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# **AC 2012-3048: THE RAISE THE BAR INITIATIVE: CHARTING THE FUTURE BY UNDERSTANDING THE PATH TO THE PRESENT - AN OVERVIEW**

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

Tom Lenox has more than 41 years of experience as a leader, team builder, and manager in diverse professional and academic environments. During his 28-year military career, he spent 15 years on the engineering faculty of the U.S. Military Academy (USMA) at West Point, including five years as the Director of the Civil Engineering Division. As Director of the Civil Engineering Division at USMA, Lenox supervised 19 faculty in the ABET-accredited Civil Engineering program. He was the USMA nominee for the 1997 Carnegie Foundation Professor of the Year Award. He served as Chair of both the Civil Engineering Division and the Middle-Atlantic Section of the American Society for Engineering Education (ASEE),

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and as a member of ASCE's Educational Activities Committee. Lenox also served as Co-principal Instructor of the NSF-supported Teaching Teachers to Teach Engineering (T4E) workshops at West Point in 1996, 1997, and 1998. Upon his retirement from the U.S. Army on Oct. 1, 1998, Lenox joined the staff of the American Society of Civil Engineers (ASCE). In his position as Educational Staff Leader of ASCE, Lenox led several new educational initiatives, collectively labeled as Project ExCEED (Excellence in Civil Engineering Education). A notable example is the ExCEED Teaching Workshop, a nationally recognized workshop that develops inexperienced faculty into effective teachers and role models for the civil engineering profession. He continues to be very active in ASEE and other associations that foster teaching excellence and has written numerous papers, made presentations, and run workshops dedicated to engineering educational reform. Currently, as ASCE's Executive Vice President (Professional and Educational Strategic Initiatives), Lenox is leading 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. A prime example is Lenox's staff leadership of ASCE's initiative to "Raise the Bar" for entry into professional practice. Lenox received a bachelor of science degree from the U.S. Military Academy, master's of science degree from Cornell University, master's of business administration degree from Long Island University, and a Ph.D. degree from Lehigh University. He is also a graduate of a number of Army service and specialty schools to include Airborne, Ranger, Jumpmaster, Field Artillery Officer Advanced, Command and General Staff, and the Army War College. Recent awards include the 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." Tom is married to Jane O'Connor Lenox. They have three adult children, two grandchildren, and one grandpuppy. Contact Information: Thomas A. Lenox, Ph.D., M.ASCE, Executive Vice President, American Society of Civil Engineers (ASCE), 1801 Alexander Bell Drive, Reston, VA 20194. Email: tlenox@asce.org; Phone: 703-295-6191.

# **The Raise the Bar Initiative: Charting the Future by Understanding the Path to the Present – A Historical Overview**

## **Background**

Beginning in 1995 at the American Society of Civil Engineers (ASCE) Civil Engineering Education Conference (CEEC '95), key educational and professional leaders of the civil engineering community in the United States began working to reform civil engineering education.<sup>3</sup> In 1998, the call for action from CEEC '95 ultimately resulted in the passage of ASCE Policy Statement 465—Academic Prerequisites for Licensure and Professional Practice. Policy 465 states that, in the future, education beyond the baccalaureate degree will be necessary for entry into the professional practice of civil engineering.<sup>6</sup> In 2003, an ASCE Board-level committee, the Committee on Academic Prerequisites for Professional Practice (CAP<sup>3</sup>), was formed to study and implement the actions that would be necessary to achieve this vision for civil engineering. The last fourteen years since Policy 465 was first approved have produced significant progress in ASCE'S "Raise the Bar" initiative.

## **Purpose and Scope**

To maintain the initiative's momentum, the successful processes of the past and the associated "lessons learned" must be clearly communicated to future leaders and proponents of the "Raise the Bar" initiative. Much has been learned from the experiences of the past – and these hard-learned experiences should guide the future direction of the initiative. A relevant quotation (from Adlai E. Stevenson) comes to mind: "We can chart our future clearly and wisely only when we know the path which has led to the present."

This is one of six scholarly papers that are scheduled for presentation at the 2012 American Society for Engineering Education (ASEE) Annual Conference in San Antonio in recognition of approaching the tenth year of CAP<sup>3</sup>. As a group, the six papers provide engineering educators and practitioners with a description of the history, lessons learned, and the next steps related to the "Raise the Bar" initiative.

This paper, the first of the six papers, provides a summary of the overall initiative as witnessed and experienced by two of the long-term leaders of CAP<sup>3</sup>. The other five papers were written from five different, yet closely related, perspectives including the (1) civil engineering bodies of knowledge, (2) revised accreditation criteria, (3) changed university curricula, (4) experiential guidelines, and (5) modified licensure laws and rules. Much of the summary in this first paper is presented in tabular form, not duplicating the more detailed information written in the other five papers. All six papers are published in the *Proceedings of the 2012 Annual Conference of the American Society for Engineering Education* of June 2012. As such, this paper is not meant to be a "stand alone document" – it was written to connect and bond the content included in its five "companion" papers:

1. Walesh, S. (2012). "The BOK and Leadership Lessons Learned."<sup>42</sup>
2. Ressler, S. (2012). "The Raise the Bar Initiative: Charting the Future by Understanding the Path to the Present -- Accreditation Criteria."<sup>30</sup>
3. Nelson, J.K.; Fridley, K.; and Hall, K. (2012). "The Raise the Bar Initiative: Charting the Future by Understanding the Path to the Present -- How Are BSCE Curricula Responding?"<sup>25</sup>
4. Phillips, M. and Holly, F. (2012). "The Raise the Bar Initiative: Charting the Future Through Strengthened Experiential Guidelines."<sup>28</sup>
5. Nelson, Jon; Musselman, C.; Conzett, M.; and Phillips, M., and Anderson, K. (2012). "The Raise the Bar Initiative: Charting the Future by Understanding the Path to the Present -- Modifying the Model Laws and Rules for Engineering Licensure."<sup>26</sup>

### **Summary and Tabular History of the Raise the Bar Initiative**

A history of the Raise the Bar initiative in tabular form is shown in Appendix A. The authors have included most of the significant events directly related to the initiative between 1995 and mid-2012 in this chronological list. Several other events that indirectly, but significantly, influenced the initiative are also listed. The record (row of table) for each event includes:

- Reference number.
- Name of the professional organization(s) leading this event/project.
- Event/project name.
- Short explanatory remarks about the event/project.
- Names of primary leaders of the event/project.

The history of the Raise the Bar initiative within ASCE pre-dates the 2003 start date of ASCE's Committee on the Academic Prerequisites for Professional Practice (CAP<sup>3</sup>). As such, the authors chose to begin the tabulated history with the ASCE Civil Engineering Education Conference of June 1995 (CEEC '95). This event marked the beginning of ASCE's focused involvement in the Raise the Bar initiative. Both of the authors attended this historic event.

### **A Short Summary of the History of the Raise the Bar Initiative**

A condensed summary of the events tabulated in Appendix A could be logically organized into six periods of time. The first five of the six time periods are approximately three years in duration. Each of these first five periods ends with the passing of a new and/or refined version of ASCE Policy Statement 465 (Academic Prerequisites for Licensure and Professional Practice) by the then-current ASCE Board of Direction (BOD). The sixth and shortest period bring us to the present. The authors' condensed summary is as follows:

### 1995-1998: Working Towards an Initial Policy

(see Events #1 to #4, Appendix A)

While the history of Raise the Bar initiative could be traced back as far as the Mann report of 1918,<sup>21</sup> ASCE's focused attention to this issue began with the preparation for, conduct of, and report of the 1995 Civil Engineering Education Conference (CEEC '95) in Denver. One of the key findings of CEEC '95 was that "an additional period of study, recognized by a professional degree, is required before entering practice."<sup>3</sup> Subsequently, ASCE leaders organized the Task Committee on Civil Engineering Education Initiatives (TCCEEI) to recommend the next steps in implementing the findings of CEEC '95. Ultimately, the work of the TCCEEI resulted in passing the initial ASCE Policy 465 by the ASCE Board of Direction. The initial ASCE Policy 465 stated in part:

*ASCE supports the concept of the Master's degree as First Professional Degree for the practice of civil engineering at a professional level.*

### 1998 to 2001: Communicating the Policy's Intent – the Master's or Equivalent (MOE).

(see Events #5 to #8, Appendix A)

Many ASCE members appeared to be surprised by the new ASCE Policy 465 of 1998 when announced in the *ASCE News* in November 1998. The rationale and the plan for implementing the new policy may not have been clearly articulated by the leadership of ASCE to its members. Subsequently the Task Committee for the First Professional Degree (TCFPD) was charged to develop a vision of the full realization of the new ASCE Policy 465 – and a strategy for achieving this vision. The work of the TCFPD resulted in explicit guidance to ASCE to move forward with the Raise the Bar initiative to include a recommendation for a refined ASCE Policy 465.<sup>4</sup>

*ASCE supports the concept of master's degree or equivalent as a prerequisite for licensure and the practice of civil engineering at a professional level.*

While ASCE's TCFPD was working between October 1999 and October 2001 to fulfill its charge, the National Council of Examiners for Engineering & Surveying (NCEES) was beginning to critically review the educational and experiential preparation of future profession engineers.<sup>26</sup> This exhaustive review and analysis began with the establishment of NCEES's Engineering Licensure Qualifications Task Force (ELQTF) in October 2000. NCEES invited over 20 engineering societies to participate on the task force. ASCE and nine other professional societies (AAEE, ABET, ACEC, ASHRAE, ASME, CEQB, EDC/ASEE, IEEE-USA, and NSPE) participated in this NCEES-sponsored task force. Each of the ten society members had full voting rights during the deliberations.

