

New Accreditation Criteria for the Civil Engineering Profession: Process and Products

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Introduction

This paper describes the ongoing development of new ABET accreditation criteria for civil engineering programs, as part of the larger process of implementing the American Society of Civil Engineers (ASCE) Policy 465. The paper summarizes the evolution of Policy 465 and the associated Civil Engineering Body of Knowledge (BOK); it discusses the advantages and limitations inherent in using accreditation criteria as an instrument for fostering implementation of the BOK; it summarizes the development process leading to new draft BOK-compliant accreditation criteria; and, finally, it provides a detailed description and analysis of the products—proposed Basic Level Civil Engineering Program Criteria, Advanced Level General Criteria, and the associated draft ASCE Commentary.

The ultimate purpose of this paper is to share the new draft criteria with a broader audience and to solicit feedback that will further improve the quality, relevance, and effectiveness of these products.

Background: Policy 465 and the Body of Knowledge

Rapid technological advancement, globalization, and ever-increasing political, social, environmental, and economic constraints are fundamentally changing the practice of civil engineering today. Yet many academic institutions are ill-equipped to respond to these challenges, because of severe credit hour limitations that have been imposed on the four-year bachelor's degree in recent years. Consequently, the bachelor's degree is becoming increasingly inadequate as formal academic preparation for the professional practice of civil engineering.

In response to this situation, the American Society of Civil Engineers (ASCE) Board of Direction adopted Policy Statement 465 in October 1998. This initial version of the policy stated that the Society “supports the concept of the master's degree as the First Professional Degree for the practice of civil engineering at the professional level.” As the strategy for achieving this vision developed, it became apparent that the policy should more broadly address the academic prerequisites for professional practice and licensure, rather than focusing only on the attainment of a specific academic degree. Hence, in October 2001, the ASCE Board adopted a modified version of Policy 465, indicating that ASCE “supports the concept of the master's degree or equivalent as a prerequisite for licensure and the practice of civil engineering at the professional level.”

Charged with implementing Policy 465, the ASCE Committee on Academic Prerequisites for Professional Practice (CAP³) began by considering the three fundamental characteristics of a profession—an ethic of professional service, a professional organization, and a specialized body of knowledge.¹ The committee's analysis of the civil engineering profession suggested that, of

these three characteristics, only the first two were adequately defined. Thus began a broad-based effort to define and articulate the Civil Engineering Body of Knowledge. In January 2004 this effort came to fruition with ASCE's publication of *Civil Engineering Body of Knowledge for the 21st Century*—a report describing the knowledge, skills, and attitudes necessary for entry into the practice of civil engineering at the professional level.²

This report describes the Civil Engineering Body of Knowledge (BOK) in terms of 15 outcomes, the first 11 of which correspond nominally to ABET Criteria 3(a) through 3(k).³ Outcome 12 describes a requirement for knowledge in a specialized area related to civil engineering; and Outcomes 13, 14, and 15 require understanding of professional practice topics such as management, business, public policy and administration, and leadership.

The scope of the BOK significantly exceeds that of the current ABET Criteria—a clear statement that future civil engineering graduates will need more education than they are receiving today. To address this need, the BOK prescribes four major changes in civil engineering education:

- Increased emphasis on fundamentals—math, science, and engineering science;
- Increased technical breadth;
- Increased professional practice breadth; and
- Increased technical depth.

In October 2004, the ASCE Board reinforced the importance of the BOK by modifying the wording of Policy 465 as follows:

The American Society of Civil Engineers supports the attainment of a Body of Knowledge for entry into the practice of civil engineering at the professional level. This would be accomplished through the adoption of appropriate engineering education and experience requirements as a prerequisite for licensure.⁴

Now that the BOK has been formally defined and endorsed in ASCE policy, its implementation is proceeding along four parallel, coordinated paths—(1) accreditation, (2) curriculum development, (3) licensure, and (4) fulfillment and validation. Each path is the responsibility of a subcommittee of CAP³. The development and implementation of BOK-compliant accreditation criteria is the responsibility of the CAP³ Accreditation Committee—and is the subject of this paper.

