



## Understanding the New Civil Engineering Program Criteria: Preparing to Prepare the Future Civil Engineer

### Dr. Kenneth J. Fridley, University of Alabama

Kenneth J. Fridley serves as Senior Associate Dean for Administration of the College of Engineering at the University of Alabama. Previously, Dr. Fridley served as Head of the Department of Civil, Construction and Environmental Engineering at the University of Alabama for 12 years. Dr. Fridley has been recognized as a dedicated educator throughout his career and has received several awards for his teaching efforts, including the ExCEED (Excellence in Civil Engineering Education) Leadership Award in 2010. At the University of Alabama, Fridley has led efforts to establish several new programs including new undergraduate degree programs in construction engineering, architectural engineering and environmental engineering, a departmental Scholars program allowing highly qualified students an accelerated program to earn their MSCE in addition to their BS degree, the interdisciplinary ideaLAB promoting innovation in engineering, and the cross-disciplinary MSCE/MBA and MSCE/JD dual-degree programs. Fridley has advised 32 masters and doctoral students to completion. His former students have moved into leadership positions in industry, public service, and academia.

### Dr. Thomas A. Lenox, American Society of Civil Engineers

Thomas A. Lenox, Ph.D., Dist.M.ASCE is Executive Vice President (Emeritus) of the American Society of Civil Engineers (ASCE). He holds a Bachelor of Science degree from the United States Military Academy (USMA), Master of Science degree in Theoretical & Applied Mechanics from Cornell University, Master of Business Administration degree in Finance from Long Island University, and a Ph.D. degree in Civil Engineering from Lehigh University. Dr. Lenox served for over 28 years as a commissioned officer in the U.S Army Field Artillery in a variety of leadership positions in the U.S., Europe, and East Asia. He retired at the rank of Colonel. During his military career, Dr. Lenox spent 15 years on the engineering faculty of USMA – including five years as the Director of the Civil Engineering Division. Upon his retirement from the U.S. Army in 1998, he joined the staff of the American Society of Civil Engineers (ASCE). In his position as educational staff leader of ASCE, he managed several new educational initiatives – collectively labeled as Project ExCEED (Excellence in Civil Engineering Education). As ASCE's Executive Vice President, Dr. Lenox led several educational and professional career-development projects for the civil engineering profession – with the overall objective of properly preparing individuals for their futures as civil engineers. An example is his staff leadership of ASCE's initiative to "Raise the Bar" for entry into professional engineering practice. Dr. Lenox's recent awards include ASCE's ExCEED Leadership Award, ASEE's George K. Wadlin Award, ASCE's William H. Wisely American Civil Engineer Award, and the CE News' "2010 Power List – 15 People Advancing the Civil Engineering Profession." In 2013, he was selected as a Distinguished Member of ASCE. In January 2014, Dr. Lenox retired from his staff position with ASCE. He continues to serve the engineering profession as a member of the ABET Board of Directors, an active member of several ASCE education and accreditation committees, and ASEE's Civil Engineering Division.

## Understanding the New Civil Engineering Program Criteria: Preparing to Prepare the Future Civil Engineer

### Background

In October 1998, the ASCE Board of Direction passed one of its most future-focused educational policies – ASCE Policy Statement 465 on the “First Professional Degree” (subsequently renamed “Academic Prerequisites for Licensure and Professional Practice”). Since then, ASCE has been engaged in a major strategic initiative, commonly referred to as the “Raise the Bar” initiative, to enhance the educational prerequisites for entry into the practice of civil engineering at the professional level. In 2002, ASCE created the Committee on Academic Prerequisites for Professional Practice (a.k.a., CAP<sup>3</sup>) to advocate and develop strategies to implement Policy Statement 465 and, in effect, raise the bar for the civil engineering profession.

In 2004, ASCE published the first edition of the *Civil Engineering Body of Knowledge for the 21<sup>st</sup> Century*<sup>1</sup> (BOK1), which established 15 outcomes that defined the knowledge, skills, and attitudes envisioned for future entry into the practice of civil engineering at the professional level. The BOK1 was the basis for changes to the ABET/EAC Civil Engineering Program Criteria (CEPC) effective for 2008/2009-accreditation cycle. Owing to ABET’s six-year accreditation cycle, as of the completion of academic year 2013/2014, all accredited civil engineering programs have been evaluated for accreditation under the BOK1-informed ABET criteria.