### 2001 to 2004: Developing and Publishing a First-Ever Civil Engineering Body of Knowledge.

(see Events #9 to #18, Appendix A)

In October 2001, TCFPD "passed the torch" within ASCE to the Task Committee on the Academic Prerequisites for Professional Practice (TCAP<sup>3</sup>). This task committee was charged

to “. . . develop, organize, and execute a detailed plan for the full realization of ASCE Policy 465.” As a manifestation of the ASCE BOD’s long-term commitment to the Raise the Bar initiative, TCAP<sup>3</sup> was changed to a standing BOD-level committee – the Committee on the Academic Prerequisites for Professional Practice (CAP<sup>3</sup>) -- in 2003.

During this period, much of the key foundational work of the Raise the Bar initiative began within ASCE, NCEES, NAE, and NSPE – and a great deal completed. In January 2002, the NSPE Board approved a policy statement supporting "the concept of engineering students meeting additional academic requirements as a prerequisite for licensure and practice of engineering at the professional level . . . additional requirements could include a master's degree or equivalent." In August 2003, the ELQTF presented its final report to the NCEES Council recommending that “. . . additional coursework be added to the current bachelor’s programs and that the bodies of knowledge required for each program be stipulated.”<sup>26</sup> In April 2004, the National Academy of Engineering (NAE) published its trailblazing work, *The Engineer of 2020 – Visions of Engineering in the New Century* stating that “. . . we should reconstitute engineering curricula and related educational programs to prepare today’s engineers for the careers of the future.”<sup>22</sup> And, in February 2004, after almost two years of intense work, the CAP<sup>3</sup> Body of Knowledge Committee published the first-ever *Civil Engineering Body of Knowledge (BOK1)*.<sup>7</sup> In October 2004, the ASCE BOD confirmed its support of the critical linkage between the Raise the Bar initiative and the CE BOK by refining ASCE Policy 465:

*ASCE supports 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.*<sup>6</sup>

2004 to 2007: Visioning the Future of Civil Engineering and Refining the Body of Knowledge.  
(see Events #19 to #25, Appendix A)

During this period, much of the scholarly foundational work of the Raise the Bar initiative was continued within NAE and ASCE – and the changes to the engineering licensure laws/rules to implement Raise the Bar began in earnest within NCEES. In September 2005, NAE published *Educating the Engineer of 2020 – Adapting Engineering Education to the New Century* stating that “It is evident that the exploding body of science and engineering knowledge cannot be accommodated within the context of the traditional four-year baccalaureate degree.”<sup>23</sup> Within ASCE, a Vision 2025 Summit was planned, organized, and conducted in June 2006 to articulate an aspirational global vision for the future of civil engineering. In parallel, ASCE organized a Second Edition of the Body of Knowledge Committee in October 2005 to refine the first edition of the BOK to include (1) incorporating the concepts of NAE’s *Educating the Engineer of 2020* and (2) monitoring the concurrent work of the ASCE Vision 2025 Summit.

During this period, significant work was done by NCEES to incorporate the principles of Raise the Bar in the licensure process. To further explore the ELQTF findings, NCEES formed a Licensure Qualifications Oversight Group (LQOG) in September 2003. LQOG presented its final report to the NCEES Council in August 2005. Based upon LQOG’s report, and the implementation work of NCEES’s Uniform Procedures and Legislative Guidelines Committee

(UPLG) in 2005-2006, the NCEES Council voted to modify the Model Law requirements for licensure to require additional education for engineering licensure no sooner than 2015. The approved language stated that an engineer intern with a bachelor's degree must have an additional 30 credits of acceptable upper-level undergraduate or graduate-level coursework from approved providers in order to be admitted to the Principles and Practice of Engineering (PE) examination. This is considered by many proponents of Raise the Bar as the key event to move the initiative forward.<sup>26</sup>

The end of this period is marked by the reconfirmation, in October 2007, of the ASCE BOD of its continued support of the Raise the Bar initiative and the BOK by further refining ASCE Policy 465:

*ASCE supports the attainment of a Body of Knowledge . . . The Body of Knowledge includes (1) the fundamentals of math, science, and engineering science, (2) technical breadth, (3) breadth in the humanities and social sciences, (4) professional practice breadth, and (5) technical depth or specialization. Fulfillment of the Body of Knowledge requires additional education beyond the bachelor's degree for the practice of civil engineering at the professional level.*

#### 2007 to 2010: Motivating Curricula Reform Using New Accreditation Criteria and the Second Edition of the Body of Knowledge.

(see Events #26 to #40, Appendix A)

Following the submission of proposed new BOK1-compliant accreditation criteria to the Engineering Accreditation Commission of ABET in June 2006, these criteria achieved final approval by the ABET Board of Directors in October 2007. These new criteria included both civil engineering program criteria and master's level general criteria. They were implemented for accreditation visits starting in the fall of 2008. Given the six-year ABET accreditation cycle, all U.S. civil engineering programs will have been evaluated under these BOK1-compliant criteria by Academic Year 2013-14.<sup>31</sup>

Another historic accreditation-related event occurred during this period. After an intensive ASCE lobbying effort, the ABET Board of Directors voted to remove the prohibition on dual level accreditation of engineering programs in March 2008. As a result of this policy change and the implementation of new master's-level general accreditation criteria, effective in the fall of 2008, the alternate path (B + M-ABET & E) has become a viable route to BOK attainment.

While new BOK1-compliant accreditation criteria were being finalized and implemented, it became apparent that significant updates to BOK1 itself would be required. These revisions were driven by (1) aspects of the 1<sup>st</sup> Edition that did not lend themselves to effective measurement and assessment; and (2) publication of several strategic vision documents that called for future engineers to develop certain knowledge, skills, and attitudes that had *not* been included in BOK1. As a result, a second edition of the Civil Engineering BOK was initiated in October 2005 and published in February 2008. The *Civil Engineering Body of Knowledge for the*

*21st Century, Second Edition*,<sup>10</sup> (abbreviated BOK2) incorporates two particularly substantive changes from the first edition:

- The number of outcomes was increased from 15 to 24. To some extent, this increase reflects the BOK2 authors' attempt to enhance clarity and specificity, rather than to increase the scope of the BOK. Nonetheless, the BOK2 Outcomes do place increased emphasis on such topics as the natural sciences, the humanities, sustainability, globalization, risk and uncertainty, and public policy.
- The BOK2 uses Bloom's Taxonomy as the basis for defining levels of achievement. The fundamental premise of Bloom's Taxonomy is that an educational objective can be referenced to a specific level of cognitive development through the verb used in the objective statement. The use of measurable, action-oriented verbs linked to levels of achievement is beneficial, in that the resulting outcome statements can be assessed more effectively and consistently.

To assess the impact of the BOK on civil engineering curricula and to facilitate broad adoption of the new BOK concepts in civil engineering education, CAP<sup>3</sup> established the BOK Educational Fulfillment Committee (BOKEdFC) in early 2008. This new committee was charged with (1) fostering the creation of a learning community of scholars interested in engineering educational reform, (2) reviewing the work products of the Body of Knowledge Committee and providing feedback, and (3) documenting how programs can incorporate the Body of Knowledge into their curriculum. A key input to this work is the second edition of the *Civil Engineering Body of Knowledge for the 21<sup>st</sup> Century*. The "companion paper" by Nelson, Fridley, and Hall provides an insight into this committee's work.<sup>25</sup>

The Body of Knowledge Experiential Fulfillment Committee (BOKEExFC) was constituted by CAP<sup>3</sup> in the spring of 2009. The committee was charged to develop a stand-alone "Guidelines Document" using the 15 outcomes in the BOK2 with experiential expectations as a basis to be used by civil engineering interns and their mentor/supervisors during the pre-licensure state of the intern's career. The goal is to provide a resource document that interns will find both useful and user friendly in documenting, validating, and reporting their pre-licensure experience activities. The report of this novel group was completed by September 2010. The "companion paper" by Phillips and Holly provides the detailed of this committee's work.<sup>28</sup>

Within NCEES, through the work of the Bachelor's Plus 30 Task Force, the Engineering Education Task Force, and the Uniform Procedures and Legislative Guidelines Committee; challenges to the new NCEES Model Law & Rules from opponents of Raise the Bar were overcome – and necessary refinements were passed by the Council and implementation processes were being planned for the future. In the summer of 2008, the implementation date for the NCEES Model Law & Rules was changed from 2015 to 2020.<sup>26</sup>

The approximate end of this period is marked by another reconfirmation, in April 2010, by the ASCE BOD of its continued support of the Raise the Bar initiative, the CE BOK, and the NCEES recommendations by further refining ASCE Policy 465:

*ASCE supports the attainment of a Body of Knowledge . . . Fulfillment of this Body of Knowledge will typically include a combination of (1) a baccalaureate*



*degree in civil engineering; (2) a master's degree, or no less than 30 coordinated graduate or upper level undergraduate technical and/or professional practice credits or the equivalent agency/organization/professional society courses which have been reviewed and approved as providing equal academic quality and rigor with at least 50 percent being engineering in nature; and (3) appropriate experience based upon broad technical and professional practice guidelines which provide sufficient flexibility for a wide range of roles in engineering practice.*

#### 2010 to Present: Consolidating, Communicating, Convincing, and Implementing.

(see Events #41 to #45, Appendix A)

The period since 2010 has been characterized by a re-prioritization of resources within ASCE. After accomplishing the important foundational steps of the Raise the Bar master plan (Vision 2025; Body of Knowledge; BOK-compliant accreditation criteria, curricula, and experiential guidelines; and NCEES Model Law & Rules 2020), ASCE's emphasis was shifted to motivating changes to the engineering licensure statutes. Based upon the extensive research, information resources, insights, and accomplishments of the committees and task committees that have worked on the Raise the Bar initiative between 1998 and 2010, work is underway to overcome the obstacles currently facing two critical actions of the Raise the Bar strategy. The thrust of those two actions can be paraphrased as (1) influence ASCE members, major employers of civil engineers, lead client groups, leaders of engineering organizations, and other key stakeholders to understand and commit to the changes necessary to implement the Raise the Bar initiative and (2) pass changes to the licensing laws in a few states to reflect the NCEES model law and raise the bar for the licensure of engineers. Substantial and significant progress has been made in this phase of the initiative – see <http://www.raisethebarforengineering.org>.