Accreditation Criteria as an Instrument for BOK Implementation

In fulfilling its charge from CAP³, the Accreditation Committee's ultimate goal is to foster the design, development, and implementation of BOK-compliant curricula in every ABET-accredited civil engineering program in the U.S. The committee's work is founded upon two fundamental assumptions:

(1) We assume that the authors of the Civil Engineering Body of Knowledge got it right. We recognize that the BOK represents the consensus of a large number of thoughtful contributors representing the full breadth and diversity of the civil engineering profession. Individual committee members might disagree with various provisions of the BOK; nonetheless, we collectively agree to implement the BOK in good faith, on behalf of ASCE. The committee will

recommend changes to the BOK, but only when those changes are required *from an accreditation perspective*.

(2) We assume that the ABET accreditation criteria constitute the only instrument that can effectively foster broad and reasonably consistent implementation of the Body of Knowledge.

Accreditation criteria can provide a powerful stimulus for curricular change—as the entire engineering profession has witnessed in the implementation of the ABET Engineering Criteria 2000 during the past decade. Furthermore, if the principal elements of the BOK are embedded in accreditation criteria, then the accreditation process can be used effectively as a mechanism for validating BOK attainment. In the absence of such a mechanism, BOK validation would require a substantial bureaucratic infrastructure that currently does not exist.

Given this second assumption, CAP³ has proposed that civil engineers should be able to attain the Civil Engineering Body of Knowledge by following either of two alternative paths:

- **Path #1: B + M^{ABET} & E** – A bachelor’s degree in any discipline plus an ABET-accredited master’s degree in civil engineering, augmented with appropriate professional experience
- **Path #2: B^{ABET} + 30 & E** – An ABET-accredited bachelor’s degree in civil engineering plus *approximately* 30 credit hours of relevant upper-level undergraduate and graduate-level coursework, augmented with appropriate professional experience

A detailed discussion of this “two-path model” is beyond the scope of this paper. However, it is important to note that, under Path #1, the ABET-accredited master’s degree provides the mechanism for validation of the academic component of the BOK (i.e., the portion of the BOK not acquired through experience). Under Path #2, a separate validation process is required, because the “approximately 30 credit hours of relevant...coursework” is not necessarily part of a formal master’s degree program. Nonetheless, this new (and, as of yet, not fully defined) validation process need only be applied to the post-baccalaureate coursework, since the bachelor’s degree is ABET-accredited. The key point of commonality between both paths is that *ABET accreditation is essential to the validation of BOK attainment*.

Although we have assumed that the ABET criteria constitute the only viable instrument for effecting BOK implementation, it is *not* true that the criteria are entirely adaptable to this purpose. The ABET criteria consist of three different components, each with its own unique limitations as an instrument for BOK implementation:

- The **Basic Level General Criteria** are applicable to *all* ABET-accredited programs in *all* engineering disciplines. Changing these criteria would require the support of ABET and ABET’s 27 member societies. In the short term, ASCE has little or no capability to gain such broad support. Thus, in the short term, we consider the ABET Basic Level General Criteria to be unchangeable.
- The **Advanced Level General Criteria** are also applicable to all engineering disciplines; however, because very few programs are currently accredited at the advanced level, it is

feasible for ASCE to influence changes to these criteria. Nonetheless, such changes must still be applicable and acceptable to all engineering disciplines. Discipline-specific additions to the Advanced Level General Criteria would not be permissible.

- The **Basic Level Program Criteria** are applicable only to specific engineering disciplines and are established and maintained by the associated ABET member society. The Basic Level Civil Engineering Program Criteria are applicable to “civil and similarly named engineering programs” and are established by ASCE. Because ASCE has considerable authority to change these criteria, they must necessarily be the principal accreditation-related mechanism for BOK implementation.

ASCE’s authority over its program criteria is not unlimited, however. All program criteria are subject to ABET approval; and in order to gain approval, proposed criteria must be appropriately outcomes-based and must not be overly prescriptive. In an era when new engineering disciplines are constantly emerging and existing disciplinary boundaries are blurring, program criteria are viewed as an anachronism in some ABET circles. Indeed, some members of the ABET leadership favor the total elimination of program criteria. In this environment, there are significant constraints on ASCE’s ability to use the Basic Level Civil Engineering Program Criteria as its principal instrument for implementation of the BOK.

