A Comparison of Civil Engineering Curriculum and EAC-ABET Civil Engineering Program Criteria

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Abstract

Accredited civil engineering programs use a variety of methods to meet the EAC-ABET General Criteria and the Civil Engineering Program Criteria (CEPC). Since the authors conducted a program study in 2018, three external changes have affected civil engineering programs [1]. This includes an updated version of the ASCE Body of Knowledge (BOK3), changes to the NCEES Fundamentals of Engineering (FE) Civil Engineering exam, and changes to the CEPC that will become effective during the 2024-2025 ABET accreditation cycle. Data for this study were gathered during the 2023-2024 academic year. This is an optimum time to review civil engineering curriculum changes that have occurred since the first phase of this longitudinal study in 2018 and provide a benchmark prior to the upcoming CEPC changes.

Civil engineering curriculums at 87 EAC-ABET accredited civil engineering programs were evaluated. This constitutes a 32.2% sample of the 270 EAC-ABET accredited civil engineering programs in the United States [2]. The study included both research and teaching focused public and private programs from all 50 states. To ensure the sample was evaluated uniformly, only programs with semester credit hours were analyzed. A database of course requirements was created and indexed to categories in the CEPC. Included in the database were over 50 different course subjects from 7 categories: mathematics and science; engineering mechanics; engineering science; technical skills; civil engineering courses; engineering electives; and general education.

Changes to civil engineering curriculums were investigated by comparing 2024 data to benchmark civil engineering program studies conducted in 2002 and 2018. Since 2018, the average number of credit hours required for a civil engineering degree decreased by 0.8 credit hours to 127.8 and the number of elective engineering credit hours decreased by 0.1 credit hours to 18.9. The study concluded that civil engineering programs continue to move toward a cafeteria approach by allowing students to craft a specialized curriculum, leaving out many traditional core classes such as reinforced concrete design, steel design, foundations, hydrology, and water and wastewater design. In addition, the following classes were only required in fewer than 60% of the programs: surveying, engineering economics, construction/project management, and hydraulics. The 2024-2025 CEPC includes new material science, numerical methods, engineering economics, risk and resilience, and diversity, equity, and inclusion curriculum requirements. The study results indicate that fewer than 23% of civil engineering programs currently require classes on any of these topics except engineering economics. In conclusion, there is no uniform curriculum in civil engineering, a pattern consistently seen in the past six years.

Introduction

As the cost of higher education continues to rise, state legislators, boards of trustees, and families have increased their calls for reduced costs [3]. A significant cost of higher education is tuition, room, board, books, and additional fees per semester [4]. One of the options available to a university to control cost in an academic program is to set limits on the credit hours required for a degree. Fewer required credit hours could reduce costs (in programs that charge per credit hour) and the time required on a university campus.

Taking "cost control" to an extreme, many universities have investigated ideas to reduce degree programs to less than three years. The goal of Zemsky and Carrell's "Degree in 3" project seeks to create three year degree programs that will satisfy accrediting agencies, college athletic associations and graduate program admission requirements, which are currently hurdles for universities interested in developing three-year programs that are less than 120 credit hours [5]. Many universities have already created programs that allow students to graduate in three years, however there are currently no accredited 3-year engineering degrees that require less than 120 credit hours. Several challenges exist that must be overcome by engineering programs to develop a 3-year degree [6]. Reacting to the increased pressure to make engineering degrees more affordable and attainable in a shorter period, past studies have shown that accredited civil engineering programs have slowly reduced the number of credit hours required to obtain a degree [1].

In addition to economic pressures to reduce the cost of degree programs, there are other factors that influence civil engineering curriculums. Since 2018, changes to two external documents have had a direct impact on civil engineering programs. According to Ressler, Nolan, and Bergstrom, The American Society of Civil Engineers (ASCE) employs a methodical approach to align the needs of the civil engineering profession, and the needs of the public, with its standards for education and practice [7]. The primary tools involved in this approach are the current version of the Civil Engineering Body of Knowledge (CEBOK) and the Civil Engineering Program Criteria (CEPC), both of which are reviewed by ASCE and revised, if necessary, on an 8-year cycle [8]. In 2019, ASCE published a revised Body of Knowledge (CEBOK3). More recently, the Engineering Accreditation Commission (EAC) of ABET, Inc. approved changes to the CEPC that will become effective during the 2024-2025 ABET accreditation cycle [8].