#### Summary: 1998 to Present

(see Events #17 to #45, Appendix A)

As previously described, many of the details of these historical events have been captured in the five “companion papers” listed in the second section of this paper. Other primary references related to the Raise the Bar initiative are listed in the bibliography of this paper and its five companion papers. In addition, the authors have identified over 100 papers that have been published on the Raise the Bar initiative since 1998 in the *Proceedings* of the annual conferences of the American Society for Engineering Education (ASEE). A special annotated list of these ASEE proceedings papers is included in Appendix B – sorted by date. All of these papers are available for individual download from <http://www.asee.org/search/proceedings>.

#### **Who Before What!**

ASCE's Raise the Bar initiative could be model case study in support of the conclusions of noted author Jim Collins in his classic study of “Good to Great” enterprises. Paraphrasing his first principle of organizing successful ventures:

*First get the right people on the bus  
the right people in the right seats,  
the wrong people off the bus,  
and then figure out where to drive it.*

The authors' experience with the Raise the Bar initiative validates Jim Collins' principle. In 1995 the Raise the Bar initiative did not know exactly what direction it would need to take. However, ASCE's and CAP<sup>3</sup>'s leadership were committed to finding the "right people."

Many of the leaders of the Raise the Bar initiative are listed along with their associated events in Appendix A. The authors believe, for historical reasons, that the dedicated engineering professionals who worked on the various ASCE Raise the Bar committees should be identified. To this end, the authors prepared Appendix C of this paper – consolidated from the various official documents of ASCE. An examination of Appendix C clearly shows that the work to the Raise the Bar for the engineering profession was not accomplished by a small group of reform-minded militants, but a robust group of dedicated, committed, and concerned professionals.

The authors also wish to express their gratitude to the leaders of the American Society of Civil Engineers (listed in Appendix D) for their unfailing support of CAP<sup>3</sup> and its leaders since 1998. The continuity of their support, vision, and leadership was critical to the furthering of the Raise the Bar initiative.

## **Next Steps**

ASCE is undergoing a possible restructuring of their board-level committees. In light of this, there will likely be a repositioning of aspects of the effort to reform civil engineering professional practice. Reform efforts, in the context of implementing the BOK beyond the minimum accreditation criteria, will be on-going. There is an initial plan to consider reviewing the BOK in 2016. In the meantime, the primary focus will be in working with the licensing community with the hope that a few states will increase their educational requirements in the future.

## **Summary**

With an understanding of the reform process used in the Raise the Bar initiative and the activities that have transpired over the last 17 years since the Civil Engineering Education Conference of 1995, the historical context of this effort for civil engineering profession has been documented. This paper, along with the five additional papers published in the series, offer the civil engineering profession a broad and deep understanding of the complexities and interrelationships between education and education reform, a professions' Body of Knowledge, accreditation, licensure, and practical experience. The end goal has been to integrate the complexities and interrelationships into a coordinated effort resulting in meaningful change that improves the

profession. This has been achieved as a result of a large number of committed, talented, and focused professionals.

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Appendix A

**Summary and Tabular History of the Raise the Bar Initiative**

This appendix includes a history of the Raise the Bar initiative in tabular form. The authors have included most of the significant events directly related to the initiative between 1995 and 2012 in this chronological list. Several other events that indirectly, but significantly, influenced the initiative are also listed. The record (row of table) for each event includes (1) reference number, (2) name of the professional organization(s) leading this event/project, (3) event/project name, (4) short explanatory remarks about the event/project, and (5) names of the primary member and staff leaders of the event/project.

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
1	Jun 1995	ASCE	CEEC'95 Held	CEEC'95 = 1995 Civil Engineering Education Conference (Denver, CO) . Conference report made recommendations relative to faculty development, the integrated curriculum, practitioner involvement in the formal educational process, and the first professional degree for entry into professional practice.	Yao, J.T.P. (Chair) Day, C. (Staff)
2	Apr 1996	ASCE	TCCEEI Formed	TCCEEI = Task Committee on Civil Engineering Education Initiatives. One of the first task committees to report directly to the ASCE Board of Direction (BOD). Charged with developing a plan for implementing the outcomes from the CEEC'95. Recommendations in the task committee's April 1998 report led to the BOD's October 1998 adoption of Policy Statement 465.	Scranton, R.J. (Chair) Berman, M.E. (Staff)
3	Apr 1998	ASCE	TCCEEI Report Presented	TCCEEI report recommended to the ASCE Board of Direction (BOD) that the Master's degree be the new First Professional Degree (FPD) for civil engineering.	Scranton, R.J. (Chair) Berman, M.E. (Staff)
4	Oct 1998	ASCE	Policy 465 (Version 1) Passed	Policy 465 = "First Professional Degree." BOD approved new policy recommending the Master's as the First Professional Degree: "ASCE supports the concept of the Master's degree as First Professional Degree for the practice of civil engineering at a professional level."	Scranton, R.J. (Chair) Kupferman, M. (Staff)

Appendix A (continued)

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
5	Oct 1999	ASCE	TCFPD Formed	TCFPD = Task Committee on the First Profession Degree. This task committee was formed and charged with developing a vision of the full realization of ASCE Policy 465 (First Professional Degree) -- and a strategy for achieving this vision.	Graef, L.W. (Chair) Kupferman, M. (Staff)
6	Sep 2000	NCEES	ELQTF Formed	ELQTF = Engineering Licensure Qualifications Task Force. Besides NCEES members, task force included membership from American Academy of Environmental Engineers (AAEE), American Society of Mechanical Engineers (ASME), Institute of Electrical and Electronics Engineers–USA (IEEE–USA), American Society of Civil Engineers (ASCE), National Society of Professional Engineers (NSPE), ABET Inc., American Council of Engineering Companies (ACEC), American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), American Society for Engineering Education (ASEE), ASEE Engineering Deans Council (EDC), and Canadian Engineering Qualifications Board (CEQB).	Nelson, J.D. (Chair);  Browne, B., 2000-01; Shannon, M., 2000–03; Adams, J.Q., 2001–03 (Staff)
7	Oct 2001	ASCE	TCFPD Presents Final Report	TCFPD = Task Committee on the First Profession Degree. Final report of the TCFPD recommended the master’s or equivalent (MOE) for licensure. Also declared that the practice of CE at the professional level means practice as a licensed professional engineer. Further stated that the admission to the practice of CE at the professional level occurs at licensure, which requires a body of specialized knowledge as reflected by (1) a combination of a baccalaureate degree and a master’s or equivalent (MOE), (2) appropriate experience, and (3) commitment to life-long learning.	Graef, L.W. (Chair) Lenox, T.A. (Staff)



Appendix A (continued)

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
8	Oct 2001	ASCE	Policy 465 (Version 2) Passed	The ASCE Board of Direction adopted Policy Statement 465 which "supports the concept of the master's degree as the First Professional Degree for the practice of civil engineering at the professional level." Name of Policy 465 changed to "Academic Prerequisites for Licensure and Professional Practice."	Graef, L.W. (Chair) Lenox, T.A. (Staff)
9	Oct 2001	ASCE	TCAP^3 Formed	TCAP^3 = Task Committee on the Academic Prerequisites for Professional Practice. The task committee was formed and charged to develop, organize, and execute a detailed plan for the full realization of ASCE Policy Statement 465.	Russell, J.S. (Chair) Lenox, T.A. (Staff)
10	Jan 2002	NSPE	Policy Statement 168 Passed	NSPE Board approved policy statement supporting "the concept of engineering students meeting additional academic requirements as a prerequisite for licensure and practice of engineering at the professional level. Possible additional requirements could include a master's degree or equivalent."	Price, B.E. (Chair) Schwartz, A. (Staff)
11	May 2002	ASCE	BOK1 Committee Formed	BOK1 = Body of Knowledge (1st Edition). The BOK1 Committee was charged to define the Body of Knowledge needed to enter the practice of civil engineering at the professional level (licensure) in the 21st Century.	Walesh, S.G. (Chair) Lenox, T.A. (Staff)
12	Aug 2003	NCEES	ELQTF Report Presented	ELQTF recommended that additional coursework be added to the current bachelor's programs and that the bodies of knowledge required for each program be stipulated. Graduates moving into public practice would supplement their coursework to meet the educational requirements for professional licensure. The task force believed implementation of this concept should be a long-term goal, perhaps occurring over a 15- to 20-year period. Task force members believed that the ultimate goal should be the addition of a professional school to the engineering educational system.	Nelson, J.D. (Chair) Adams, J.Q. (Staff); Shannon, M. (Staff)

Appendix A (continued)