To aid in the interpretation and implementation of the CEPC, ASCE has long maintained a commentary on the civil engineering program criteria. In 2007 ASCE also published a special *Commentary on the ABET Engineering Criteria for Civil and Similarly Named Programs in the Context of the Civil Engineering Body of Knowledge*<sup>2</sup> specifically relating the 15 BOK1 outcomes to the ABET general engineering accreditation criteria and the CEPC. The primary purpose of this special BOK1-focused commentary was to assist those programs that desired to go above and beyond the ABET criteria and fully implement some or all of the BOK1 outcomes. The more traditional *Commentary for Civil and Similarly Named Programs*<sup>3</sup> continues to be the “operational” commentary designed to provide guidance to faculty and program evaluators regarding the interpretation and implementation of the CEPC.

In 2008, ASCE published the second edition of the *Civil Engineering Body of Knowledge for the 21<sup>st</sup> Century*<sup>4</sup> (BOK2), the same year as the BOK1-informed criteria came into effect. Four years later, in 2012, ASCE organized the Civil Engineering Program Criteria Task Committee (CEPCTC), which was charged to develop and propose new Civil Engineering Program Criteria that considered and implemented the BOK2, and to do so in an open and inclusive manner seeking input from key stakeholder groups<sup>5</sup>. The CEPCTC completed this charge in the summer of 2014<sup>6</sup> with proposed new CEPC being approved on first reading by ABET/EAC (July 12, 2014) and the ABET Board of Directors (November 1, 2014). Following ABET/EAC procedures, the proposed CEPC were published and open for public comment through June 15, 2015 and, once approved on second reading by the ABET/EAC (July 2015) and ABET Board of Directors (October 2015), would go into effect for the 2016/2017-accreditation cycle.

In the fall of 2014, the CEPCTC initiated a comprehensive effort to revise and update the commentary for the CEPC. In December 2014, the CEPCTC released a draft of the new *Commentary on the ABET Engineering Criteria for Civil and Similarly Named Programs*<sup>7</sup> for comment by civil engineering faculty, program managers, program evaluators, and other key civil engineering accreditation stakeholders. A final version of the new commentary is scheduled for release in the fall of 2015.

## **Purpose**

The impetus for this paper is to provide civil engineering faculty, program directors, program evaluators, and other interested parties with a thorough understanding of the new criteria and an appreciation of the background leading to changes in the criteria. Such an understanding of the new criteria would be highly beneficial to faculty and program evaluators in preparation for the implementation of the new CEPC. The basis for this paper is the new *Commentary on the ABET Engineering Criteria for Civil and Similarly Named Programs*; therefore, this paper also provides an overview of the new commentary.

## **Current and Proposed Civil Engineering Program Criteria**

The ABET/EAC accreditation criteria for baccalaureate-level civil engineering programs includes both general criteria and program-specific criteria. Requirements stipulated in the program-specific criteria are limited to two areas: (1) curriculum topics and (2) faculty qualifications. The focus of this paper is on civil engineering curriculum topics, noting that the faculty qualifications area has not changed in many years nor have any changes to the faculty qualifications been proposed. The current (2015/2016) civil engineering program curriculum criterion<sup>6</sup> is provided here:

The program must prepare graduates to apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of basic science, consistent with the program educational objectives; apply knowledge of four technical areas appropriate to civil engineering; conduct civil engineering experiments and analyze and interpret the resulting data; design a system, component, or process in more than one civil engineering context; explain basic concepts in management, business, public policy, and leadership; and explain the importance of professional licensure.

