Comparison of ABET-Accredited Construction Engineering Curricula in U.S. Universities

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Abstract

Accreditation verifies program quality and ensures a strong educational foundation for students. The Accreditation Board for Engineering and Technology (ABET) is the premier accrediting body in the U.S., evaluating programs across 91 disciplines, including three construction-related areas: Construction Engineering (ConE), Construction Engineering Technology, and Construction Management. While ABET establishes baseline criteria, prior curriculum comparisons of ConE programs are typically limited to small or cross-disciplinary contrasts, leaving a gap in national, quantitative investigation across accredited ConE programs. Given that ConE programs must balance core engineering sciences with application-specific construction knowledge, ensuring consistency and relevance is paramount. This paper compares the curricula of all 22 ABET-accredited Construction Engineering programs in U.S. universities to analyze how these programs interpret and adhere to specific ABET criteria. By systematically categorizing course catalogs from these 22 programs into areas such as Engineering Science, Math/Basic Science, and Management, the study identifies core differentiating features within the discipline. Findings reveal significant variance in credit allocation, particularly within engineering science and management requirements. These insights highlight curricular flexibility and emerging pedagogical trends, offering a valuable framework for institutions developing or revising ConE programs to meet the evolving needs of the modern construction industry.

Key Words: Curricula, Construction Engineering

Introduction

The curriculum of a Construction Engineering (ConE) program must strike a delicate balance between the rigorous analytical requirements of traditional civil engineering and the applied operational demands of the construction industry. While both disciplines share a common lineage, the increasing complexity and technological advancement of global infrastructure projects have necessitated a divergence in student preparation.

To understand the current state of ConE education in the U.S., this study performs a comprehensive comparative analysis of curricula across 22 distinct university programs. By examining the "guaranteed baseline" of education – the core courses required for every graduate – this research identifies whether specific programs are fundamentally technical design degrees with a construction focus, or management-centric degrees built on an engineering foundation.

Literature Review

ABET Accreditation Framework

ABET accreditation establishes minimum standards for engineering education by defining program criteria, student outcomes, and continuous improvement requirements. The shift from prescriptive, input-based accreditation to outcomes-based assessment has significantly influenced curriculum design across engineering disciplines, requiring programs to demonstrate alignment between educational objectives, learning outcomes, and assessment evidence. Prior studies indicate that ABET-accredited engineering programs are generally perceived by industry as better preparing graduates with core technical competencies, professional skills, and ethical responsibility [1-3].

In Construction Engineering (ConE), ABET outlines discipline-specific criteria that distinguish the field from related disciplines by emphasizing construction process analysis and system design rather than facility design alone. Core competencies include mathematics, basic sciences, engineering sciences, construction methods and systems, cost and scheduling, safety, management principles, and ethical issues. Although these standards establish baseline expectations, ABET intentionally allows flexibility in how programs structure and emphasize curricular content to accommodate institutional missions, regional industry needs, and evolving professional practice [4, 5].

Existing research highlights that such flexibility leads to meaningful differences among accredited programs, even as they all meet ABET requirements. Studies comparing construction-related disciplines and select ConE programs indicate differences in credit-hour allocation, sequencing of engineering science and construction courses, and integration of management content. However, most prior work focuses on cross-disciplinary comparisons or limited samples, providing only partial insight into how ConE programs collectively interpret and implement ABET criteria [6-8].

Curriculum Components

Construction engineering curricula are designed to blend foundational technical knowledge with specialized construction-focused content. Engineering science coursework provides the analytical foundation necessary for construction process design, while construction methods courses address the application of engineering principles to real-world construction operations [5].

Design within ConE programs is commonly interpreted as construction process and system design, encompassing means and methods, equipment selection, site layout, work sequencing, temporary structures, logistics, and safety systems. Unlike traditional civil engineering design focused on permanent facilities, ConE design emphasizes constructability, execution planning, and performance under practical constraints such as cost, schedule, safety, and risk [3, 9].

Management education represents a distinguishing feature of ConE curricula and includes estimating, scheduling, project controls, contracts, and organizational management. While ABET requires coverage of management fundamentals, prior studies report substantial variation in the depth and placement of management content within ConE programs. Similarly, technical electives provide additional flexibility, allowing programs to emphasize specialized areas aligned with faculty expertise or industry demand [10, 11].

Comparative analyses of construction-related curricula indicate notable differences across institutions in the balance of engineering science, construction methods, design, and management. These variations create distinctive curricular profiles that influence graduate skills and readiness for professional practice. However, the extent and nature of this variation among ABET-accredited CE programs at a national level have not been comprehensively quantified [4, 12].