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
13	Sep 2003	NCEES	LQOG Formed	LQOG = Licensure Qualifications Oversight Group. LQOG established to further explore the findings from the ELQTF report.	Sutherland, W. (Chair: 2003–04); Phillips, M.L. (Chair, 2004–05); Shannon, M. (Staff)
14	Oct 2003	ASCE	CAP <sup>3</sup> Becomes Standing Committee of ASCE	CAP <sup>3</sup> = Committee on the Academic Prerequisites for Professional Practice. Committee was charged to develop, organize, and execute a detailed plan for the full realization of ASCE Policy Statement 465 (Academic Prerequisites for Licensure and Professional Practice). The Committee's activities were to be organized to occur in a concurrent, integrated, and coordinated manner across the broad areas of civil engineering body of knowledge, curriculum development, accreditation, and licensing.	Russell, J.S. (Chair) Lenox, T.A. (Staff)
15	Feb 2004	ASCE	BOK1 Published	BOK1 reported on three themes to meet its charge: (1) what should be taught and learned, (2) how/where it might be taught and learned, and (3) who should teach and learn it. "What should be taught and learned" was expressed as 15 outcomes expressed at three hierarchical levels of achievement (recognition-understanding-ability).	Walesh, S.G. (Chair) Lenox, T.A. (Staff)
16	Feb 2004	ASCE	CAP <sup>3</sup> Accreditation Committee Formed	Committee was charged to develop, organize, and execute a detailed plan for supporting, through the accreditation process, the full realization of ASCE Policy 465 and the associated Civil Engineering Body of Knowledge for the 21st Century.	Bergstrom, W.R. (Chair) Lenox, T.A. (Staff)
17	Apr 2004	NAE	NAE's Engineer of 2020 Published	NAE = National Academy of Engineering. Report envisions the future and uses that knowledge to attempt to predict the roles that engineers will play in the future.	G. Wayne Clough (Chair) Mead, P.F. (Staff)

Appendix A (continued)

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
18	Oct 2004	ASCE	Policy 465 (Version 3) Passed	BOD approves policy recommending the attainment of a body of knowledge (BOK) for licensure: "ASCE supports attainment of a body of knowledge for entry into the practice of civil engineering at professional level. This would be accomplished through the adoption of appropriate engineering education and experience requirements as a prerequisite for licensure."	Russell, J.S. (Chair) Lenox, T.A. (Staff)
19	Aug 2005	NCEES	LQOG Report Presented	Based upon the LQOG recommendations, the Council approved a motion to increase mandatory engineering education for licensure. As a result, the Uniform Procedures and Legislative Guidelines (UPLG) Committee was charged with recommending revisions to the Model Law to require additional education as a base requirement for P.E. licensure. The committee considered recommended LQOG language, including a provision to raise the current educational requirements by 30 additional hours, and made its recommendations to the Council in 2006. The increased education requirements would be implemented no sooner than 2010.	Phillips, M.L. (Chair) Shannon, M. (Staff)
20	Aug 2005	NCEES	UPLG Charged to Revise Model Law	UPLG = Uniform Procedures and Legislative Guidelines. Committee charged to revise the Model Law to require additional education (see item above).	Baker, C.V. (Chair) Anderson, K. (Staff)
21	Sep 2005	NAE	NAE'S Educating the Engineer of 2020 Published	NAE = National Academy of Engineering. Examined engineering education and asked what it needs to do to prepare individuals to be the engineers of the future. "It is evident that the exploding body of science and engineering knowledge cannot be accommodated within the context of the traditional four-year baccalaureate degree."	G. Wayne Clough (Chair) Taber, R. (Staff)

Appendix A (continued)

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
22	Oct 2005	ASCE	BOK2 Committee Formed	BOK2 = Body of Knowledge (2nd Edition). The BOK2 Committee was charged to update (if appropriate) the Body of Knowledge needed to enter the practice of civil engineering at the professional level (licensure) in the 21st Century.	Anderson, R. O. (Chair) Lenox, T.A. (Staff)
23	Jun 2006	ASCE	Vision 2025 Summit Held	Diverse group of civil engineering and other leaders, including international guests, gathered to articulate an aspirational global vision for the future of civil engineering addressing all levels and facets of the civil engineering community.	Mongan, D. G. (Chair) Jaeger, S. (Staff)
24	Aug 2006	NCEES	Model Law Changed	Based upon the UPLG recommendations, NCEES members voted to modify the Model Law requirements for licensure to require additional education for engineering licensure no sooner than 2015. The approved language states that an engineer intern with a bachelor's degree must have an additional 30 credits of acceptable upper-level undergraduate or graduate-level coursework from approved providers in order to be admitted to the Principles and Practice of Engineering (PE) examination.	Baker, C.V. (Chair) Anderson, K. (Staff)
25	Apr 2007	ASCE	Policy 465 (Version 4) Passed	BOD refined policy providing more details on the nature of the BOK: "ASCE supports the attainment of a Body of Knowledge . . . The Body of Knowledge includes (1) the fundamentals of math, science, and engineering science, (2) technical breadth, (3) breadth in the humanities and social sciences, (4) professional practice breadth, and (5) technical depth or specialization. Fulfillment of the Body of Knowledge requires additional education beyond the bachelor's degree for the practice of civil engineering at the professional level."	Russell, J.S. (Chair) Lenox, T.A. (Staff)

Appendix A (continued)

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
26	Aug 2007	NCEES	Model Law Challenged and Model Rules Changed	NCEES voted to reaffirm Model Law changes to "B + 30." UPLG presented motions to revise the Model Rules definitions of Model Law Engineer and Model Law Structural Engineer to include the "B.S. plus 30" requirement. This change made the Model Rules consistent with the Model Law language that member boards passed at the 2006 annual meeting.	Harclerode, H.C. (Chair) Anderson, K. (Staff)
27	Sep 2007	NCEES	B+30TF Formed	B+30TF = Bachelor's +30 Task Force. The task force is charged to clarify the requirements of the new Model Law to allow easier implementation by NCEES Member Boards. Charges included defining approved credits and approved course providers -- and proposing revisions to make the Model Rules consistent with the Model Law concerning the bachelor's plus 30 requirements.	Conzett, M.J. (Chair) Anderson, K. (Staff)
28	Sep 2007	ASCE	Vision 2025 Published	Vision 2025 begins: "Entrusted by society to create a sustainable world and enhance the global quality of life, civil engineers serve competently, collaboratively, and ethically as master . . ."	Mongan, D. G. (Chair) Jaeger, S. (Staff)
29	Oct 2007	ASCE	New Accreditation Criteria Approved	New civil engineering accreditation program criteria (based on BOK1) and new master's level criteria approved by the ABET Board of Directors effective for accreditation reviews beginning in Sep 2008.	Ressler, S. J. (Chair) Lenox, T.A. (Staff)
30	Feb 2008	ASCE	BOK2 Published	BOK2 reported on three themes to meet its charge: (1) the knowledge, skills, and attitudes necessary for entry into professional practice; (2) how/where the BOK2 might be taught and learned relative to the baccalaureate, master's or equivalent, and/or experience; and (3) guidance for faculty, students, engineer interns, and practitioners. "What should be taught and learned" was expressed as 24 outcomes expressed at Bloom's six hierarchical levels of achievement (knowledge-comprehension-application-analysis-synthesis-evaluation).	Anderson, R. O. (Chair) Lenox, T.A. (Staff)

Appendix A (continued)

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
31	Aug 2008	NCEES	Model Law/Rules Refined	The B+30TF delivered its report and the Council passed each of its three motions. The first motion called for a committee to be charged with exploring the idea of creating a clearinghouse to carry out activities needed to implement the higher education requirement for engineering licensure. The second motion presented language defining the coursework and course providers acceptable in fulfilling the requirement. The third motion addressed whether a degree from an ABET-accredited master's program (M-ABET) should be included in the definition of Model Law Engineer. The motion was to charge the UPLG Committee with incorporating this M-ABET concept into the Model Law/Rules. In a related motion, UPLG proposed a motion to change the implementation date from 2015 to 2020 (passed).	Konzett, M.J. (Chair) Anderson, K. (Staff)
32	Sep 2008	NCEES	B+30TF Renamed as the EETF	EETF = Engineering Education Task Force. The name change for this task committee was partially motivated by the confusion over the focus on the "+30" as a fulfillment path of the required additional formal education. Simultaneous with the name change of the task committee was NCEES's reference to "B + MOE" (Master's or Equivalent) rather than "B + 30."	Konzett, M.J. (Chair) Anderson, K. (Staff)

Appendix A (continued)

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
33	Aug 2009	NCEES	Model Law/Rules Refined	EETF successfully moved to proceed with developing a national clearinghouse to assist Member Boards with implementing the education requirement, which will require engineering licensure candidates to obtain an MOE. The proposed clearinghouse would assist boards in determining whether candidates meet the new education requirement, with the goal of promoting consistency across jurisdictions as the requirement is implemented. UPLG presented a motion, approved by the Council, incorporating language into the Model Law and Model Rules specifying the terms "approved course providers" and "acceptable coursework" as they pertain to the MOE requirement. Another successful motion incorporated the ABET-accredited master's program category of degree into the Model Law and Model Rules. ABET had previously not accredited engineering programs at both the bachelor's and master's level.	Conzett, M.J. (Chair) Anderson, K. (Staff)
34	Oct 2009	ASCE	+30 TC Report Formed	+30-TC = Plus Thirty Task Committee. Committee was charged to explore what the +30 credits should be and practical alternatives for how civil engineers can attain +30 credits that will be required for licensure as a professional engineer in the future – and that are beyond the requirements of an accredited baccalaureate engineering degree. Specific attention will be focused on alternatives such as corporate universities, public agency professional development programs, professional intensive short courses, and non-engineering degree programs.	Textor, N.G. (Chair) Roth, L. (Staff)

Appendix A (continued)