In theory, *Advanced Level Civil Engineering Program Criteria* might also be used as an instrument for BOK implementation. In practice, however, no advanced level program criteria are currently included in the ABET Engineering Criteria, and there is little chance of gaining ABET approval for such criteria. Thus the Accreditation Committee has not considered Advanced Level Civil Engineering Program Criteria to be viable.

The **ASCE Commentary** is also available as an instrument for BOK implementation, although it is not (nor can it ever be) a formal part of the ABET criteria. The commentary is an internal ASCE document that provides civil engineering program evaluators with guidelines for conducting accreditation visits under the current ABET criteria—with emphasis on the Basic Level Civil Engineering Program Criteria.⁵ Since the ASCE Commentary is permitted by ABET and is already well known to program evaluators and civil engineering faculty, it represents a powerful means of communication with several of the most important constituencies associated with BOK implementation. Like the Civil Engineering Program Criteria, however, the ASCE Commentary is subject to significant constraints. Most important, in order to remain acceptable to ABET, the ASCE Commentary may not supplement the ABET criteria in any way. The commentary can provide guidance on how to apply the existing criteria; however, it may not include any provision that might be interpreted as an additional evaluation criterion. To emphasize its unofficial status, the ASCE Commentary is now, and will continue to be identified as, a draft document.

Challenges and Solutions

Given this highly constrained set of accreditation-related instruments, the Accreditation Committee faced the challenge of determining which instrument would be most appropriate for fostering the implementation of each BOK outcome. Three considerations heavily influenced the committee’s approach to meeting this challenge:

- The first 11 outcomes of the Civil Engineering Body of Knowledge correspond *nominally* to Criteria 3(a) through 3(k) in the ABET Basic Level General Criteria; however, the BOK describes these outcomes with a considerably greater specificity than the ABET criteria. For example, BOK Outcome 1 (an ability to apply knowledge of mathematics, science, and engineering) is nominally identical to ABET Criterion 3(a); however, the text associated with BOK Outcome 1 also calls for coverage of mathematics through differential equations, probability and statistics, calculus-based physics, biology, chemistry, ecology, geology/geomorphology, engineering economics, mechanics, material properties, systems, geo-spatial representation, information technology, and several recognized major civil engineering areas. None of these subjects are specified under Criterion 3(a); thus, ABET's prohibition on supplementing the ABET General Criteria would prevent ASCE from requiring competency in these subjects under the auspices of Criterion 3(a). If any such requirement is to be enforceable, it would have to be included in the Civil Engineering Program Criteria.
- The ABET Advanced Level General Criteria provide the only feasible means of accomplishing two distinctly different aspects of BOK implementation. First, since BOK Outcome 12—the requirement for ability in a specialized area of civil engineering—can only reasonably be accomplished at the graduate level, this requirement must be incorporated into the Advanced Level General Criteria. Second, these criteria must address the requirement for an ABET-accredited master's degree to serve as the *de facto* validation for civil engineers seeking to attain the BOK via Path #1 (described above). To satisfy this requirement, the Advanced Level General Criteria must require satisfaction of the Basic Level General Criteria and the Basic Level Program Criteria. Without such a provision, awarding an ABET-accredited master's degree would not guarantee that the entire Civil Engineering Body of Knowledge had been attained. This particular requirement represents a major political challenge, because many engineering disciplines prefer not to require that master's degree recipients in their disciplines also satisfy their Basic Level Program Criteria.
- BOK Outcomes 1 through 11 are logically addressed in the basic level criteria, because of their direct association with ABET Criteria 3(a) through 3(k). BOK Outcome 12 is logically addressed in the advanced level criteria, because it requires advanced, specialized knowledge. BOK Outcomes 13 through 15, however, might reasonably be addressed at *either* the basic or advanced level. These professional practice topics—project management, construction management, asset management, business, public policy and administration, and leadership—could logically be integrated into the undergraduate civil engineering curriculum *or* offered as part of a professional practice-oriented master's program. From an accreditation perspective, however, it is *only* possible to address these topics in the Basic Level Civil Engineering Program Criteria. Addressing these professional practice topics at the graduate level would require their inclusion in the Advanced Level General Criteria—which cannot be approved without the broad support of the other engineering societies. Since these topics are, to some degree, discipline-specific, it would be virtually impossible to gain the support necessary for their approval.