Another influence is the National Council of Examiners for Engineering and Surveying (NCEES). They maintain and update the topics on the Fundamentals of Engineering (FE) Civil Engineering Exam, the first test required for civil engineers to become licensed in most jurisdictions. In 2020 they updated the list of topics and the weight of each topic on the Civil Engineering FE specific exam [9].

Accredited civil engineering programs use a variety of methods to meet ABET curriculum requirements and address NCEES and ASCE curriculum criteria [10], [11]. At some universities, required curriculum topics are lumped together in a single course. For example, CEPC topics such as principles of sustainability, basic project management concepts, business, public policy, leadership, professional ethics, and professional licensure are frequently included in a senior seminar or capstone design course [1]. Every civil engineering program has the discretion to

determine how it will meet the CEPC criteria, and embedding required curriculum topics in a single course or several courses are two common methods. The following study investigates how civil engineering programs are addressing the current ABET requirements in the 2023-24 academic year.

Background

During the period 2002-2018, civil engineering curriculums experienced continuous pressure to adapt to changes to EAC-ABET criteria, the CEPC, the NCEES Fundamentals of Engineering (FE) exam, and input from external stakeholders such as alumni, professional societies, and state legislatures. Russell and Stouffer conducted a survey of 90 of the nation's 218 undergraduate civil engineering programs using data from each program's most recent accreditation under the 2002-2003 EAC-ABET criteria [12]. They found that the average number of semester credit hours required for a civil engineering degree was 130.4. Subsequent studies in 2011, 2017, 2018, and 2019 showed a gradual, sustained reduction in the average number of credit hours required for a bachelor's degree in civil engineering (Table 1).

Table 1. Average Number of Credit Hours to obtain a Bachelor's Degree in Civil Engineering

Date	Average Number of Credit Hours in CE Curriculum
2002 [12]	130.4
2011 [13]	130.0
2017 [14]	129.6
2018 [1]	128.6
2019 [15]	128.2

Since 2002, many fundamental engineering courses have been changed or even eliminated. An electrical engineering circuits course was required in 58% of curriculums and a thermodynamics course was required in 55.6% of curriculums in 2002. By 2018, those percents were reduced to 10.5% and 18.6%, respectively. In contrast, a computer programming course was required in 37.8% of civil engineering curriculums in 2002, but this number increased to 52.3% in 2018 [1].

Civil engineering curriculums have become more flexible. In 2002, there were an average of 11 credit hours of electives. This rose to 19 credit hours in 2018. Civil engineering programs evolved to provide students with increased opportunity to focus their education and make it more specialized [1]. Civil engineering curriculums are not uniform, and programs use a variety of methods to meet EAC-ABET curriculum criteria.

The 2019 third edition of the ASCE Body of Knowledge incorporated six major changes to the second edition [7], [16]. ASCE formed a CEPC Task Committee in 2020 to review the CEBOK3 outcomes and develop draft revisions to the CEPC [17]. The EAC-ABET approved the revised CEPC in July 2023 and the ABET Area Delegation approved it on November 3, 2023 [18]. Four of the major changes to the CEPC include:

- Application of either *computer science, data science*, or an additional area of basic science.

- Application of *engineering mechanics, material science, and numerical methods relevant to civil engineering*
- Application of principles of sustainability, risk, resilience, *diversity, equity, and inclusion to civil engineering problems*
- Explanation of *concepts and principles in* project management and *engineering economics*

Some of these requirements are entirely new while others provide increased flexibility for programs. The requirement for curriculums that includes the "application of engineering mechanics, material science, and numerical methods relevant to civil engineering" is meant to allow each program the flexibility to deliver a subset of each topic deemed appropriate for the program's objectives, whether by program faculty or others [8]. Other changes contain specific requirements for mathematics, basic sciences, civil engineering technical areas, design content, experimentation, sustainability, and a series of other topics related to business, management, public policy, leadership, professional ethics, and licensure [19]. Civil engineering programs use their discretion to determine how they will meet these criteria. Each program determines the degree requirements, including the total number of required credit hours, the number of required civil engineering courses, the number of technical elective courses, and the organization of the design courses.