In addition to the current accreditation criteria, ABET also published proposed changes to the 2015/2016 accreditation criteria (to be effective in the 2016/2017-accreditation cycle), including proposed changes to the civil engineering program curriculum criterion<sup>8</sup> as follows:

The curriculum program must prepare graduates to apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of basic science, consistent with the program educational objectives; apply probability and statistics to address uncertainty; apply knowledge of analyze and solve problems in at least four technical areas appropriate to civil engineering; conduct civil engineering experiments in at least two technical areas of civil engineering and analyze and interpret the resulting data;

design a system, component, or process in ~~at least two~~ ~~more than one~~ civil engineering contexts; include principles of sustainability in design; explain basic concepts in project management, business, public policy, and leadership; analyze issues in professional ethics; and explain the importance of professional licensure.

### **Understanding the Proposed Criteria**

This section is intended to provide both civil engineering program faculty and program evaluators an improved understanding of the new Civil Engineering Program Criteria. The following is based largely on the draft new commentary<sup>7</sup> and provides a summary of both “what” is intended by each criterion and “why” the provision is included in the Program Criteria. Also, even though Bloom’s Taxonomy<sup>4,9</sup> is not an explicit part of the accreditation criteria, the CEPC utilizes Bloom’s verbs to describe the intended levels of achievement for each provision of the criteria. Accordingly, the rationale behind the Bloom’s verb in each provision is included to assist in interpreting the criteria.

#### ***Apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of basic science***

This provision of the CEPC requires the program’s curriculum content to be sufficient to prepare graduates to apply concepts and principles from mathematics and science to solve relatively straightforward problems. For the additional area of basic science, programs may include biology, ecology, geology, and geomorphology – areas of significant interest and increasing importance for civil engineers. This list is by no means all-inclusive. However, for topics other than those listed above, it is the program’s responsibility to demonstrate the selected area(s) of science provides breadth beyond physics and chemistry. In general, an advanced course in physics or chemistry (i.e., a physics or chemistry course that is part of a physics or chemistry sequence for which a basic-level physics or chemistry course serves as a prerequisite) would not fulfill this requirement because such a course would provide additional *depth* rather than additional *breadth*. Courses such as geo-physics, seismology, organic or bio-chemistry that are not part of a standard physics or chemistry sequence might be appropriate, especially if they can be tied to student outcomes and program’s curricular emphasis. Likewise, a course that is primarily engineering science in content would not fulfill this requirement. It has been long established that courses such as thermodynamics, computer science or materials science do not meet this requirement. Finally, it is also important to note that it is not necessary for all students within a particular program’s curriculum take the same additional area of science.

The BOK2 includes two outcomes related to this provision of the CEPC: Outcome 1-Mathematics and Outcome 2-Natural Sciences. Mathematics through differential equations, calculus-based physics, and chemistry have long been considered part of the technical core of civil engineering. The requirement for “one additional area of basic science” reflects an increasing emphasis on biological systems, ecology, sustainability, and nanotechnology within the practice of civil engineering. According to Bloom’s Taxonomy, the verb “apply” denotes the expected level of achievement is Bloom’s Level 3, or “application level.” Both the BOK2 Outcome 1-Mathematics and Outcome 2-Natural Sciences are also at Bloom’s Level 3 of achievement.

### ***Apply probability and statistics to address uncertainty***

To comply with this provision of the CEPC, the program's curriculum must be sufficient to prepare graduates to apply concepts and principles from probability and statistics to address uncertainty in data, measurements, or calculations. This provision does not require a specific course or set of courses that a curriculum must include, nor does it define specific topics within probability or statistics that must be included. That is, the intent is to provide students with a foundation on which they can, as future professionals, manage risk and uncertainty. The key element is for the curriculum to include the opportunity for students to apply these concepts to address uncertainties.