Research Gap and Study Objective

While ABET accreditation ensures that all ConE programs meet baseline educational standards, existing literature provides limited empirical evidence regarding specific differences in curricular emphasis and structure among accredited programs. Previous research has often been restricted in scope, focusing on cross-disciplinary comparisons or relying on qualitative descriptions rather than systematic, quantitative analysis.

This study addresses this gap by conducting a comprehensive, quantitative comparison of the curricula of all ABET-accredited ConE programs in the United States. The objective is to identify similarities and differences in curricular composition and to document how programs distribute emphasis across core content areas while complying with ABET criteria. Currently, no single document offers a direct comparison of all such programs; consequently, institutions or departments seeking to establish new ConE programs must often conduct independent investigations to gather necessary benchmarking data. This manuscript serves as a centralized resource for identifying how peer institutions structure their ConE curricula. By providing this direct comparison, the study contributes to the construction engineering body of knowledge and supports informed curriculum assessment, development, and continuous improvement.

Importantly, the authors do not intend to suggest that any programs mentioned fail to satisfy ABET requirements. Rather, this analysis showcases the diverse methods by which these requirements are successfully met, as evidenced by the varying curricular structures across institutions.

Methodology

Sample Selection and Data Sources

To compare U.S. construction engineering curricula, the authors utilized the ABET directory of accredited programs [13]. Using the keywords “Construction Engineering” (ConE) and “Construction Engineering and Management” (CE&M), the search identified 18 ConE programs and 4 CE&M programs that satisfy ABET's construction engineering criteria Table *1.* The 22 programs range from the first accredited program at North Carolina State University (1958) to several accredited programs as recently as 2020.

Data Categorization

Curricula and course descriptions were retrieved from university department pages and catalogs to identify content requirements. Courses were compared to identify commonalities in how each program satisfies accreditation standards. The investigation focused on:

- Total credit requirements: The total number of credits required to complete a degree at each university.

- Math and Science course requirements: foundational courses in calculus, differential equations, linear algebra, and natural sciences.
- General Education requirements: Humanities, social sciences, and communications.
- Civil Engineering background course requirements: Traditional engineering science (e.g., Statics, Geotechnical Engineering, Fluids).
- Construction related course requirements: Courses focused on the project lifecycle, including Estimating, Scheduling, Safety, and MEP systems.

Table 1: List of CE and CEM programs used in the analysis

No.	University	Program Type	Accred. Year	Required Credits
1	North Carolina (NC) State Univ. Raleigh	ConE	1958	126
2	Iowa State University	ConE	1976	128
3	North Dakota State Univ.	ConE	1983	129
4	Purdue University West Lafayette	ConE	1984	126
5	Univ. of New Mexico	ConE	1988	122
6	Western Michigan University	ConE	1998	125
7	Univ. of Nebraska Lincoln	ConE	2006	125
8	The University of Alabama	ConE	2007	125
9	University of Central Florida	ConE	2007	128
10	San Diego State University	ConE	2008	120
11	Virginia Tech	CE&M	2008	124
12	Marquette University	ConE	2010	131
13	Texas Tech University	ConE	2011	128
14	East Texas A&M University	ConE	2012	126
15	Arizona State University	ConE	2013	120
16	The citadel	ConE	2019	136
17	Georgia Southern Univ.	ConE	2019	130
18	Univ. of Hawaii Manoa	ConE	2019	130
19	University of Texas at El Paso (UTEP)	CE&M	2019	120
20	The University of Utah	ConE	2020	120
21	Cal Poly Pomona	CE&M	2020	122
22	University of Delaware	CE&M	2020	126

In many cases, courses can be described as having a high design component but are directly related to construction operations. In this study, courses were categorized based on their primary relevance to the construction professional’s daily practice. In this case, a “Temporary Structures” course as an example was categorized as "Construction Related." While it involves rigorous structural design, its application is uniquely central to the construction engineering discipline rather than traditional permanent-works civil design.

Results

The overall credit requirements to complete the ConE or CE&M degree in the identified programs varies significantly. On one end of the spectrum, several universities require the completion of their degrees in just 120 credits (Arizona State University, San Diego State University, The University of Utah, and University of Texas at El Paso). At the other end of the spectrum, Georgia Southern University and University of Hawaii Manoa require 130 credits, Marquette University requires 131 credits, and the Citadel requires 136 credits. The median number of required credits for the ConE and CE&M degree is 126 credits (Table *1*).

