curricula's trade-offs are further constrained by credit hour constraints, as well as the growing necessity for technological education in programs. The construction industry employs a wide range of technologies, making it challenging to educate students on all the relevant applications within an already dense degree plan. Programs must decide whether to prioritize technical theory or applied construction competencies, and this decision varies widely among institutions. It is essential to understand how these curricular choices impact exam readiness, enabling the construction industry to meet the demands of professional licensure in an increasingly competitive market.

To explore this relationship in measurable terms, the following section compares the required coursework from the 24 ABET-accredited Construction Engineering programs in the U.S. against the published topics for the FE and Construction PE exams. This comparison aims to highlight the frequency with which programs opt to substitute certain courses, providing insight into exam preparedness among relevant institutions.

Methodology

Overview of Approach

This study employed a comparative content analysis to evaluate the relationship between the curricula of ABET-accredited Construction Engineering programs and the topic areas specified by NCEES for FE and PE examinations. The objective was to produce a measurable alignment between the Construction Engineering coursework and the technical examination knowledge necessary for professional licensure. Because Construction Engineering graduates may have differing licensure pathways, this study examines three exam frameworks:

1. Civil - Fundamentals of Engineering Exam
2. Other Disciplines - Fundamentals of Engineering Exam
3. Civil: Construction - Principles and Practice of Engineering

Each examination was analyzed independently to determine the alignment of coursework with different possible steps to licensure. This study acknowledges that some of the PE examination's content is intended to be learned through professional experience, rather than through schoolwork; however, it is still noteworthy to note how much is focused on through education versus experience.

Program Selection

Twenty-four undergraduate ABET-accredited Construction Engineering (or similarly named) programs were included in this analysis. These programs were selected through the ABET Accredited Program Search based on the following criteria

1. The program is ABET-accredited under the “Construction Engineering” Discipline
2. The program is classified as a “Bachelor’s Degree” level
3. The location of the program is in the United States of America

Programs that are not titled exactly as “Construction Engineering” but received accreditation under ABET’s “Construction Engineering” criteria were included. The schools that meet this criterion, along with their respective program titles, are shown in Table 3.

Table 3. ABET-Accredited Construction Engineering Programs

#	University	Program Title
1	The University of Alabama	Construction Engineering
2	Arizona State University	Construction Engineering
3	University of Arkansas at Little Rock	Civil and Construction Engineering
4	California State Polytechnic University, Pomona	Construction Engineering and Management
5	University of Central Florida	Construction Engineering
6	The Citadel	Construction Engineering
7	University of Colorado Denver	Construction Engineering & Management
8	University of Delaware	Construction Engineering and Management
9	East Texas A&M University	Construction Engineering
10	Georgia Southern University	Construction Engineering
11	University of Hawaii at Manoa	Construction Engineering
12	Iowa State University	Construction Engineering
13	Marquette University	Construction Engineering
14	University of Nebraska - Lincoln	Construction Engineering
15	University of New Mexico	Construction Engineering
16	North Carolina State University at Raleigh	Construction Engineering
17	North Dakota State University	Construction Engineering
18	Purdue University at West Lafayette	Construction Engineering
19	San Diego State University	Construction Engineering
20	University of Texas at El Paso	Construction Engineering and Management
21	Texas Tech University	Construction Engineering
22	The University of Utah	Construction Engineering
23	Virginia Polytechnic Institute and State University	Construction Engineering and Management
24	Western Michigan University	Construction Engineering

Data Collection and Analysis

Curriculum data were collected directly from each institution's course catalog, plan of study, and departmental advising sheets to identify the required courses, as well as recommended elective

courses. Although elective courses were noted during data collection, the data provided only show required courses to portray the required pathway provided by each curriculum. Each required course was coded by primary subject area based on title, and then appropriately mapped to examination topics to show that the criteria have been met. In cases where multiple topics were combined into a single class or course, or course titles were unclear, the catalog descriptions were used to map courses appropriately. All twenty-four programs were evaluated into the following mapping frameworks:

- FE – Civil Engineering Exam Topics vs. Curriculum Required Courses
- FE – Other Disciplines Exam Topics vs. Curriculum Required Courses
- PE – Civil: Construction Exam Topics vs. Curriculum Required Courses

By mapping the required courses in curricula against the required exam topics, as shown in Table 4 below, we can gain a deeper understanding of how programs prepare students for licensure. The two main data points evaluated in this study are the percentage of programs that cover each exam topic and the percentage of each exam that programs cover.