Probability and statistics was part of the CEPC until 2006-2007, after which it was removed from the criteria. At that time, the provision required "graduates have proficiency in ... probability and statistics..." The provision was removed primarily for two reasons: (1) probability and statistics was not included explicitly in the BOK1, and (2) there was a belief that, while still recognized as an important subject, most programs would continue to include probability and statistics even without the provision. However, the BOK2 includes Outcome 12 – Risk and Uncertainty, which includes the following outcome statement at the baccalaureate level: "apply principles of probability and statistics to solve problems containing uncertainties." Since probability and statistics concepts are integral to most civil engineering subjects and since they are included in the BOK2, the subject matter was reintroduced into the CEPC. Moreover, graduates are required to be able to analyze and interpret data from experiments (see later section on the experiments provision of the CEPC), which implies some background in probability and statistics. It is entirely feasible for appropriate coverage of probability and statistics to occur in the associated engineering courses, rather than in a separate course in probability and statistics. Finally, according to Bloom's Taxonomy, the verb "apply" denotes the expected level of achievement is Bloom's Level 3, or "application level." Both this provision of the Civil Engineering Program Criteria and the related BOK2 outcome use the same verb "apply," therefore this program criterion is consistent with the BOK2.

### ***Analyze and solve problems in at least four technical areas appropriate to civil engineering***

The field of civil engineering involves many traditional technical areas of specialization, including construction, environmental, geotechnical, structural, surveying, transportation, and water resources. That said, civil engineering is a profession that continues to evolve, and new specialty areas will continually emerge. It is important that this provision of the CEPC not stifle curricular innovation and a program's ability to respond to future opportunities or needs. If a curriculum's four technical areas include one or more nontraditional technical area, the program is responsible for demonstrating the technical area or areas are "appropriate to civil engineering." The program must provide information on which a well-reasoned judgment can be made by the program evaluator. This judgment must balance the desirability of curricular innovation against the need for relevant technical breadth in all civil engineering graduates. Finally, there is no requirement for a minimum number of credit hours or courses in each of the four technical areas, and there is no requirement that all graduates of a given program take courses in the same four areas.

This is a long-standing provision of the CEPC and is intended to ensure every civil engineering graduate has sufficient relevant technical breadth. The areas of civil engineering a program chooses to include in its curriculum are intentionally not specified in this provision. The primary change from previous editions of the breadth provision of the CEPC is replacing “apply knowledge of” with “analyze and solve problems” to make this provision consistent with the BOK2. The verb “apply” used in previous editions of this provision expected Bloom’s Level 3, Application. The requirement to “apply” knowledge is the ability to use learned material in new and tangible situations. This may include the using rules, methods, concepts, principles, laws, and theories to solve problems. “Analysis” is a Bloom’s Level 4 verb and is a higher cognitive level than application because it requires an understanding of both the content and the organizational form of the material.

***Conduct experiments in at least two technical areas of civil engineering and analyze and interpret the resulting data***

This provision of the CEPC requires a program’s curriculum to include student exposure to conducting laboratory experiments or tests in at least two technical areas of civil engineering and then analyzing and interpreting the resulting data. This may be accomplished by showing graduates have sufficient exposure to laboratory experiences within the curriculum and that all students must obtain that level of exposure in order to graduate. The program may consider providing experimental experiences in any of the traditionally recognized civil engineering technical areas as well as new or emerging technical areas of civil engineering practice. Additionally, “virtual laboratories” attempt to replicate the hands-on experiences of conventional physical labs using computer simulations and may be used to fulfill the provision. In general, such curricular innovations are encouraged, and the program evaluator must keep an open mind when considering their effectiveness.

Design of experiments is not emphasized in the CEPC because civil engineers generally do not develop experimental procedures; rather, they select and conduct experiments according to published standards, such as the American Society for Testing and Materials (ASTM) specifications and the Standard Methods for the Examination of Water and Wastewater. It is important to recognize the absence of any reference to experimental design in the CEPC as the “design of experiments” is required by ABET<sup>6</sup> General Engineering Criterion 3(b).

The requirement of including an experimental experience in “at least two technical areas of civil engineering” is new and stems from a perceived reduction in the practical hands-on skills of students entering engineering, an apparent trend towards a reduction in laboratory courses from engineering curricula, and aligns with the BOK2. Following Bloom’s Taxonomy, the verb “conduct” implies the level of achievement for such tasks as experimental setup, measurement, and data collection is Level 3, Application. The verbs “analyze” and “interpret” imply the level of achievement for processing experimental data is Level 4, Analysis.