Civil engineering programs undergoing EAC-ABET reaccreditation visits in 2024 are required to meet the recently modified CEPC criteria. The 2023-2024 academic year is a transition period when civil engineering program faculty will begin to contemplate and make curriculum changes to meet the new CEPC criteria. The following study focuses on this transition period before most programs begin to evolve to meet the newest round of CEPC requirements.

Research Methods

A study was conducted to evaluate civil engineering curriculums in published undergraduate catalogs, course descriptions, and academic policies. These documents were accessed online during the 2023-2024 academic year. Civil engineering curriculums at the same 86 EAC-ABET accredited civil engineering programs that were evaluated in the 2018 study were included in this study. One additional program was added to this study. The 87 programs in the study constitute a 32.2% sample of the 270 EAC-ABET accredited civil engineering programs in the United States [2]. The study included both research and teaching-focused public and private programs from all 50 states. To ensure the sample was evaluated uniformly, only programs with semester credit hours were analyzed. A database of course requirements was created and indexed to curriculum requirement categories in EAC-ABET Criterion 5 and the CEPC. Included in the database were over 50 different course subjects from seven categories: mathematics and science; engineering mechanics; engineering science; technical skills; civil engineering courses; engineering electives; and general education.

The objective of the study was to evaluate how the curriculum data addresses the following research questions:

1. What is the average number of credit hours required to obtain a civil engineering degree?
2. What are the average number of required credit hours in the EAC-ABET Criterion 5 topic areas: general education, mathematics and science, and engineering science?
3. Have the number of engineering electives increased in civil engineering curriculums since 2018?
4. How many civil engineering curriculums require courses in topics that were added to the CEPC for implementation in 2024-2025 (material science, engineering economics, numerical methods, risk and resilience, and diversity, equity, and inclusion)?

Results

The data was collected and reported in seven categories: mathematics and science; engineering mechanics; engineering science; technical skills; civil engineering courses; engineering electives; and general education. Below is a summary of the results from each.

Mathematics and Science

The mathematics and science results are presented in Table 2. Courses are required in calculus, physics, and chemistry in every program, but electives in these areas are not a requirement of any program. Over 93% of the programs require courses in differential equations, probability and statistics, and a 3rd basic science (beyond the first two in physics and chemistry) to meet the current CEPC. Mathematics and science electives, linear algebra classes, and data science classes are not commonly required or offered as electives. The average credits in calculus, physics, and chemistry indicate most programs offer two or more classes in each category.

Table 2. Mathematics and science credits in civil engineering programs.

Subject	Required course (% of programs)	Elective course (% of programs)	Avg (credits)	Stand. Dev. (credits)	Max (credits)	Min (credits)
Calculus	100.0%	0.0%	11.4	1.39	14.0	8.0
Differential Equations	95.4%	2.3%	3.1	0.56	4.0	2.0
Probability and Statistics	93.1%	1.1%	3.0	0.41	4.0	1.0
Linear Algebra	29.9%	24.1%	2.1	0.85	4.0	0.3
Physics	100.0%	0.0%	6.5	2.21	11.0	3.0
Chemistry	100.0%	0.0%	5.3	1.79	10.0	3.0
3rd Basic Science	96.6%	0.0%	3.4	0.82	9.0	3.0
Math/Science Elective	28.7%	21.8%	3.7	0.63	5.0	3.0
Data Science	4.6%	21.8%	2.8	1.73	4.0	0.3

Engineering Mechanics

The engineering mechanics courses are summarized in Table 3. Courses in statics and mechanics of materials were offered in every program and required in nearly every program. Typically, statics is a 3.0 credit hour course, but the number of credit hours for mechanics of materials courses varied as demonstrated by higher average and standard deviation. Fluid mechanics is offered in the majority of programs. Dynamics is required in about two thirds of programs and offered in over 90% of the programs. Materials science is only offered in about one fourth of the programs and required in very few (3.4%) programs. The percent of programs requiring a materials science course decreased from 2018 to 2024 despite the fact that the 2019 ASCE BOK3 listed material science as an "engineering fundamentals outcome" [20].

Table 3. Engineering mechanics credits in civil engineering programs.