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
35	Oct 2009	ASCE	+30 TC Report Presented	+30-TC = Plus Thirty Task Committee. Validated the wording of the NCEES Model Law & Rules for 2020. Reported that attainment of the knowledge to practice at the professional level will require an accredited bachelor's degree plus either an engineering master's degree, or an additional 30 credits or equivalents of higher level professional education. At least 15 of these 30 credits must be technical courses in engineering. Education beyond the bachelor's degree can be delivered by universities or validated, providers including government and corporate entities and distance learning.	Textor, N.G. (Chair) Roth, L. (Staff)
36	Oct 2009	ASCE	TCICS Formed	TCISC = Task Committee on Implementing the Competency Strategy. The committee was charged with developing the coordination and communications strategies necessary to achieve the outcomes articulated within the ASCE Competency Strategy (aka Raise the Bar Strategy).	Rachford, T.M. (Chair) Dinger, C.V. (Staff)
37	Apr 2010	NSPE	Position Statement 1752 Passed	NSPE Board approved position statement related to "Engineering Education Outcomes." PS-1752 states that engineering students of all disciplines who become licensed professional engineers should attain education outcomes in addition to those already included in the ABET baccalaureate level general criteria. The additional outcomes include the ability to (1) apply principles of leadership, (2) account for risk and uncertainty in the solution of engineering problems, (3) apply principles of project management, (4) explain where and how public policy is developed and how it influences engineering practice, (5) explain business concepts applicable to engineering practice, and (6) apply principles of sustainability to the design and evaluation of engineering systems.	Musselman, C.N. (Chair) Schwartz, A. (Staff)



Appendix A (continued)

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
38	Aug 2010	NCEES	ALPTF Formed	ALPTF = Alternate Licensure Pathway Task Force. ALPTF was created to address the second motion of the Engineering Education Task Force from the August 2010 annual meeting. The motion was to investigate an alternate pathway to initial licensure that would allow a combination of assessed learning days and structured mentoring.	Liles, H.V. (Chair) Anderson, K. (Staff)
39	Aug 2010	NCEES	Model Law/Rules Refined	EETF was continued until August 2010 to address potential alternative pathways to licensure. Two alternatives were proposed for consideration at the 2010 NCEES annual meeting. One reflected bachelor degree programs that require 150 or more credit hours and met certain requirements for content. This alternative actually reflects some existing bachelor programs, specifically some in architectural engineering. EETF successfully moved to have UPLG include this pathway into the Model Law and Model Rules. EETF made a second successful motion related to a possible pathway requiring the completion of some number of "assessed learning days" (ALD) of continuing education plus six years of progressive experience. The intent of this alternative was to reflect the different nature of education acquired by engineers who work in industry. EETF successfully moved to pass this alternative on to another committee (see "ALPTF" below) for further study.	Conzett, M.J. (Chair) Anderson, K. (Staff)

Appendix A (continued)

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
40	Oct 2010	ASCE	Policy 465 (Version 5) Passed	BOD refines policy providing more details on the fulfillment of the BOK (to align with the NCEES Model Law & Rules and the report of the ASCE Plus 30 TC): "ASCE supports the attainment of a Body of Knowledge . . . Fulfillment of this Body of Knowledge will typically include a combination of (1) a baccalaureate degree in civil engineering; (2) a master's degree, or no less than 30 coordinated graduate or upper level undergraduate technical and/or professional practice credits or the equivalent agency/organization/professional society courses which have been reviewed and approved as providing equal academic quality and rigor with at least 50 percent being engineering in nature; and (3) appropriate experience based upon broad technical and professional practice guidelines which provide sufficient flexibility for a wide range of roles in engineering practice."	Russell, J.S. (Chair) Lenox, T.A. (Staff)
41	Oct 2010	ASCE	TCICS Report Presented	TCISC = Task Committee on Implementing the Competency Strategy. The task committee's major effort was devoted to selecting and guiding a communications consultant on the development of the communications plan presented in its report.	Rachford, T.M. (Chair) Dinger, C.V. (Staff)

Appendix A (continued)

#	Date	Society	Event Name (Abbreviated)	Remarks	Leaders (if applicable)
42	Jan 2011	ASCE	TCICS2 Formed	TCISC2 = Task Committee on Implementing the Competency Strategy - Two. The committee was charged to build on the extensive research, information resources, insights, and accomplishments of the committees and task committees that have worked on the Raise the Bar initiative and develop a plan to overcome the obstacles currently facing two key Competency Strategy actions. The thrust of those two actions can be paraphrased as (1) influence ASCE members, major employers of civil engineers, lead client groups, leaders of engineering organizations, and other key stakeholders to understand and commit to the changes necessary to implement the Raise the Bar initiative and (2) pass changes to the licensing laws in a few states to reflect the NCEES model law and raise the bar for the licensure of engineers.	Leonard, B.D. (Chair) Jaeger, S.A. (Staff)
43	Aug 2011	NCEES	ALPTF Report Presented	ALPTF = Alternate Licensure Pathway Task Force. The task force presented its findings as a motion for Council action at the 2011 annual meeting. The motion did not pass.	Liles, H.V. (Chair) Anderson, K. (Staff)
44	Aug 2011	NCEES	UPLG Refines Model Law/Rules 2020	UPLG = Uniform Procedures and Legislative Guidelines. UPLG successfully moved to add new Model Law/Rules language creating an authorized fulfillment path for bachelor degree programs that require 150 or more credit hours and meet certain requirements for content.	Liles, H.V. (Chair) Anderson, K. (Staff)
45	Oct 2012	ASCE	Raise the Bar Committee Formed (tentative but probable)	Planning is currently being accomplished to organize a new Raise the Bar Committee within ASCE. It is envisioned that with the formation of this new committee, the efforts of CAP^3 and TCICS2 would be consolidated. At this time, it is not known how the various constituent committees of CAP^3 will be organized within the ASCE committee structure. Planning for this reorganization is scheduled to be completed by Sep 30, 2012.	To Be Determined

## Appendix B

### **ASEE *Proceedings* Papers Directly Related to the Raise the Bar Initiative**

The authors have identified approximately 100 papers that have been published on the Raise the Bar initiative since 1998 in the *Proceedings* of the annual conferences of the American Society for Engineering Education (ASEE). All of these ASEE *Proceedings* papers are available for download from <http://www.asee.org/search/proceedings>. This is a special annotated list of these ASEE proceedings papers – arranged by date (oldest to newest). Each of the papers has also been given a "Topic Category" from the following four classifications:

- Raise the Bar Initiative -- Overview/Concepts
- BOK (via Education and/or Experience)
- Accreditation
- Licensure

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Adams, E. and Bras, R. (1999). "MIT's Master of Engineering Degree in Civil and Engineering--a first professional degree." Paper# 296. *Proceedings of the 1999 Conference of the American Society for Engineering Education*, June 1999, Charlotte, NC.

[**Topic Category**] Raise the Bar Initiative -- Overview/Concepts

[**Annotation**] After ASCE's policy statement 465 was released supporting the Master's degree as the First Professional Degree for the practice of Civil Engineering at a professional level, MIT's Department of Civil and Environmental Engineering developed a new degree, seeking a unique and different post-baccalaureate experience. This paper summarizes this new degree program based on the authors' experiences with three graduating classes. The authors hope this will become the model of the first professional degree.

Koehn, E. (1999). "Innovative Master's Degree in a Professional Program." Paper# 204. *Proceedings of the 1999 Conference of the American Society for Engineering Education*, June 1999, Charlotte, NC.

[**Topic Category**] Raise the Bar Initiative -- Overview/Concepts

[**Annotation**] This paper summarizes the recommendations of ASCE's Educational Activities Committee for developing a policy for the first professional degree in civil engineering. In order to study alternatives to the ASCE recommendations, this paper investigates the requirements associated with two graduate degrees, Master of Engineering (ME/M.Eng./MEng) and especially the Master of Engineering Management (MEM), which may serve as the first professional degree in an engineering program. The specific credit hours and typical courses required to obtain a particular degree are indicated. In addition, the concept of a Doctor of Engineering degree (Engr. D.) is also introduced.

Adams, C.; Fitch, M.; and Burken, J. (2000). "Military on Campus: A Joint UMR-Army Program Providing Non-Traditional Master's Degrees.." Paper# 422. *Proceedings of the 2000 Conference of the American Society for Engineering Education*, June 2000, St. Louis, MO.

[**Topic Category**] Raise the Bar Initiative -- Overview/Concepts

## Appendix B (continued)

**[Annotation]** This paper summarizes the efforts of the University of Missouri-Rolla's Environmental Engineering Program to bring non-traditional students into the classroom by developing a program to offer Master's degrees to US Army Officers completing the Engineering Officer's Advanced Course (EOAC) at Fort Leonard Wood.

Koehn, E. (2000). "Assessment of First Professional Degree Criteria." Paper# 30. *Proceedings of the 2000 Conference of the American Society for Engineering Education*, June 2000, St. Louis, MO.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** This paper presents the results of an investigation involving the perceptions of a group of undergraduate and graduate students as well as practicing engineers concerning the ASCE first professional degree policy statement which supports the concept of the Master's degree as the First Professional Degree for the practice of engineering.

Chinowsky, P. (2001). "Addressing the Management Crisis in Civil Engineering Education." Paper# 15. *Proceedings of the 2001 Conference of the American Society for Engineering Education*, June 2001, Albuquerque, NM.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper addresses the growing need for Civil Engineering students to be exposed to management topics such as entrepreneurship, financial management, and global economics. The author claims that if the civil engineering industry desires to evolve into a new economy business, industry professionals must be as comfortable with the financial and technology components of the business as they are with design or construction fundamentals. The author calls for a new mindset and approach to engineering education in order for universities to develop individuals who have the capability to succeed in the challenging technical business world in which they operate.