***Design a system, component, or process in at least two civil engineering contexts***

This is another long-standing provision of the CEPC, including the requirement to have design experiences in at least two civil engineering contexts. The intent of requiring more than one area

is for the “civil engineering contexts” to be significantly different from one another. ABET<sup>8</sup> defines design as “the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.” This definition forms the basis for evaluation of the design-related provisions of the CEPC. Elements to look for in evaluating students design experience may include the following characteristics:

- (1) Both analysis and synthesis – analysis without synthesis is *not* engineering design.
- (2) An iterative cycle – students should experience *some* iterative design in the curriculum; expecting *all* design experiences to be iterative would place an unrealistically heavy burden on the program.
- (3) Ill-defined problems – students should have an opportunity to define a problem, including scope and design objectives.
- (4) Open-ended problems – design problems have no single correct answer, while recognizing that in an academic setting there are significant practical constraints on a program’s ability to implement open-ended design experiences across the curriculum.
- (5) Engineering standards and realistic constraints – the most common types of standards used in civil engineering design are consensus standards, codes, and regulations.
- (6) Multidisciplinary teams – for civil engineering design, a team consisting of representatives from the established sub-disciplines of civil engineering, a more broadly comprised team with representatives from civil engineering with other engineering disciplines, other non-engineering disciplines (e.g., architecture, law, finance, etc.), or some combination of the two would be considered multidisciplinary teams.

Consistent with Bloom’s Taxonomy, the verb “design” implies the expected level of achievement is Level 5, Synthesis. Requiring design experiences in at least two civil engineering contexts also builds on the previously presented provision requiring the curriculum to “prepare graduates to analyze and solve problems in at least four technical areas appropriate to civil engineering,” which implies the expected level of achievement for the four or more areas is Bloom’s Level 4, Analysis. Therefore, it can be inferred for at least two technical areas of civil engineering that the expected level of achievement is raised to Level 5, Synthesis, through this design provision of the CEPC.

### ***Include principles of sustainability in design***

This is a new provision to the CEPC, and to comply with this provision of the CEPC the program must demonstrate its curriculum content prepares graduates to include principles of sustainability in design. It is noted that sustainability is included, but not mandated, as one of several possible constraints in the ABET<sup>6</sup> General Engineering Criterion 3(c), which requires “an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.” The CEPC reflects the importance of including sustainability and identifies it as necessary to the design process. Additionally, the CEPC does not require a program to include sustainability in all student design experiences or that it be included in more than one context. The provision simply requires coverage of sustainability in the curriculum be sufficient so graduates can include key concepts of sustainability in at least one engineering design context.

There are many definitions of sustainability, and there is not a consensus definition of what constitutes sustainability. This is specifically recognized in the provision's wording of "... include principles of sustainability" versus "... include the principles of sustainability." This recognizes there is not a specific set of principles of sustainability that must be included. Rather, the program is allowed the latitude to include principles of sustainability in a context most appropriate for its curriculum. ASCE<sup>10</sup> defines sustainability as a "set of environmental, economic and social conditions in which all of society has the capacity and opportunity to maintain and improve its quality of life indefinitely without degrading the quantity, quality or availability of natural, economic, and social resources."

The importance of sustainability is communicated in many ways, and ASCE is a recognized leader in this advancing area. The Civil Engineering Code of Ethics<sup>11</sup> includes as one of the Fundamental Canons that "Engineers shall...strive to comply with the principles of sustainable development..." The BOK2 also has an outcome specific to sustainability, which states baccalaureate-level students should be able to "apply the principles of sustainability to the design of traditional and emergent engineering systems." The verb "apply" indicates a level of attainment for sustainability at Bloom's Level 3 – Application. While sustainability is central to the modern practice of civil engineering, requiring an additional curricular topic that fully addresses the BOK2 outcome statement was deemed too far-reaching and potentially too difficult for programs to attain without creating a separate course in sustainability. The provision as stated, "to include principles of sustainability in design," allows a more qualitative approach and lowers the cognitive level of achievement required, yet ensures sustainability is not neglected by simply being part of a larger list of requirements.