In response to these considerations, the Accreditation Committee has structured its proposed BOK-compliant ABET accreditation criteria as illustrated in Figure 1 below. BOK Outcomes 1 through 11 are addressed in both the Basic Level General Criteria and the Basic Level Civil Engineering Program Criteria. Specifically, all aspects of BOK Outcomes 1 through 11 that are not addressed in the *existing* Basic Level General Criteria must be incorporated into *revised* Basic Level Civil Engineering Program Criteria. This differentiation is driven by the fact that the General Criteria cannot effectively be changed by ASCE, while the Program Criteria can. BOK Outcome 12 is addressed in revised Advanced Level General Criteria—carefully worded such that the revisions are likely to be acceptable to other ABET member societies. Outcomes 13 through 15 are addressed entirely within the Basic Level Civil Engineering Program Criteria, again primarily because these criteria are subject to ASCE’s control.

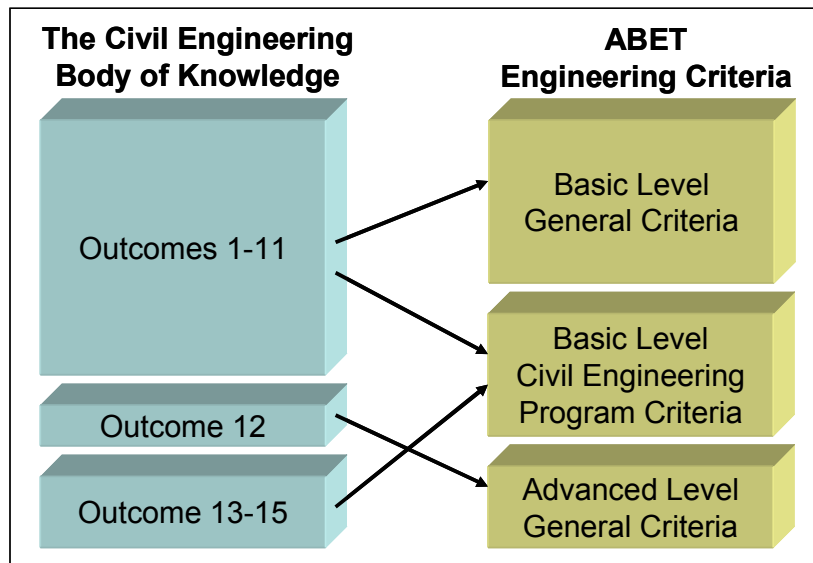


Figure 1. Model for formulation of BOK-compliant accreditation criteria

Consistent with this model, new BOK-compliant ABET Basic-Level Civil Engineering Program Criteria and Advanced Level General Criteria were drafted in the spring of 2004 and are now being shared with the broader community of civil engineering educators and practitioners. ASCE’s goal is to fully implement these criteria for accreditation visits occurring during academic year 2008-2009.

Basic Level Civil Engineering Program Criteria

The Accreditation Committee’s first attempt to produce BOK-compliant Basic Level Civil Engineering Program Criteria met with mixed results. The first-draft criteria were based on a fundamental premise that *satisfaction of the criteria must also guarantee full implementation of the Civil Engineering Body of Knowledge*. This premise, though advantageous from the perspective of BOK implementation, resulted in a set of criteria that were excessively prescriptive. Upon reviewing the draft, many civil engineering department heads expressed strong opposition, and ASCE’s representatives on the Engineering Accreditation Commission suggested that the criteria were too prescriptive to be approved by ABET.

On the positive side, the circulation of highly prescriptive draft Civil Engineering Program Criteria got the attention of many constituents who, until that time, had demonstrated only a passing interest in Policy 465 and the BOK. The draft also called attention to several previously misunderstood aspects of the BOK—most notably the fact that BOK Outcomes 1 through 11 do not corresponded exactly to ABET Criteria 3(a) through 3(k).