Table 4. Example Mapping Format for FE Civil Engineering vs. Required Courses

Exam Topics	University 1	University 2	National Average
Mathematics	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100%
Probability and Statistics	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100%
Chemistry	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	100%
Instrumentation and Controls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0%
Engineering Ethics and Societal Impacts	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	66.7%
Safety, Health, and Environment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	66.7%
Engineering Economics	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	33.3%
Statics	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	66.7%
Dynamics	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	66.7%
Strength of Materials	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	33.3%
Materials	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	33.3%
Fluid Mechanics	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	33.3%
Basic Electrical Engineering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0%
Thermodynamics and Heat Transfer	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	33.3%
Percentage of Topics Required	71.4%	64.2%	21.4%	

The same format was used for all three exams included in this study, with their respective exam topics. After collecting data from each program and mapping it to exam topics, percentages of coverage were used to provide comparative insights into topic coverage across the three exams. Using the required course and topic mapping, the frequency of presence or absence of exam topics in the curricula could be recorded and converted into national coverage percentages. The coverage results were compared across the three exams to determine how Construction Engineering programs align with the NCEES expected examination material. This data provided a quantitative foundation for identifying which exam topics are often required in Construction Engineering curricula and which topics are not required or offered as elective courses.

Analysis and Findings

Overview of Metrics

After analyzing the required coursework from 24 ABET-accredited Construction Engineering programs and mapping each course to the topics required by NCEES in the FE – Other Disciplines, FE – Civil Engineering, and PE – Construction exams, the results were compiled into two complementary formats: national average and percentage of required topics.

1. **National Average:** for each exam topic, the percentage of programs with at least one required course covering that topic. For example, 83% of programs have a required course covering Surveying for FE Civil.
2. **Percentage of Topics Required:** for each program and exam, the percentage of exam topics covered by required courses in that curriculum. For example, University 1 has a required course dedicated to 76% of the exam topics for FE Other.

To quantify the national average as a single percentage that represents overall exam preparedness, a weighted average was used, based on the national average for each program, as well as a percentage average. The weighted average takes into account the number of questions for each exam topic, as specified by NCEES. Using these data points, the national commonality of each exam topic and the completeness of each program's required curriculum in relation to each NCEES exam can be analyzed.

Topic Coverage Across Programs

Overall, the national average for topics related to baseline science, engineering, and mathematics, including 100% coverage in the following topics:

- Mathematics
- Probability and Statistics
- Chemistry
- Construction Engineering
- Estimating Quantities and Costs
- Project Planning and Scheduling

These high coverages are followed by 7 topics with coverage ranging from 75% to 100%, while the remaining topics have coverage below 75%. A few of the topics with below 75% coverage are those that appear across multiple exams, such as dynamics and fluid mechanics. There are other significant exam topics that appear consistently, such as statics, materials, and structural engineering.

FE – Other Disciplines

Using the national average analysis, the FE – Other Disciplines exam, there are some very noticeable shortcomings in more specialty areas, such as instrumentation and controls (0% coverage), basic electrical engineering (8% coverage), and thermodynamics and heat transfer (4% coverage), as shown in Figure 1 below. It is possible that basic electrical engineering topics could be covered in required physics courses; however, it is not necessary to teach all the information necessary in those courses.

The average national coverage for exam topics on this exam is 60.7%. Using the weighted average, the national coverage is 60.9%, which suggests that programs commonly do not cover lesser-examined topics, but are missing major required material overall.

The maximum percentage coverage amongst programs is 79%, while the minimum coverage is 29%. This suggests that programs may not be as focused on specific major exam material, such as topics in electrical and mechanical engineering.