### ***Explain basic concepts in project management, business, public policy, and leadership***

Previously, this provision did not specifically state project management and implied a broader exposure to management, including project management, construction management, and asset management. As stated in the BOK2, basic concepts in project management include project manager responsibilities, defining and meeting client requirements, risk assessment and management, stakeholder identification and involvement, contract negotiation, project work plans, scope and deliverables, budget and schedule preparation and monitoring, interaction among engineering and other disciplines, quality assurance and quality control, and dispute resolution processes. Basic business concepts are defined in the BOK2 as being typically applied in the private, government and non-profit sectors include legal forms of ownership, organizational structure and design, income statements, balance sheets, decision (engineering) economics, finance, marketing and sales, billable time, overhead, and profit. The BOK2 defines basic public policy concepts to include the political process, formulation of public policy, laws and regulations, funding mechanisms, public education and involvement, government-business interaction, and the public service responsibility of professionals. Leadership, which differs from and complements the other components of this criterion, requires broad motivation, direction, and communication skills. The BOK2 defines desirable behaviors of leaders, which can be taught and learned, to include earning trust, trusting others, formulating and articulating vision, communication, rational thinking, openness, consistency, commitment to organizational values, and discretion with sensitive information.



Narrowing the focus on management in the previous program criteria to project management in the new program criteria recognizes civil engineering work is largely project based. According to Bloom's Taxonomy, the verb "explain" in this provision implies the expected level of achievement is Level 2 – Comprehension. Graduates must explain some (but not all) of the key concepts in the four areas listed in the provision. It is not necessary for the program to offer one or more courses explicitly devoted to project management, business, public policy, or leadership. Rather, these topics may be integrated into other courses or curricular experiences. Additionally, graduates' ability to explain generic, business-oriented project management, business, public policy, or leadership concepts such as those acquired from a course or courses offered outside engineering could also represent full compliance with this criterion.

### ***Analyze issues in professional ethics***

The ABET General Engineering Criterion 3(f) requires graduates have "an understanding of professional and ethical responsibility." This is a new provision in the CEPC and reflects an elevated expectation and greater importance for professional ethics. It effectively requires a curriculum to include an opportunity for students to go beyond a simple understanding of ethical responsibility and to have students analyze issues in professional ethics. "Analyze" is a Bloom's Level 4 verb, whereas "understanding" would be considered a Level 2 Bloom's verb.

While there are a wide variety of ways a program may meet this criterion, one possible way to encourage students' ethical development is to provide developmentally appropriate curricular experiences in multiple contexts at multiple times through the curriculum. Another possible way to address this criterion is to include ethical development in selected co- and extra-curricular activities. Regardless, it is critically important to recognize programs may prepare its graduates to analyze issues in professional ethics in any number of ways. The examples provided here are not intended to limit how any program may meet the criterion. A program's curriculum only needs show how it prepares its graduates to analyze issues in professional ethics.

BOK2 Outcome 24, Professional and Ethical Responsibility endorses civil engineering graduates being able to "analyze a situation involving multiple conflicting professional and ethical interests to determine an appropriate course of action." The ABET General Criteria falls short of the ASCE BOK with regards to ethical and professional conduct. An "understanding" as listed in ABET Criterion 3(f) could be achieved by programs with seminars or single session lectures. However, such traditional instructional approaches may not be adequate to impart a higher level of ethical responsibility in civil engineering graduates. Seminars or lectures may be ineffective in addressing ethical decision-making and, more importantly, influencing ethical and professional behavior. According to data maintained by the National Council of Examiners for Engineering and Surveying (NCEES), during fiscal year 2013-2014 nearly two-thirds of complaints against engineers were for ethical misconduct<sup>12</sup>. While graduating professionals who behave ethically throughout their careers is ultimately what undergraduate programs and the profession wish to achieve, it is unrealistic to place a statement to that effect in the Civil Engineering Program Criteria.

### ***Explain the importance of professional licensure***

To comply with this provision of the CEPC, a program's curriculum must address the importance of licensure so all graduates are exposed to and could explain the concept. While professional licensure is not explicitly addressed in the ABET General Engineering Criteria, this long-standing provision in the Civil Engineering Program Criteria is related to and supportive of General Criterion 3(f), which requires graduates to have an understanding of professional and ethical responsibility.