Before developing a second draft of the Basic Level Civil Engineering Program Criteria, the Accreditation Committee needed to reevaluate its concept of BOK-compliance. Rather than ensuring that satisfaction of the criteria would also guarantee full implementation of the BOK, the Accreditation Committee established two new fundamental premises:

- The criteria represent only a *minimum standard* for attainment of the Civil Engineering Body of Knowledge.
- Programs that aspire to full, robust implementation of the BOK will need to do considerably more, on a voluntary basis, than the criteria prescribe.

This revised concept of BOK-compliance strikes a more realistic balance between fostering full implementation of the BOK and preserving curricular flexibility.

Consistent with these fundamental premises, the Accreditation Committee formulated the following draft Basic Level Civil Engineering Program Criteria:^{*}

1. Curriculum

The program must demonstrate that graduates have an ability to apply knowledge in mathematics through differential equations, calculus-based physics and chemistry; an understanding of the fundamentals in at least one additional area of science, consistent with the program educational objectives; an understanding of the fundamentals of four technical areas appropriate to civil engineering; an ability to conduct civil engineering experiments and analyze and interpret the resulting data; an understanding of the design process in more than one civil engineering context; and a recognition of management, business, and leadership principles.

2. Faculty

The program must demonstrate that faculty teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure, or by education and design experience. The program must demonstrate that it is not critically dependent on one individual.

These criteria use the terms *recognition*, *understanding*, and *ability* to describe three specific levels of competence. These terms are used, but not defined, in the ABET General Criteria. To enhance clarity and to promote shared understanding, the authors of *Civil Engineering Body of Knowledge for the 21st Century* formally defined the three levels of competence as follows:

^{*}This is the committee's current working draft, as of March 1, 2005; however, the draft is still subject to review and may have changed by the time this paper is presented in June 2005.

- **Recognition** represents a reasonable level of familiarity with a concept. At this level, the engineer is familiar with a concept, but lacks the knowledge to specify and procure solutions without additional expertise. For example, an engineer might recognize that a particular architectural plan poses significant construction difficulties without having the expertise to devise improved construction or design alternatives.
- **Understanding** implies a thorough mental grasp and comprehension of a concept or topic. Understanding typically requires more than abstract knowledge. For example, an engineer with an understanding of professional and ethical responsibility should be able to identify and to communicate ethical issues arising from a practical case study.
- **Ability** is a capability to perform with competence. An engineer with the ability to design a particular system can take responsibility for the system, identifying all the necessary aspects of the design, and match objectives with appropriate technological solutions. As an engineer develops, the engineer's abilities also develop so that more challenging and difficult problems can be solved.

This new draft is best understood through a direct comparison of the current Civil Engineering Program Criteria, published in November 2004³, and the proposed BOK-compliant criteria presented above. A line-by-line comparison is provided in Table 1 below. In this table, the current and proposed criteria have been dissected into phrases, each of which represents a specific provision. The phrases are designated with letters, A through F, for ease of reference.

Phrase	Current Criteria	Proposed BOK-Compliant Criteria
	The program must demonstrate that graduates have	The program must demonstrate that graduates have
A	proficiency in mathematics through differential equations, probability and statistics, calculus-based physics, and general chemistry;	an ability to apply knowledge in mathematics through differential equations, calculus-based physics and chemistry;
B		an understanding of the fundamentals in at least one additional area of science, consistent with the program educational objectives;
C	proficiency in a minimum of four (4) recognized major civil engineering areas;	an understanding of the fundamentals of four technical areas appropriate to civil engineering;
D	the ability to conduct laboratory experiments and to critically analyze and interpret data in more than one of the recognized major civil engineering areas;	an ability to conduct civil engineering experiments and analyze and interpret the resulting data;
E	the ability to perform civil engineering design by means of design experiences integrated throughout the professional component of the curriculum;	an understanding of the design process in more than one civil engineering context;

F	and an understanding of professional practice issues such as: procurement of work, bidding versus quality-based selection processes, how the design professionals and the construction professions interact to construct a project, the importance of professional licensure and continuing education, and/or other professional practice issues.	and a recognition of management, business, and leadership principles.
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Table 1. Comparison of current and proposed Basic Level Civil Engineering Program Criteria

The proposed BOK-compliant Basic Level Civil Engineering Program Criteria differ from the current criteria as follows:

Phrase A. The proposed criteria continue to recognize mathematics through differential equations, calculus-based physics, and chemistry as part of the “technical core” of civil engineering. For consistency with the BOK, the level of competence in these subject areas is defined as *ability*, rather than *proficiency*. In the interest of reducing prescriptiveness, the requirement for probability and statistics has been dropped in the new criteria. Because applications of probability and statistics are prevalent in civil engineering, it is expected that most programs will continue to offer this subject to their students.