Epstein, H. (2002). "ASCE Policy Statement on The First Professional Degree: Where Does it Stand?." Paper# 1020. *Proceedings of the 2002 Conference of the American Society for Engineering Education*, June 2002, Montreal, Quebec.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** The primary purpose of this paper is to present the chronology of events and the current status of the issue of the first professional degree in civil engineering.

Russell, J.; Stouffer, B.; Walesh, S.; and Anderson, R.; Price, B.; DeSoto-Duncan, A.; Maples, B.; Buehring, N.; Galloway, G.; Lenox, T.; Esslinger, J, Durrant, J.; and Parsons B. (2002). "Why Raise the Education Bar for Civil Engineers?." Paper# 1071. *Proceedings of the 2002 Conference of the American Society for Engineering Education*, June 2002, Montreal, Quebec.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** The purpose of this paper is to better define six of the nine broad issues developed by the ASCE Task Committee on the First Professional Degree necessitating an increase in engineering education. The six issues defined are leadership preparation, broader formal education, professional skills development, appeal to youth, management by non-engineers, and changing systems. This increase in education is in reference to Policy Statement 465 and ASCE's support of the concept of the Master's degree or equivalent as a prerequisite for licensure and the practice of civil engineering at a professional level

## Appendix B (continued)

Walesh, S. (2002). "Implementing ASCE's "Masters" Policy." Paper# 1084. *Proceedings of the 2002 Conference of the American Society for Engineering Education*, June 2002, Montreal, Quebec.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** Described in this paper is the manner in which ASCE is working with stakeholders to develop, organize, and execute a detailed implementation process for Policy Statement 465 which "supports the concept of the Master's Degree or Equivalent (MOE) as a prerequisite for licensure and the practice of civil engineering at a professional level."

(TCAP^3) (2003). "ASCE'S Raise The Bar Initiative: Master Plan For Implementation." Paper# 952. *Proceedings of the 2003 Conference of the American Society for Engineering Education*, June 2003, Nashville, TN.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** The purpose of this paper is to describe the efforts of the Task Committee on Academic Prerequisites for Professional Practice (TCAP^3) and their master plan for the implementation of ASCE's Policy Statement 465

Ghaly, A.; Jewell, T.; and Wolfe, F. (2003). "Perception Versus Reality in Civil Engineering Education Today." Paper# 650. *Proceedings of the 2003 Conference of the American Society for Engineering Education*, June 2003, Nashville, TN.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper attempts to offer a global view of steps implemented by large and small institutions to modernize their Civil Engineering curricula in an attempt to incorporate advancements in technology in newly structured civil engineering courses. The author presents a self-assessed degree of success of these changes, and the level of acceptance these newly revamped programs received.

Nelson, J.K.; Abudayyeh, O.; Tsang, E.; and Williams, M. (2003). "A Civil Engineering Curriculum for the 21st Century." Paper# 696. *Proceedings of the 2003 Conference of the American Society for Engineering Education*, June 2003, Nashville, TN.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper presents a new Civil Engineering curriculum used at Western Michigan University in response to the ways in which technology has changed the engineering design process and the skills needed for engineering graduates to successfully enter the work force.

Nixon, W. and Bhatti, M. (2003). "A Methodology to Define the Body of Knowledge in Civil Engineering." Paper# 318. *Proceedings of the 2003 Conference of the American Society for Engineering Education*, June 2003, Nashville, TN.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper will explore, for a particular subdiscipline within civil engineering (structures), how the Body of Knowledge, defined in ASCE's Policy Statement 465, should be developed and of what it might consist at both graduation and licensure levels.

## Appendix B (continued)

Smerdon, E.; Anderson, R.; and Russell, J. (2003). "ASCE's Raise the Bar Initiative: Accreditation-Related Barriers and Critical Issues." Paper# 1294. *Proceedings of the 2003 Conference of the American Society for Engineering Education*, June 2003, Nashville, TN.

**[Topic Category]** Accreditation

**[Annotation]** This paper describes ASCE's efforts to develop a consensus on the Body of Knowledge that is needed for the practice of Civil Engineering at the professional level. The authors discuss a push for ABET and the EAC to allow institutions the opportunity to obtain accreditation of engineering programs at both the master's and baccalaureate level. The authors believe that allowing dual level accreditation would promote students to continue their education through advanced degrees, thus expanding their Body of Knowledge, and would allow the attainment of such degrees to serve as partial fulfillment of the requirements for licensure.

Walesh, S. (2003). "ASCE's Raise the Bar Initiative: The Body of Knowledge for the Future." Paper# 113. *Proceedings of the 2003 Conference of the American Society for Engineering Education*, June 2003, Nashville, TN.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** ASCE's Task Committee on Academic Prerequisites for Professional Practice (TCAP<sup>3</sup>) was charged to develop, organize, and execute a detailed plan for the full implementation of ASCE Policy 465 (Academic Prerequisites for Licensure and Professional Practice). This paper presents the recommendations of the TCAP<sup>3</sup>'s Body of Knowledge-Curricula Committee and, secondarily, describes the process used to arrive at those draft recommendations.

Kolar, R.; Knox, R.; Miller, G.; and Muraleetharan, K.; and Sabatini, D. (2004). "An Assessment of How the Sooner City Project Addresses ASCE's Body of Knowledge." Paper# 240. *Proceedings of the 2004 Conference of the American Society for Engineering Education*, June 2004, Salt Lake City, UT.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper examines the University of Oklahoma's efforts to incorporate the Body of Knowledge that all students should possess in order to enter the practice of the Civil Engineering (as outlined in ASCE's Policy Statement 465) into their curriculum. This curriculum reform project called Sooner City began in 1996 at the University of Oklahoma and the author outlines the ways in which the Sooner City-based curriculum meets the BOK outcomes.

Massie, W. (2004). "Justifying a Body of Knowledge." Paper# 979. *Proceedings of the 2004 Conference of the American Society for Engineering Education*, June 2004, Salt Lake City, UT.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper describes the recent discussion on the credentials required of Civil Engineers and the Body of Knowledge needed to practice professionally. The author uses his experience with the Delft University of Technology's Civil Engineering curriculum to define the knowledge and skills needed by engineers to be successful in the professional world.

Robinson, M. and Sutterer, K. (2004). "The ASCE BOK – A Case Study of the Evaluation and Design of a BOK Curriculum." Paper# 222. *Proceedings of the 2004 Conference of the American Society for Engineering Education*, June 2004, Salt Lake City, UT.

## Appendix B (continued)

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper describes the Rose-Hulman Institute of Technology's efforts to evaluate and modify their civil engineering curriculum based on ASCE's Policy Statement 465 and the description of the Body of Knowledge as a means of providing educational requirements appropriate for professional licensure.

Siller, T.J. and Johnson, G. (2004). "Constituent Influences on Engineering Curricula." Paper# 468. *Proceedings of the 2004 Conference of the American Society for Engineering Education*, June 2004, Salt Lake City, UT.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper provides an overview of the changes made to the engineering curriculum in the United States. The paper focuses on showing the relative shift from an emphasis on purely analytical course work to curricula that emphasize design as well as social aspects of engineering including communication, business practices, and leadership.

Siller, T.J.; Criswell, M.; Fontane, D.; and Grigg, N. (2004). "Some Methods to Achieve Changes in Delivered Civil Engineering Body of Knowledge." Paper# 561. *Proceedings of the 2004 Conference of the American Society for Engineering Education*, June 2004, Salt Lake City, UT.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper describes the ongoing effort of Colorado State University's Civil Engineering Department to update their curriculum to meet the career needs of future civil engineers. The paper outlines three program features at CSU facilitating the curricular changes needed to achieve consistency with the desired BOK in their undergraduate program. These features include an integrated sequence of eight core courses in which many topics to be developed "across the curriculum" are emphasized, an ongoing planning effort to integrate IT topics into a combination of new or reorganized required and elective courses, and a recently implemented practice-oriented Masters of Engineering program.

Walesh, S. (2004). "From Civil Engineering Body of Knowledge To Civil Engineering Curricula." Paper# 341. *Proceedings of the 2004 Conference of the American Society for Engineering Education*, June 2004, Salt Lake City, UT.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper presents the recommendations of ASCE's Task Committee on Academic Prerequisites for Professional Practice's Body of Knowledge (BOK) Committee. The paper introduces the subsequent Civil Engineering curricula design effort to ensure that graduating engineers have the appropriate BOK for the professional world.

Dennis, N. and Larson, D. (2005). "Who Should Teach the Civil Engineering "Body of Knowledge?"" Paper# 511. *Proceedings of the 2005 Conference of the American Society for Engineering Education*, June 2005, Portland, OR.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper describes the current efforts by ASCE's Committee on Faculty Development to define who should teach ASCE's body of knowledge that needs to be addressed in Civil Engineering Programs that lead to a professional degree. The discussion focuses on



## Appendix B (continued)

faculty credentials, methods of content delivery, and venue of programs, e.g., in-residence versus distance education programs.

Estes, A.; Welch, R.; and Meyer, K. (2005). "Will Ten Pounds Fit into a Five Pound Bag?." Paper# 299. *Proceedings of the 2005 Conference of the American Society for Engineering Education*, June 2005, Portland, OR.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The purpose of this paper is to provide an initial assessment on how well the current West Point Civil Engineering program meets the broad based, Body of Knowledge breadth requirements expressed by ASCE (2004b).

Houghtalen, R. (2005). "Can ASCE Cover the "E" in the MOE?." Paper# 121. *Proceedings of the 2005 Conference of the American Society for Engineering Education*, June 2005, Portland, OR.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper reviews the Body of Knowledge (BOK) proposed for future licensure that will be required beyond the BS degree. The proposed BOK includes not only a Bachelor's degree but a Master's degree or equivalent. The paper describes possible ways for engineers to obtain the "or equivalent" portion of the advanced education ASCE deems necessary for professional licensure.