Licensure tells the public an engineer has mastered the critical elements of the profession, a symbol of achievement and assurance of quality. Civil engineers comprise the majority of licensed professional engineers and have responsible charge over projects with direct impact on the everyday lives of the public. The first Fundamental Canon of ASCE's Code of Ethics<sup>9</sup> is "Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties." The Bloom's verb "explain" used in this provision implies the expected level of achievement is Level 2 – Comprehension. Graduates should be able to explain the unique nature of civil engineers' responsibility to the general public and the consequent emphasis on professional licensure in civil engineering professional practice

### **Summary**

The Civil Engineering Program Criteria Task Committee (CEPCTC) was created in 2012 and charged to develop and propose new Civil Engineering Program Criteria (CEPC). The proposed CEPC were published by ABET and are open for comment through June 2015. Once approved, the new criteria will go into effect for the 2016/2017-accreditation cycle. In late 2014, the CEPCTC distributed a draft of the new *Commentary on the ABET Engineering Criteria for Civil and Similarly Named Programs* for comment by civil engineering faculty, program managers, program evaluators, and other key civil engineering accreditation stakeholders. This draft *Commentary* was the foundation for this paper. A final version of the new commentary is scheduled for release in the fall of 2015.

The proposed new Civil Engineering Program Criteria was reviewed in detail by providing a thorough understanding of the new criteria and an appreciation of the background leading to changes in the criteria. The intent was to provide a review of both "what" is intended by each criterion and "why" the provision is included in the Program Criteria. Also, even though Bloom's Taxonomy is not an explicit part of the accreditation criteria, the CEPC utilizes Bloom's verbs to describe the intended levels of achievement for each provision of the criteria and the rationale behind the Bloom's verb in each provision is included to assist in interpreting the criteria.

## References

- <sup>1</sup> *Civil Engineering Body of Knowledge for the 21st Century: Preparing the Civil Engineer for the Future*. American Society of Civil Engineers, 2004.
- <sup>2</sup> *Commentary on the ABET Engineering Criteria for Civil and Similarly Named Programs in the Context of the Civil Engineering Body of Knowledge*. American Society of Civil Engineers, 2007.
- <sup>3</sup> *Commentary for Civil and Similarly Named Programs*. American Society of Civil Engineers, 2011.
- <sup>4</sup> *Civil Engineering Body of Knowledge for the 21st Century: Preparing the Civil Engineer for the Future, Second Edition*. Reston, VA: American Society of Civil Engineers, 2008.
- <sup>5</sup> Estes, A.C. and Lenox, T.A. “New Civil Engineering Program Criteria: How the Sausage is Being Made.” Proceedings of the 2014 Annual Conference of the American Society for Engineering Education, Indianapolis, June 2014.
- <sup>6</sup> Estes, A.C., Lenox, T.A., and Anderson, R.O. “New Civil Engineering Program Criteria: The Rest of the Story.” Proceedings of the 2015 Annual Conference of the American Society for Engineering Education, Seattle, June 2015.
- <sup>7</sup> *Draft Commentary on the ABET Engineering Criteria for Civil and Similarly Named Programs, Version 5.1*. American Society of Civil Engineers, 2014.
- <sup>8</sup> *Criteria for Accrediting Engineering Programs 2015-2016* (<http://www.abet.org/eac-criteria-2015-2016/>). ABET, 2014.
- <sup>9</sup> Bloom, Benjamin S. *Taxonomy of Educational Objectives*, New York: Longman, 1956.
- <sup>10</sup> *Sustainability* (<http://www.asce.org/sustainability>). American Society of Civil Engineers, 2015.
- <sup>11</sup> *Code of Ethics* ([http://www.asce.org/code\\_of\\_ethics/](http://www.asce.org/code_of_ethics/)). American Society of Civil Engineers, 2015.
- <sup>12</sup> Personal Communication with Regina Dinger, Executive Director, Alabama Board of Licensure for Professional Engineers and Land Surveyors. October 2014.