These credits are divided in various proportions between math and sciences courses, courses in humanities and social sciences, background engineering courses, civil engineering courses, and construction courses.

Mathematics and science requirements

ABET mandates that engineering programs include a minimum of 30 credit-hours in mathematics and basic sciences [14]. To evaluate how programs meet this standard, the authors analyzed course descriptions from university websites and catalogs, categorizing specific courses as mathematics or science in accordance with ABET criteria. Notably, some qualifying courses – such as geology or statistics – are taught internally within engineering departments. Despite their civil or construction engineering designations, these were counted as mathematics and science credits based on their content. In instances where the 30-credit minimum was not immediately apparent, the authors will seek clarification during the next phase of the study, which includes faculty interviews.

Of the 22 programs analyzed, 100% require at least two calculus courses, a course in probability and statistics, and at least one course each in chemistry and physics. Beyond these fundamentals, programs vary in their requirements, with some prescribing linear algebra, differential equations, geology, additional sciences, or a range of electives. Specifically, 15 programs (68%) require three or more calculus courses, while only 14 (64%) require a combination of differential equations or linear algebra (Table *2*).

Background civil engineering courses

Construction engineering evolved historically from some specialized courses in civil engineering programs with emphasis in structures [15]. With the need for more specialization, construction programs were developed. This historical evolution of the construction engineering discipline from civil engineering programs is showcased by the tremendous overlap of courses with civil engineering, with the addition of specialization area courses that make a ConE degree unique. The 22 programs included in this investigation require civil engineering courses as well (Table *3*). All schools require at least one structures area course, and one geotechnical/soil mechanics course. As observed in Table *3*, 19 of the programs require a surveying course, while 15 require a fluids/water resources course, two require an environmental engineering course, and three require a transportation engineering course. Many schools also offer the capability of construction engineering students to enroll in more civil engineering electives in addition to their construction courses if they so inclined.

Table 2: Distribution of mathematics and science courses in each program

University	Calculus Courses	Differential Eq.	Linear Algebra	Comb. Diff EQ & Lin Alg.	Mathematics Electives	Statistics	Chemistry Courses	Physics Courses	Geology or similar	Biology or similar	Science Electives	Math/Science Course Total	Math/Science Credits Total
The Univ. of Alabama	3	1				1	1	2			1	9	30
Arizona State Univ.	3	1	1			1	1	2			1	10	32
Univ. of Central Florida	3	1				1	1	2				8	30
The Citadel	2					1	2	1		1		7	30
East Texas A&M Univ.	3	1	1			1	1	2				9	33
Georgia Southern Univ.	2					1	1	2	1			7	27
Iowa State Univ.	2	1			1	1	1	2				8	32
Marquette Univ.	2	1				1	2	1			1	8	30
Univ. of Nebr. Lincoln	3	1				1	1	2				8	32
Univ. of New Mexico	3	1				1	1	2			2	10	35
NC State Univ. Raleigh	3					1	1	2	1		1	9	33
Purdue Univ.	3	1	1			1	1	2				9	32
San Diego State Univ.	2					1	1	2	1	1		8	30
Texas Tech University	3	1				1	1	1	1			8	30
Western Michigan Univ.	3			1		1	1	2				8	33
The Univ. of Utah	2			1		1	1	1			2	8	30
Univ. of Hawaii Manoa	4					1	2	2			1	10	36
North Dakota state Univ.	3	1	1			1	2	1	1			10	32
Cal Poly Pomona	3					1	1	2	1	1		9	32
Univ. of Delaware	2				2	1	1	1	1			8	29
Univ. of Texas at El Paso	3					1	1	1	1			7	24
Virginia Tech	3	1	1			1	1	1	1			9	30
											Median Value	8	32