Koehn, E. and Tohme, H. (2005). "Body of Knowledge: Ethical Responsibility in Engineering and Construction Education and National/Global Professional Bidding Practice." Paper# 1211. *Proceedings of the 2005 Conference of the American Society for Engineering Education*, June 2005, Portland, OR.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** An international task force has been established to fight the problem of unethical activity occurring in engineering and construction firms in certain areas throughout the world. This paper reviews and investigates the level of corruption at the national/international level and presents a concept that may explain why this corruption is occurring. The paper also presents two solutions to solve the problem of corruption and unethical business practices.

Ressler, S. (2005). "New Accreditation Criteria for the Civil Engineering Profession: Process and Products." Paper# 1217. *Proceedings of the 2005 Conference of the American Society for Engineering Education*, June 2005, Portland, OR.

**[Topic Category]** Accreditation

**[Annotation]** This paper describes the ongoing development of new ABET accreditation criteria for civil engineering programs based on ASCE's Policy 465 detailing the Civil Engineering Body of Knowledge required of professional engineers. This paper summarizes the evolution of the Body of Knowledge, discusses advantages and limitations of using accreditation criteria as a means of implementing the Body of Knowledge, and provides a detailed description of the proposed, BOK-compliant, accreditation criteria. The ultimate purpose of the paper is to share the new draft criteria with a broader audience to solicit feedback.

## Appendix B (continued)

Robinson, M. and Sutterer, K. (2005). "The Design of a Four-Year ASCE BOK Compliant Program Tract." Paper# 477. *Proceedings of the 2005 Conference of the American Society for Engineering Education*, June 2005, Portland, OR.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** ASCE's Body of Knowledge has 15 defined program outcomes, the twelfth being the ability to apply knowledge in a specialized area related to civil engineering. This paper describes the Rose-Hulman Institute of Technology's efforts to incorporate this outcome into their existing civil engineering curriculum.

Schmucker, D. (2005). "Real Engineering Practice In The Classroom: Can ASCE'S BOK Be Done In 4 Years?." Paper# 185. *Proceedings of the 2005 Conference of the American Society for Engineering Education*, June 2005, Portland, OR.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The paper briefly discusses how the baccalaureate Civil Engineering program at Western Kentucky University (WKU) was developed in the context of ABET's EC2000, how it compares to ASCE's BOK, and the performance of students. In particular, the authors explore to what degree the joint program between WKU and the University of Kentucky accomplishes the major objectives of ASCE's BOK in a project-based, 4-year program.

Varma, V. (2005). "Basic Elements of the 21st Century Body of Knowledge for a Construction Professional: Challenges for Construction Educators." Paper# 1015. *Proceedings of the 2005 Conference of the American Society for Engineering Education*, June 2005, Portland, OR.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper presents the basic elements of a current four-year educational program for a construction professional, and compares this with an educational program that would be more suited for a future construction professional based on the ASCE's Body of Knowledge and the subsequent curriculum reform of Civil Engineering Departments around the country. This paper presents a proactive approach to developing broad-based knowledge, requisite skills, attitudes, and integrity in future construction graduates. It stresses understanding of issues such as 21st century global business economy, and multi-cultural teams. The paper also lays the foundation for a strong understanding of world cultures, languages, and local practices in the context of international collaboration on construction projects of all sizes.

Koehn, E.; Koehn, J.; and Paleru, S. (2006). "Satisfying Future Body Of Knowledge Outcomes." Paper# 792. *Proceedings of the 2006 Conference of the American Society for Engineering Education*, June 2006, Chicago, IL.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper summarizes the findings of research conducted to determine which of the BOK criteria are being satisfied by current undergraduate civil engineering curricula. This investigation indicates that almost all the BOK outcomes tend to be perceived by the respondents as being satisfied in the currently existing undergraduate curriculums except one; specialized knowledge. The authors feel obtaining knowledge in a specialized area is found to be difficult to accomplish in an undergraduate program. The paper draws a comparison between the specialized knowledge needed to become a Certified Public Accountant and the specialized knowledge deemed necessary for professional engineering licensure as described in outcome twelve of ASCE's BOK.

## Appendix B (continued)

Merino, D. (2006). "A Proposed Engineering Management Body Of Knowledge (EMBOK)." Paper# 174. *Proceedings of the 2006 Conference of the American Society for Engineering Education*, June 2006, Chicago, IL.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** In this paper an Engineering Management Body of Knowledge (EMBoK) is proposed and then used to develop topics and their relative weights which could be used for an Engineering Manager's certification test. The EMBoK definitions are then compared to the Accreditation Board for Engineering and Technology (ABET) and the American Society of Engineering Management (ASEM) criteria for EM programs to determine if there is consistency.

Ressler, S. (2006). "Progress On Raising The Bar — New CE Accreditation Criteria." Paper# 1197. *Proceedings of the 2006 Conference of the American Society for Engineering Education*, June 2006, Chicago, IL.

**[Topic Category]** Accreditation

**[Annotation]** This paper describes the progress made with ASCE's "Raising the Bar" initiative in an effort to change the Civil Engineering accreditation criteria. Based on the ASCE Policy Statement 465 and the associated Body of Knowledge, this paper expands on the advantages and limitations of using accreditation criteria as a means of implementing the Body of Knowledge, emphasizes the changes to the BOK-compliant accreditation criteria originally presented in Paper 1217, and provides a description of the draft criteria submitted to ABET in the Spring of 2006.

Russell, J.; Lenox, T.; Walesh, S.; and Anderson, R.; Galloway G.; Musselman, C.; Bergstrom, W.; Nelson, J.K.; and O'Brien, J. (2006). "2006-110: Progress On Raising The Bar – Current Progress And Anticipated Next Steps." Paper# 110. *Proceedings of the 2006 Conference of the American Society for Engineering Education*, June 2006, Chicago, IL.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** The purpose of this paper is to describe the Committee on Academic Prerequisites for Professional Practice's (CAP<sup>3</sup>) efforts to implement Policy Statement 465, to describe the progress over the last year (2005), and outline the next steps for implementation.

Smerdon, E.; Ressler, S.; Nelson, J.; and O'Brien, J. (2006). "Progress On Raising The Bar - Issues Related To The Prohibition On Dual-Level Accreditation Of Engineering Programs." Paper# 246. *Proceedings of the 2006 Conference of the American Society for Engineering Education*, June 2006, Chicago, IL.

**[Topic Category]** Accreditation

**[Annotation]** The purpose of this paper is to directly address the principal points of opposition to dual-level accreditation. The authors feel that substantive change is necessary to implement the BOK, and that if civil engineers are to adequately meet the nation's technological challenges of the future, artificial constraints, such as the prohibition of dual level accreditation, must be removed.

Unnamed Author (2006). "Satisfying Body of Knowledge (BOK) Outcomes in an Undergraduate Curriculum." Paper# 761. *Proceedings of the 2006 Conference of the American Society for Engineering Education*, June 2006, Chicago, IL.

## Appendix B (continued)

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper summarizes the findings of research conducted to determine which of the BOK criteria are being satisfied by current undergraduate civil engineering curricula. This investigation indicates that almost all the BOK outcomes tend to be perceived by the respondents as being satisfied in the currently existing undergraduate curriculums, except one, specialized knowledge. The authors feel obtaining knowledge in a specialized area is found to be difficult to accomplish in an undergraduate program. This paper draws a comparison between the post-baccalaureate education needed to practice law, versus the type of specialized education referenced in outcome twelve of the Civil Engineering Body of Knowledge.

Delatte, N.; Bosela, P.; Rens, K.; and Carper, K.; and Sutterer, K. (2007). "Findings From Workshops On Failure Case Studies In The Civil Engineering And Engineering Mechanics Curriculum." Paper# 783. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper summarizes the findings from four workshops held for engineering educators addressing case studies in engineering mechanics, structural engineering, other civil engineering courses, ethics/professional issues/capstone design courses, and forensic engineering/failure analysis courses. The goal of these workshops was to teach educators how to bring forensics and failure case studies into the civil engineering curriculum as a way of offering students valuable insights into associated technical, ethical, and professional issues

Evans, J.; Lynch, D.; and Lange, D. (2007). "The Role Of Humanities And Social Sciences In The Civil Engineering Body Of Knowledge." Paper# 1373. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper summarizes the broad education necessary for 21st century civil engineers to think critically about issues confronting them and develop solutions that are informed not only by math, science, and engineering, but by humanities and social sciences as well; to implement those solutions effectively within real social contexts; and to evaluate them in humanistic as well as technical terms.

Fridley, K. and Anderson, R. (2007). "ASEE 2007 Abstract--CE BOK--FRIDLEY.DOC." Paper# 432. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper describes the inclusive process being used to develop the second edition of the BOK expected for the future practice of civil engineering. The author feels that a strong effort is being made to assess existing and evaluate possible new outcomes for inclusion in the second edition of the BOK. The paper presents six levels of Bloom's Taxonomy to clearly define the desired levels of achievement for each BOK technical and professional outcome, and outlines the resulting BOK outcome rubric.

Appendix B (continued)

Hains, D.; Evans, M.; and Ressler, S. (2007). "Teaching The BOK ? Challenges for Faculty And Programs." Paper# 2036. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper discusses the non-traditional faculty model in the Department of Civil & Mechanical Engineering at the United States Military Academy and how they have modified their program and educated faculty to teach the new BOK. This version of the Body of Knowledge includes 16 technical and 10 professional outcomes. The professional outcomes, which require a modification of the traditional Civil Engineering program, include leadership, teamwork, communication, history and heritage, professional and ethical responsibility, and life-long learning.