Figure 1. FE – Other Disciplines National Coverage by Exam Topic

FE – Civil

Examining the national average reveals significant shortcomings in exam topics, such as Water Resources and Environmental Engineering, and Transportation Engineering, as shown in Figure 2 below.

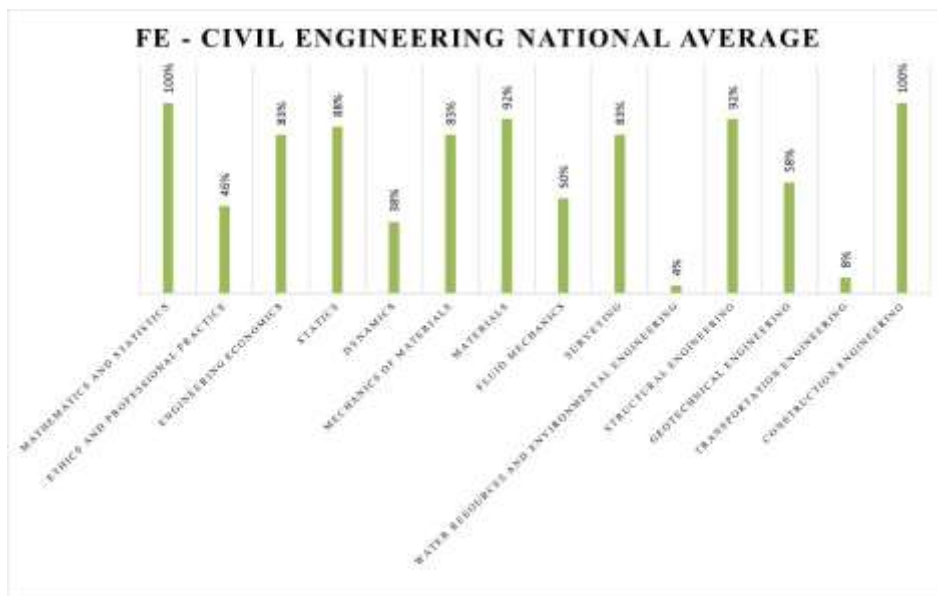


Figure 2. FE – Civil National Coverage by Exam Topic

The average national coverage for this exam is 66%; however, the weighted average national coverage is 65.1%. This change is likely due to the large portion of the exam being devoted to Water Resources

and Environmental Engineering (10-15 questions) and Transportation Engineering (9-14 questions). The maximum coverage by a program for this exam is 86% and the minimum coverage is 29%. The national coverage average indicates that programs are more likely to be prepared to take this exam compared to other disciplines exam, based on the required courses.

PE Civil: Construction

The national average for PE exam topics is significantly lower than compared to FE exam coverage, as shown in Figure 3 below. This is likely because of the more industry-focused exam topics included on PE examinations. The average national coverage percentage across all programs is 44.3%, while the weighted average is 44.1%. The maximum national coverage is 82%, while the minimum national coverage is 27%. This exam has the widest range of coverage as well as the lowest average coverage. It is possible that these topics are covered throughout other courses instead of having their own designated required courses.



Figure 3. PE – Civil: Construction National Coverage by Exam Topic

This study shows low coverage in the site layout and development, material, production, and execution quality control; however, these topics could be covered in other construction-related courses.

Conclusion

This study aimed to assess the alignment between ABET-accredited Construction Engineering Bachelor's Degree programs and the NCEES Fundamentals of Engineering and Principles and Practice of Engineering exams. The results indicate slight discrepancies when comparing required courses to exam content. The study demonstrates strong coverage in baseline engineering courses, such as mathematics and statistics, as well as in core construction courses. These findings reinforce the core argument that ABET outcome compliance does not guarantee readiness for the FE and PE exams; however, a deeper dive into course content, schedule, and other program resources is necessary to understand individual programs' exam readiness. This is further proof that programs should consider lecturing about the importance and process of licensure, integrating FE and PE practice problems into coursework, and potentially offering a one-credit FE preparation course to

encourage students to take the first step. Doing this can strengthen the identity of Construction Engineering programs and their graduates, and, therefore, enhance the construction industry.

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