Table 3: Civil engineering sub-discipline courses required in each program

University	Structures Introductory	Steel design	Concrete design	Either steel or concrete design	Geotech/ Soil Mechanics	Fluids/Water Resources	Surveying	Environmental	Transportation
The Univ. of Alabama	X			X	X		X		
Arizona State Univ.	X			X	X				
Univ. of Central Florida	X				X	X		X	
The Citadel	X				X		X		
East Texas A&M Univ.	X	X	X		X	X	X		
Georgia Southern Univ.	X	X	X		X	X	X	X	X
Iowa State Univ.	X	X	X		X	X	X		
Marquette Univ.	X				X		X		
Univ. of Nebr. Lincoln	X	X	X		X	X	X		
Univ. of New Mexico	X				X	X	X		
NC State Univ. Raleigh			X		X	X	X		
Purdue Univ.	X		X		X	X	X		
San Diego State Univ.	X				X		X		
Texas Tech University	X	X	X		X	X	X		
Western Michigan Univ.	X				X	X	X		
The Univ. of Utah	X		X		X		X		X
Univ. of Hawaii Manoa	X				X	X	X		X
North Dakota state Univ.	X				X	X	X		
Cal Poly Pomona	X		X		X	X	X		
Univ. of Delaware	X				X	X	X		
Univ. of Texas at El Paso	X				X	X	X		
Virginia Tech	X				X				
Totals	21	5	9	2	22	15	19	2	3
%	95.5	22.7	40.9	9.1	100	68.1	86.4	9.1	13.6

The curricula of these 22 programs have also shown some variety in the required courses for statics, dynamics, mechanics of materials, and engineering materials courses. As observed in Table *4*, all programs require a course in statics, and a course in either mechanics of materials or engineering materials. Only nine of the programs require a course in dynamics. In addition, 16 of the programs require a course in graphics or technical drawing, and ten require a course in computer coding or computer applications (Table *4*). Only three of the programs have a required course in either BIM or VDC. This does not suggest that the courses are not taught in other programs. It only suggests that a stand-alone course in these topics is not required. It is also possible that aspects of VDC and BIM be covered in each of the graphics and technical drawing courses but not reflected in the course descriptions. In a further investigation of the elective courses offered in all the programs, it was observed that several of them have electives in these areas. Such examples include courses in terrestrial LIDAR (Georgia Southern University), VDC/BIM (Cal Poly Pomona, Virginia Tech), digital construction and manufacturing (Virginia Tech), and construction robotics and automation (Virginia Tech).

Table 4: Other course requirements

University	Statics	Dynamics	Mech. of Materials	Civil/Constr. Materials	Graphics/ Tech. Drawing	BIM / VDC / etc.	Computer Applications/ Coding
The Univ. of Alabama	X	X	X	X	X		
Arizona State Univ.	X	X	X	X		X	
Univ. of Central Florida	X		X	X			X
The Citadel	X		X	X	X		X
East Texas A&M Univ.	X		X		X		X
Georgia Southern Univ.	X		X	X	X		
Iowa State Univ.	X		X	X	X		
Marquette Univ.	X		X	X			
Univ. of Nebr. Lincoln	X	X	X	X		X	X
Univ. of New Mexico	X	X	X	X	X		X
NC State Univ. Raleigh	X	X	X	X	X		
Purdue Univ.	X	X		X	X		
San Diego State Univ.	X		X	X	X		
Texas Tech University	X		X	X	X		X
Western Michigan Univ.	X	X	X	X	X		X
The Univ. of Utah	X		X	X	X		X
Univ. of Hawaii Manoa	X	X	X	X	X		X
North Dakota State Univ.	X	X	X	X	X		
Cal Poly Pomona	X		X	X	X		
Univ. of Delaware	X		X	X	X		X
Univ. of Texas at El Paso	X		X	X			
Virginia Tech	X		X	X		X	
Totals	22	9	21	21	16	3	10
%	100	40.9	95.5	95.5	72.7	13.6	45.5

Construction Specific courses

Regarding construction specific courses, there is also a great variation between the 22 programs (Table *5*). Looking at the estimating courses, 16 of the programs require at least one stand-alone estimating course. In two of the programs (East Texas A&M and Georgia Southern University) the curriculum requires two estimating courses. Sixteen of the programs require a scheduling/planning course, while three programs require one combined estimating and scheduling course.

For more specific courses, five programs require a temporary structures course, 17 require a course in Contracts / Law / Construction Documents, and 12 of the programs require a course in accounting Table *5*. Eleven programs require a dedicated safety course. ABET requires that the topic of safety be included as part of accreditation, but there are no specifications on how the topic be taught, so many programs can choose to offer a stand-alone course, or include safety within other courses, similar to the examples provided by the ASCE Construction Engineering Commentary [5]. All schools also require a capstone course as a culminating experience for the degree, with 13 of the programs requiring that the capstone experience be distributed in two courses over the whole senior year. This variation in requirements showcases the fact that there are a variety of ways to complete a ConE degree that satisfy ABET requirements.