Phrase B. This requirement for one additional area of science is found only in the new criteria and reflects the BOK’s increased emphasis on fundamentals and on technical breadth. The BOK is actually much more prescriptive in its requirement for specific science subjects, such as biology, ecology, geology, geomorphology, and geo-spatial representation. By leaving the choice of additional science coverage to the program (consistent with the program objectives), the new criteria provide curricular flexibility, while still clearly communicating the intent of the BOK.

Phrase C. The proposed criteria retain the requirement for coverage of four civil engineering technical areas—a clear statement that the BOK will accommodate no reduction in civil engineering technical breadth. However, the current requirement for *proficiency* in four areas has been changed to *understanding*—a reduction in the required level of competence. This change was necessary because the proposed Civil Engineering Program Criteria also require undergraduate programs to offer greater breadth in science and in professional practice. The undergraduate curriculum is a “zero sum game” at best; new requirements in any area must be balanced with reduced requirements in another.

In a larger sense, however, the change from *proficiency* to *understanding* of four civil engineering areas does not represent a lowered standard. Rather, it is a reallocation of civil engineering technical depth from the undergraduate level to the graduate level—as reflected in the new Advanced Level General Criteria discussed below.

Finally, it should be noted that the phrase “technical areas appropriate to civil engineering” is specifically intended to provide programs with greater flexibility in defining curricular content.

Under the new criteria, non-traditional and emerging engineering subjects could be defined as “technical areas appropriate to civil engineering,” even though they probably would not have qualified as “recognized major civil engineering areas” under the current criteria.

Phrase D. Under the proposed criteria, the ability to conduct experiments need only be demonstrated in one civil engineering technical area. This change was made for consistency with the BOK and to provide programs with greater curricular flexibility. It must be noted, however, that the required level of competence is still *ability*. Attaining this level will still require a robust laboratory program.

Phrase E. The proposed criteria have been made less prescriptive and more outcomes-based through the elimination of the requirement for “ability to perform civil engineering design by means of design experiences integrated throughout the professional component of the curriculum.” The new reference to “more than one civil engineering context” is intended to ensure that students experience the design process in at least two different civil engineering technical areas (e.g., a structural design experience and an environmental design experience). Thus the new criteria communicate the BOK’s emphasis on breadth of the engineering design experience without prescribing how that breadth must be achieved.

The change from *ability* to *understanding* ensures consistency with the BOK. However, this level of competence applies only to the *application of the engineering design process in multiple contexts*. This provision does not supersede the requirement for “an *ability* to design a system, component, or process to meet desired needs” specified in ABET General Criterion 3(c). The Criterion 3 provision requires a higher level of competence (*ability*) but does not need to be demonstrated in more than one context.

Phrase F. Although the professional practice-related provisions of the new criteria are considerably shorter than those of the current criteria, the required subject areas—management, business, and leadership principles—are much broader. This change reflects the BOK’s increased emphasis on professional practice breadth. The BOK actually defines these subjects with considerably greater specificity—project management, construction, asset management, business fundamentals, public policy, public administration, leadership principles, and attitudes—but the criteria use more general terminology to promote flexibility.

It is also noteworthy that the proposed criteria only require *recognition* of professional practice topics, in contrast with the requirement for *understanding* in the current criteria.

Advanced Level General Criteria

The Accreditation Committee’s proposed BOK-compliant Advanced Level General Criteria are as follows:

Advanced Level Programs must develop and publish educational objectives and program outcomes. The criteria for an advanced level program are fulfillment of the basic level general criteria, fulfillment of the basic level program criteria that are appropriate to the advanced level specialization area, and one academic year of study beyond the basic level. The program must demonstrate that graduates have an ability to apply advanced level knowledge in a specialized area of engineering related to the program area.