Subject	Required course (% of programs)	Elective course (% of programs)	Avg (credits)	Stand. Dev. (credits)	Max (credits)	Min (credits)
Statics	98.9%	1.1%	2.9	0.30	4.0	2.0
Dynamics	67.8%	23.0%	2.9	0.39	3.0	1.0
Mechanics of Materials	100.0%	0.0%	3.3	0.47	4.0	2.0
Materials Science	3.4%	21.8%	3.3	0.58	4.0	3.0
Fluid Mechanics	94.3%	1.1%	3.4	0.52	4.0	2.0

Engineering Science

The data in Table 4 shows that traditional courses in engineering science, such thermodynamics and electrical circuits, are rarely required and not universally offered in programs. About 10% of the programs in the study allow students to take either thermodynamics or electrical circuits to fulfill an engineering science elective requirement. The most popular class in this category is computer programming which is required in over half of the programs. Numerical methods is the second most required course, although less than half of the programs offer it as a required or elective course.

Table 4. Engineering science credits in civil engineering programs

Subject	Required course (% of programs)	Elective course (% of programs)	Avg (credits)	Stand. Dev. (credits)	Max (credits)	Min (credits)
Thermodynamics	17.2%	47.1%	2.9	0.26	3.0	2.0
Electrical Circuits	3.4%	42.5%	3.3	0.58	4.0	3.0
Engr Science Elective	10.3%	11.5%	3.0	0.00	3.0	3.0
Computer Programming	56.3%	11.5%	2.6	0.91	4.0	0.3
Numerical Methods	23.0%	19.5%	2.6	0.95	4.0	1.0

Technical Skills

Five classes were included in the technical skills category shown in Table 5. Almost 80% of the programs required a CAD course, but very few programs required the other four topics. GIS was the only other course offered in more than half of the programs. These classes had lower average credits and high standard deviations because the credit hours varied greatly. In a few programs there were required FE review courses in curriculums that students completed for no credit hours.

Table 5. Technical skills credits in civil engineering programs.

Subject	Required course (% of programs)	Elective course (% of programs)	Avg (credits)	Stand. Dev. (credits)	Max (credits)	Min (credits)
Computer Aided Design (CAD)	79.3%	6.9%	2.2	0.8	3.0	1.0
Risk/Reliability	6.9%	25.3%	2.5	0.8	3.0	1.0
GIS	10.3%	41.4%	1.9	1.0	3.0	1.0
Systems Engineering	11.5%	8.0%	2.9	0.3	3.0	2.0
FE Review Course	6.9%	5.7%	1.3	0.6	3.0	1.0

Civil Engineering Courses

Traditional civil engineering courses are shown in Table 6, organized by sub-disciplines. Most courses were at or below 3 credit hours on average except capstone, soil mechanics, pavement design, and environmental engineering. All of these courses except pavement design commonly included labs and this is reflected in the higher average number of credit hours. Courses that are required in almost all programs include introduction to engineering, structural analysis, soil mechanics, transportation engineering, environmental engineering, civil engineering materials, and civil engineering capstone. Courses that were least often required, but still offered in more than half of the programs include steel design, reinforced concrete, structural engineering electives, foundation design, pavement design, traffic engineering, hydrology/hydrologic systems, water/wastewater, and sustainable design. Courses that were seldom offered include infrastructure design, geomatics, civil engineering fundamentals, and civil engineering seminar. Surveying, hydraulic engineering, construction/project management, and engineering economics are required by about 60% of programs and available in most programs. This demonstrates the flexibility many programs are using even for the selection of traditional civil engineering courses.

Table 6. Civil engineering course credits in civil engineering programs.