Table 5:Construction specific course requirements, number of electives, and capstone experience

University	Estimating courses	Comb. Estim. & Sched.	Scheduling	Temporary Structures	Heavy Civil/ Equipment	Safety	MEP	Contr. / Documents / Law	Accounting	# of Electives	# Capstone Courses
The Univ. of Alabama	X		X		X	X				2	2
Arizona State Univ.	X		X		X	X		X		1	2
Univ. of Central Florida		X			X		X		X	3	2
The Citadel	X		X	X			X	X	X	0	2
East Texas A&M Univ.	X		X		X		X	X	X	0	2
Georgia Southern Univ.	X		X		X	X				2	2
Iowa State Univ.	X		X	X	X					1	2
Marquette Univ.	X		X		X			X	X	3	1
Univ. of Nebr. Lincoln			X		X	X				2	1
Univ. of New Mexico	X		X			X		X	X	2	1
NC State Univ. Raleigh		X					X	X	X	2	1
Purdue Univ.				X				X	X	3	2
San Diego State Univ.	X		X	X	X	X	X	X		1	2
Texas Tech University	X				X	X	X	X		0	1
Western Michigan Univ.	X				X			X	X	2	2
The Univ. of Utah			X		X			X		4	1
Univ. of Hawaii Manoa	X		X		X	X		X	X	1	2
North Dakota State Univ.	X		X		X	X		X		4	1
Cal Poly Pomona	X		X		X		X	X	X	1	2
Univ. of Delaware	X		X			X		X	X	4	1
Univ. of Texas at El Paso	X		X			X	X	X	X	0	1
Virginia Tech		X		X			X	X		4	2
Totals	16	3	16	5	15	11	9	17	13		
%	72.7	13.6	72.7	22.7	68.1	50.0	40.9	77.3	59.1		

Conclusions

Since the first ConE program's accreditation in 1958, there have only been 22 ConE programs in the US [13]. In contrast there are more Construction Management (CM) accredited programs. There are also 22 ABET CM accredited programs, but by far the American Council for

Construction Education (ACCE) has accredited 88 4-year CM programs [16]. There seems to be a disparity in the number of programs, considering graduates from both types (ConE and CM) in general get hired in the construction industry [15].

This study performed a comprehensive quantitative analysis of the 22 ABET-accredited Construction Engineering (ConE) and Construction Engineering and Management (CEM) programs in the United States. The findings reveal that while all programs adhere to the foundational requirements set by ABET, there is significant diversity in how institutions interpret the balance between engineering science and construction operations.

A median of 126 credits is required for graduation from ConE programs, with a heavy emphasis on core Civil Engineering subjects like structures, geotechnical engineering, and surveying. This confirms that ConE remains firmly rooted in the civil engineering tradition.

The greatest variance exists in construction-specific requirements. While estimating and scheduling are nearly universal, subjects like temporary structures and Safety are far less consistent. This suggests that "Construction Engineering" is not a monolith; rather, programs choose to emphasize either the engineering of the process (temporary works, equipment) or the management of the project (accounting, safety, contracts, etc.). Even though courses might not appear in the core of courses that all students take, it is possible for students to select them as part of their elective requirements.

Although ABET requires 30 credit-hours in math and basic sciences, programs vary in their "rigor" regarding advanced math. Only 64% of programs require a combination of differential equations and linear algebra, indicating a split between programs that maintain traditional engineering math sequences and those that may prioritize applied science.

Emerging trends such as BIM and sustainability are appearing in technical electives and a small number of core courses, showing that the curricula are beginning to adapt to the "modern construction industry" requirements

Limitations

The investigation presented in this manuscript does have some limitations, primarily due to the nature of sourcing the information presented. The authors relied on material available online, such as department websites, university catalogs, and course descriptions, which could have errors or be outdated. Because of this disconnect from department personnel, some information might be outdated, or not reflect the proper sequence of courses.

Future Work

The authors plan to continue this work to further investigate the nuances between ConE programs in the US. As a first step the authors plan to interview faculty in each of the programs to:

a. Recognize the differences in the courses offered in each program and try to interpret some of the reasoning for the structure of each curriculum.
b. Identify courses that they are considering adding or removing from their programs.

c. Understand the profile of the students enrolling in construction engineering.
d. Identify the reasons students enroll in a construction engineering program compared to a construction management program.
e. Identify courses or problem areas students might have as they progress through each of the curricula.

In addition, with the help of faculty from the ConE programs, the authors would like to distribute a survey to recent ConE graduates to discover:

a. The type of employment they obtain.
b. The student experience they had in their program.
c. Any changes they would like to suggest for the improvement of the ConE degree experience in the various programs in the US.

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