Only two specific phrases from these criteria are directly associated with the BOK. First, the requirement for “fulfillment of the basic level general criteria [and] fulfillment of the basic level program criteria that are appropriate to the advanced level specialization area” provides the mechanism for validating BOK attainment via Path #1, as discussed above. Second, the requirement for “ability to apply advanced level knowledge in a specialized area of engineering related to the program area” addresses BOK Outcome 12—an ability to apply knowledge in a specialized area related to civil engineering. The remaining phrases were included at the request of other professional societies, during negotiations aimed at gaining approval of these draft criteria.

The ASCE Commentary

For nearly a decade, the draft ASCE Commentary has served the accreditation process effectively by providing practical guidelines for ABET civil engineering program evaluators to apply the ABET criteria in a fair and consistent manner. The commentary has served civil engineering faculty equally well, by providing insights about the criteria and the evaluation process from an evaluator’s perspective. With the advent of the BOK, a new draft ASCE Commentary will continue to serve these purposes but will also be used for one additional function—providing guidelines to close the gap between satisfaction of the ABET criteria and fulfillment of the BOK.

As discussed above, the proposed criteria represent only a *minimum standard* for attainment of the BOK; programs that aspire to full, robust implementation of the BOK must voluntarily do more than the criteria prescribe. The new draft ASCE Commentary provides recommendations for specific voluntary measures that will ensure full, robust BOK implementation.

This document is organized in terms of the 15 BOK Outcomes, emphasizing that the BOK is the foundation upon which civil engineering accreditation is built. For each outcome, the following are provided:

- A brief rationale for the outcome;
- The specific ABET criteria representing the minimum standard for fulfillment of the outcome;
- Commentary on these criteria; and
- Recommended measures that exceed the criteria but are required to ensure full, robust implementation of the BOK.

The commentaries on each outcome are intended primarily for civil engineering program evaluators, although they will also be of considerable interest to civil engineering faculty. The recommended measures to ensure full BOK implementation are intended solely for faculty. These measures exceed the criteria and thus, by definition, may not be enforced by program evaluators.

The new draft ASCE Commentary is currently under internal review by the Accreditation Committee. Upon completion of this review, it will be posted on the ASCE Policy 465 website (<http://www.asce.org/raisethebar/>) for public review and comment.

Conclusion

Given that future civil engineering graduates will need more education than they are receiving today, ASCE's Civil Engineering Body of Knowledge prescribes four major changes in civil engineering education:

- Increased emphasis on fundamentals—math, science, and engineering science;
- Increased technical breadth;
- Increased professional practice breadth; and
- Increased technical depth.

The Accreditation Committee of CAP³ has developed a set of draft ABET Criteria that establish a minimum standard for BOK implementation in all four areas. The proposed Basic Level Civil Engineering Program Criteria emphasize fundamentals by requiring graduates' understanding of an additional area of science beyond the traditional civil engineering technical core of math, physics, and chemistry. Through this same provision, the criteria also provide increased technical breadth, while preserving the longstanding requirement for competence in four civil engineering areas. The proposed Basic Level Civil Engineering Program Criteria significantly increase professional practice breadth through a provision requiring recognition of management, business, and leadership principles. And finally, the proposed Advanced Level General Criteria provide for increased technical depth through the requirement for graduate-level knowledge in a specialized area of civil engineering.

Although these new criteria reflect the four main ideas of the BOK, they are not sufficiently specific to ensure full, robust BOK implementation. Our unsuccessful early attempts at criteria development demonstrated conclusively that fully BOK-compliant criteria are neither acceptable to several important constituencies nor suitable for approval by ABET. As a result, we have developed criteria representing only the *minimum standard* for BOK implementation—and we have used the ASCE Commentary to recommend additional measures that exceed the criteria but are necessary for full, robust BOK implementation.

As of this writing, the Basic Level Civil Engineering Program Criteria, Advanced Level General Criteria, and ASCE Commentary remain *draft work products* of the CAP³ Accreditation Committee. This paper represents one component of a broader campaign to share these products with the civil engineering education, professional practice, and accreditation communities. Readers who wish to provide comments and recommendations about any of these products are strongly encouraged to do so by contacting the author at stephen.ressler@usma.edu.

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