Subject	Required course (% of programs)	Elective course (% of programs)	Avg (credits)	Stand. Dev. (credits)	Max (credits)	Min (credits)
Introduction to Engineering	92.0%	0.0%	2.8	1.44	7.0	1.0
Civil Engineering Fundamentals	33.3%	1.1%	2.1	1.06	5.0	0.0
Structural Analysis	87.4%	12.6%	3.3	0.63	7.0	3.0
Steel Design	23.0%	77.0%	2.7	0.57	3.0	1.5
Reinforced Concrete	36.8%	63.2%	3.0	0.61	4.0	1.5
Structural Engineering Elective	3.4%	78.2%	3.0	0.00	3.0	3.0
Soil Mechanics	87.4%	12.6%	3.8	0.46	5.0	3.0
Foundation Design	18.4%	75.9%	3.0	0.00	3.0	3.0
Pavement Design	1.1%	67.8%	4.0	0.00	4.0	4.0
Transportation Engineering	80.5%	19.5%	3.1	0.66	7.0	1.5
Traffic Engineering	8.0%	64.4%	2.7	0.98	4.0	1.5
Hydraulic Engineering	59.8%	36.8%	2.9	0.87	5.0	1.0
Hydrology/Hyd Systems	29.9%	67.8%	2.4	0.77	4.0	1.5
Environmental Engineering	78.2%	19.5%	3.5	1.00	8.0	3.0
Water/Wastewater	21.8%	75.9%	3.1	0.32	4.0	3.0
Construction/Project Mgt	58.6%	33.3%	3.0	1.12	7.0	1.0
Civil Engineering Materials	79.3%	11.5%	3.1	0.81	5.0	1.0
Surveying	58.6%	13.8%	2.8	0.87	4.0	1.0
Engineering Economics	58.6%	14.9%	2.2	0.83	3.0	1.0
Sustainable Design	19.5%	47.1%	2.7	0.73	3.0	1.0
Civil Engineering Capstone	95.4%	0.0%	3.9	1.23	8.0	2.0
Infrastructure Design	8.0%	32.2%	2.4	0.63	3.0	1.5
Geomatics	17.2%	18.4%	3.2	1.01	5.0	1.5
CE Seminar	44.8%	2.3%	1.6	0.87	4.0	0.0

Engineering Electives

Most civil engineering programs have engineering electives in their curriculum, but the descriptions vary (Table 7). About half of the programs require civil engineering core electives. For example, in some programs students are required to take 4 courses from a list of 6 to 8 courses in Table 6 subjects. The number of credit hours can vary as shown by the large standard deviation. Most programs require technical electives, but the number of credit hours varies greatly. Specific design electives are required in 39% of the programs and general engineering electives are required in about 18% of the programs. Nearly every program had some form of engineering elective, further demonstrating flexibility. The weighted average of all engineering electives for all 87 programs in the study was 18.9 credits.

Table 7. Engineering elective credits in civil engineering programs.

Subject	Required course (% of programs)	Avg (credits)	Stand. Dev. (credits)	Max (credits)	Min (credits)
Civil Engineering Core Electives	55.2%	10.8	6.19	29.0	2.0
Technical Elective	87.4%	11.3	5.91	34.0	3.0
Design Electives	39.1%	6.0	2.46	12.0	3.0
Engineering Electives	18.4%	4.0	2.53	12.0	1.0

General Education

Every program has general education requirements, and it is typically the category with the largest number of credits (Table 8). Ethics and technical writing are required in about a third of the programs. Only about a quarter of the programs offer a free elective course and very few programs require or offer specific DEI, social justice, or ROTC courses that count toward a civil engineering degree.

Table 8. General education credits in civil engineering programs.

Subject	Required course (% of programs)	Elective course (% of programs)	Avg (credits)	Stand. Dev. (credits)	Max (credits)	Min (credits)
General Education	100.0%	0.0%	21.7	4.4	33.0	9.0
DEI	9.2%	4.6%	*	*	*	*
Social Justice	2.3%	3.4%	*	*	*	*
ROTC	1.1%	4.6%	12.0	0.0	12.0	12.0
Ethics	35.6%	37.9%	2.0	1.0	3.0	0.5
Technical Writing	35.6%	17.2%	2.9	0.4	3.0	1.0
Free Electives	26.4%	NA	5.7	4.0	18.0	1.0

*The credit hours for these courses were included in the general education statistics.

Discussion of Results

Table 9 provides a historical comparison of the major curriculum categories in an engineering program: math and science, general education, technical skills/other, and total engineering topics. The values for math and science were obtained from Table 2 and technical skills/other from Table 5. The general education number was computed by taking a weighted average of all categories in Table 8. The values for total engineering topics are a summation of the topics in Table 3, Table 4, Table 6, and Table 7. The total number of credits is shown at the bottom of Table 9.

Table 9. Comparison of average credits in civil engineering programs.

	2002 [12]		2018 [1]		2024	
Subject	**Average Credits**	**Program Percent (%)**	**Average Credits**	**Program Percent (%)**	**Average Credits**	**Program Percent (%)**
Math and Science	35.2	27	34.6	26.9	34.0	26.6
General Education	26.7	20.5	24.2	18.8	25.0	19.5
Technical Skills/Other	2.1	1.5	3.4	2.7	2.5	2.0
Total Engineering Topics	66.4	51	66.4	51.6	66.3	51.9
Required	55.4	83.4	47.4	71.4	47.4	71.4
Elective	11	16.6	19	28.6	18.9	28.6
Total	130.4		128.6		127.8	

Research Question 1

What is the average number of credit hours required to obtain a civil engineering degree?

Overall, the average number of credits for civil engineering programs declined from 130.4 in 2002 to 127.8 in 2024. The variation in total credits among the 87 programs in this study is shown in Table 9 and Figure 1. Clearly, 128 credit hours is the most common number, but many programs require between 124 and 132 total credit hours. The standard deviation was 3.72. There are a few that have reduced graduation requirements to as few as 120 credit hours. Only 5 civil engineering programs in the study require more than 132 semester credit hours.

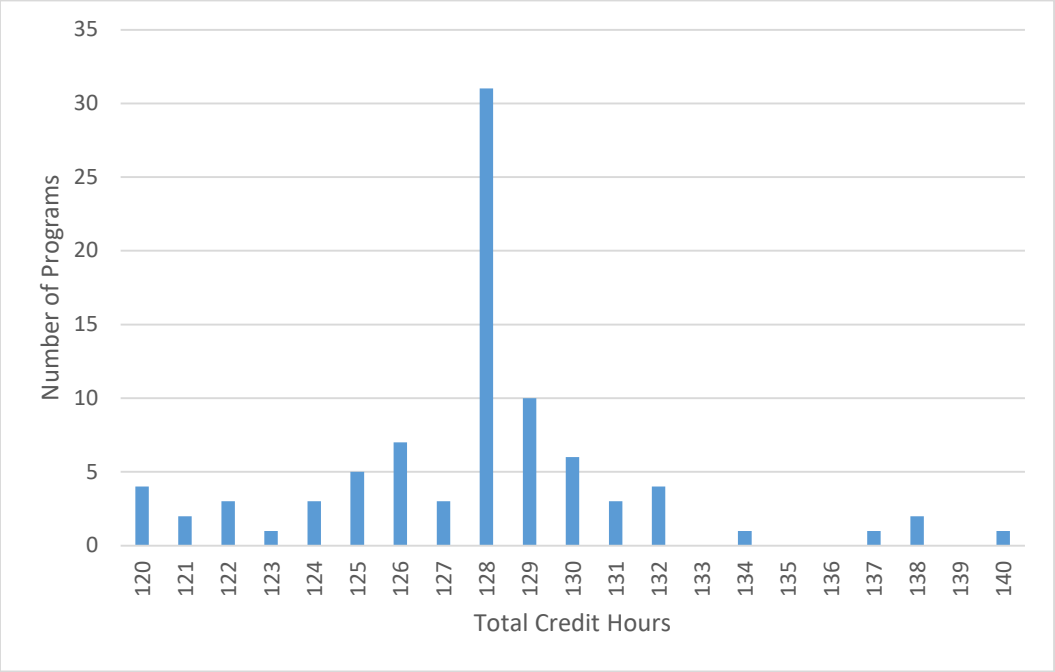

Figure 1. The total number of required credits in civil engineering programs.

Research Question 2
What are the number of required credit hours in the EAC-ABET Criterion 5 topic areas: general education, mathematics and science, and engineering science?

EAC-ABET Criterion 5 requires engineering programs to provide adequate content for specific subject areas to ensure that students are prepared to enter the practice of engineering [16]. Three of these subject areas are mathematics and basic sciences, engineering topics appropriate for the program, and a broad education component that is typically considered to be general education.

This study found that the number of required mathematics and science credits decreased from 35.2 in 2002 to 34.6 in 2018 to 34.0 in 2024. The most recent decrease coincides with changes to the EAC-ABET criteria. The 2018-2019 EAC-ABET Criterion 5 required one year (32 semester credit hours or one fourth of the total graduation requirements) of a combination of college level mathematics and basic sciences [21]. The 2019-2020 EAC-ABET Criterion 5 reduced this requirement to 30 semester credit hours of a combination of college level mathematics and basic sciences [22].

The total engineering topics credits has changed little in any study; it is very close to 66.3 credits which is well above both the 2018-2019 and 2019-2020 EAC-ABET Criterion 5 requirements of 1.5 years (48 credit hours) and 45 credit hours, respectively. A similar trend is seen in the technical skills/other classes.

The average number of general education credits has fluctuated between 24.2 and 26.7 and is currently 25.0. EAC-ABET Criterion 5 requires that engineering curriculums have a broad education component but does not specify a number of general education courses. These credits are influenced by other factors such as the core curriculum at a university.

Research Question 3
Have the number of engineering electives increased in civil engineering curriculums since 2018?

The number of required versus elective engineering credits in 2024 is much like it was in 2018. The weighted average of all engineering electives for all 87 programs in the study was 18.9 compared to 11 in 2002 and 19.0 in 2018. Almost all programs require technical electives; the number of credit hours ranges from 2 to 34 with a standard deviation of 5.91. Many programs require students to select civil engineering core courses in a minimum of 4 civil engineering topic areas. This limits breadth but corresponds to the CEPC requirement that the curriculum require students to solve complex engineering problems in at least four specialty areas appropriate to civil engineering.

Research Question 4
How many civil engineering curriculums require courses in topics that were added to the CEPC for implementation in 2024-2025 (material science, engineering economics, numerical methods, risk and resilience, and diversity, equity, and inclusion)?

The number of programs requiring a course in material science decreased from 7.0% in 2018 to 3.4% in 2024. Engineering economics is required in 58.6% of civil engineering programs and available in 73.5% of programs. A numerical methods course is either a required course (23.0%) or an elective in 42.5% of civil engineering programs. Required courses in the last two topics, risk and resilience, and diversity, equity, and inclusion, were found in less than 10% of all civil engineering programs.

Conclusions

Civil engineering curriculums at 87 EAC-ABET accredited civil engineering programs were evaluated and compared to 2002 and 2018 curriculum studies and the EAC-ABET CEPC. This constitutes a 32.2% sample of the 270 EAC-ABET accredited civil engineering programs in the United States.

The number of credit hours required to complete a civil engineering degree in an EAC-ABET accredited program has continually decreased since 2002 from 130.4 in 2002 to 128.6 in 2018 to 127.8 in 2024. The total number of credit hours in the engineering topics category remained virtually unchanged from 2002 to 2024 (66.4 versus 66.3 credit hours). The average number of elective engineering credit hours was 18.9 credit hours which is similar to the 2018 study results. This is 28.5% of the total number of engineering topics credits. The study results indicate that civil engineering programs are continuing the trend of supporting specialization of civil engineering students with technical electives and civil engineering core electives as compared to the historic curriculum model that included a broad set of required civil engineering courses in 7 or more specialty areas.

Traditional civil engineering courses are not uniformly covered. Over 75% of civil engineering programs require courses in structural analysis, soil mechanics, transportation engineering, environmental engineering, and civil engineering materials. Fewer than 37% require courses in reinforced concrete, steel design, foundation design, hydrology, and water and wastewater design. Fewer than 60% of all programs require courses in surveying, hydraulics, construction/project management, and engineering economics.

A review of the results from the 2002, 2018 and 2024 civil engineering curriculum studies yielded the following trends.

- The number of programs requiring a course in material science has decreased since 2018 from 7.0% to 3.4%.
- The average number of programs that require an electrical circuits course decreased from 58.0% in 2002 to 10.5% in 2018 to 3.4% in 2024.
- Dynamics and thermodynamics were required in a majority of civil engineering curriculums in 2002. In 2024, they are required in 67.8% and 17.2%, respectively.

Most programs do not require courses in material science, numerical methods, risk and resilience, and diversity, equity, and inclusion, or embed these topics in other civil engineering courses as required by the 2024-2025 CEPC. Slightly over half of civil engineering programs require a course in engineering economics. This will pose a challenge to civil engineering programs and EAC-ABET civil engineering program evaluators (PEVs) during the 2024-2025

accreditation cycle.

The study revealed that civil engineering curriculums are very diverse. A common civil engineering curriculum did not exist in 2018 and there is no evidence from this study that the profession has moved toward a uniform curriculum that meets CEPC requirements in the past six years.

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