Hoadley, P. (2007). "The ASCE BOK And Attitudes Assessment." Paper# 1845. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper addresses the definition of ASCE's Body of Knowledge: the "knowledge, skills, and attitudes necessary for an individual to enter the professional practice of civil engineering." The purpose of this paper is to address the "attitudes" portion of the Body of Knowledge, and discuss attitude assessment tools that can be used in lieu of the objective means of measuring "knowledge and skills."

Lynch, D.; Kelly, W.; Jha, M.; and Harichandran, R. (2007). "Implementing Sustainability In The Engineering Curriculum: Realizing The ASCE Body Of Knowledge." Paper# 2422. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper discusses the emphasis placed on sustainability in the second edition of the ASCE's BOK as an independent technical outcome and has set out specific levels of cognitive achievement required of all engineers prior to licensure. Addressed in this paper are the elements of a university program including the sustainable use of natural resources, sustainable infrastructure, sustainable production of goods and services, and a research agenda.

Maccariella, J. (2007). "The Role Of Adjuncts In Teaching ASCE'S Body Of Knowledge." Paper# 101. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper summarizes student evaluations of a two-semester senior design course that was developed and taught by an adjunct faculty member at Rowan University. The author claims that, based on student's feedback, the adjunct instructors' practical experience and knowledge of day-to-day operations of engineering projects effectively supplements the traditional engineering curricula

Mullenax, C. (2007). "The Role Of The Master's Degree Within Engineering Education." Paper# 565. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

## Appendix B (continued)

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** There has been debate over the structure of the master's degree and its role in fulfilling an engineer's educational needs as the first professional degree instead of the bachelor's degree. This paper provides a historical perspective of Master's Degrees and shows the trends of granted degrees to the present time. It discusses these trends, broaches the pros and cons of the Master's Degree, discusses current trends in curricula, and assesses the value of the Master's Degree as currently implemented for the engineering practitioner.

Ressler, S. (2007). "An Aspirational Vision Of Civil Engineering In 2025: The Role Of Accreditation." Paper# 643. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** Accreditation

**[Annotation]** This paper presents an analysis of the recently developed vision for civil engineering in 2025, resulting in the identification of likely changes to current ABET accreditation criteria that would be required to pursue the vision. The analysis is based on a model that emerged during the development of BOK-compliant accreditation criteria, in conjunction with the implementation of ASCE Policy 465.

Roberts, M.; Parker, P.; Curras, C.; and Penn, M.; and Anderson, M. (2007). "An Innovative Infrastructure Curriculum For 21ST Century Civil Engineering." Paper# 1085. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper summarizes a new civil engineering curriculum implemented at the University of Wisconsin-Platteville (UWP) to create a focus on infrastructure topics and the built environment in addition to the existing civil engineering coursework. The paper provides details on how an infrastructure theme will be infused throughout the curriculum at UWP.

Russell, J.; Galloway, G.; Lenox, T.; and O'Brien, J. (2007). "ASCE Policy 465 ? The Means For Realizing The Aspirational Visions of Civil Engineering In 2025." Paper# 224. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** The purpose of this paper is to discuss ASCE's current plan for implementing Policy Statement 465 and reforming civil engineering education. Included in this plan is the development of a revised Civil Engineering Body of Knowledge (BOK), modified accreditation criteria, improved civil engineering curricula, and licensure issues.

Seagrave, J. (2007). "Interdisciplinary Pedagogy: Using Teams To Teach The BOK." Paper# 389. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper considers how the University of Utah approaches the question "who should teach the body of knowledge?" The paper examines interdisciplinary team teaching in Civil and Environmental Engineering. It specifically focuses on the communication related learning outcomes 6, 7, 8, 9, and 15, and how University of Utah employs teaching teams,

## Appendix B (continued)

including instructors from Communication, Writing, and Engineering in order to accomplish them by following the collaboration in one, department-required, technical communication course over four semesters.

Sutterer, K.; Hanson, J.; and Aidoo, J. (2007). "First Year Engineering Design: Incorporating Leadership Development Into Real Project Experiences." Paper# 2497. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper outlines the First Year Engineering Design Course at Rose-Hulman Institute of Technology as a way of incorporating leadership development into the engineering curriculum at the start of the student's undergraduate career.

Unnamed Author (2007). "Comparing Present Outcome Data to that Utilizing Bloom's Taxonomy." Paper# 306. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper presents data that indicates civil/construction engineering programs at the bachelor's level may presently be satisfying, to some degree, 14 of the 15 BOK outcomes. The author feels however, that the twelfth outcome, the attainment of specialized knowledge within civil/construction engineering may be difficult to satisfy in a normal undergraduate civil/construction engineering program. This paper presents a way for universities to evaluate and measure the achievement of BOK outcomes and objectives.

Walesh, S.; Chajes, M.; and Mongan, D. (2007). "Civil Engineering In 2025: The Vision And How It Was Developed." Paper# 1233. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** This paper describes the proceedings of the Summit on the Future of Civil Engineering held in 2006. The summit was attended by a highly varied group of civil and other engineers as well as other industry leaders. The goal of the summit was to articulate an aspirational global vision for the future of civil engineering addressing all levels and facets of the civil engineering community, that is, professional (licensed) civil engineers, non-licensed civil engineers, technologists, and technicians.

Welch, R.; Robinson, M.; Glagola, C.; and Nelson, J.K. (2007). "An Aspirational Vision For Civil Engineering In 2025: The BOK And Future Directions For Civil Engineering Curricula." Paper# 950. *Proceedings of the 2007 Conference of the American Society for Engineering Education*, June 2007, Honolulu, HI.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The primary topics addressed in the paper are: the current status of civil engineering degree programs in relation to the ASCE BOK, the means to assess that status at an individual institution, strategies for implementing the ASCE BOK into an institution's civil engineering degree programs at comprehensive doctoral institutions as well as undergraduate

## Appendix B (continued)

focused institutions, and a methodology for the assessment of BOK-compliant civil engineering degree programs

Anderson, R.; Walesh, S.; and Fridley, K. (2008). "The New And Improved Civil Engineering Body Of Knowledge." Paper# 611. *Proceedings of the 2008 Conference of the American Society for Engineering Education*, June 2008, Pittsburgh, PA.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper discusses the development of a revised Civil Engineering Body of Knowledge by outlining the processes used by ASCE's BOK2 committee, initiated in late 2005, to arrive at a new set of outcomes in three categories, Foundational, Technical, and Professional that all new engineers should possess as they enter the professional world.

Delatte, N. (2008). "Using Failure Case Studies To Address Civil Engineering Program And BOK Criteria." Paper# 532. *Proceedings of the 2008 Conference of the American Society for Engineering Education*, June 2008, Pittsburgh, PA.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper suggests ways that failure case studies may be used to address Accreditation Board for Engineering and Technology Engineering Accreditation Commission's (ABET EAC) general and civil engineering program specific criteria, as well as Civil Engineering Body of Knowledge (BOK) criteria.

Evans, J. and Lynch, D. (2008). "Foundational Outcomes Of The New Civil Engineering Body Of Knowledge." Paper# 667. *Proceedings of the 2008 Conference of the American Society for Engineering Education*, June 2008, Pittsburgh, PA.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The new civil engineering Body of Knowledge (BOK2) identifies three categories of outcomes as follows: Foundational, Technical and Professional. The four Foundational outcomes are Mathematics, Natural Sciences, Humanities and Social Sciences. This paper explores the background, philosophy, intent and goals of the four Foundational outcomes.

Reinhart, D. (2008). "Developing A Body Of Knowledge For Environmental Engineering." Paper# 175. *Proceedings of the 2008 Conference of the American Society for Engineering Education*, June 2008, Pittsburgh, PA.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper examines the need for the development of an Environmental Engineering Body of Knowledge, modeled after ASCE's second edition of the Civil Engineering Body of Knowledge. The paper discusses meetings held to establish the Environmental BOK and its purpose. The goal of these meetings was to provide a guide for curriculum development and reform, a guide for employers so they know what they are getting when they hire an environmental engineer, and a mechanism to call for specific attributes such as creativity and innovation.

Ressler, S. (2008). "Influence Of The New Civil Engineering Body Of Knowledge On Accreditation Criteria." Paper# 1097. *Proceedings of the 2008 Conference of the American Society for Engineering Education*, June 2008, Pittsburgh, PA.



## Appendix B (continued)

### **[Topic Category]** Accreditation

**[Annotation]** The purpose of this paper is to present an analysis of the ASCE Civil Engineering Body of Knowledge for the 21st Century, Second Edition, (BOK2) from the perspective of accreditation. Specifically, the author proposes a methodology by which potential changes to the ABET Accreditation Criteria are derived from the BOK2 and then prioritized. This paper also presents an analysis of timing and transition issues associated with implementation of the current BOK1-compliant accreditation criteria and any additional changes that might emerge from the BOK2 process.

Russell, J.; Galloway, G.; Lenox, T.; and O'Brien, J. (2008). "ASCE Policy 465 – Progress And Next Steps." Paper# 46. *Proceedings of the 2008 Conference of the American Society for Engineering Education*, June 2008, Pittsburgh, PA.

### **[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** The purpose of this paper is to discuss ASCE's current plan for implementing civil engineering curriculum reform including: its release of the second edition of the Civil Engineering Body of Knowledge (BOK), modified accreditation criteria, improved civil engineering curricula, refined experience guidelines for engineer interns, and licensure issues.

Arciszewski, T.; Bronzini, M.; and Houck, M. (2009). "Implementing BOK2: A Modular Post-B.S. Civil Engineering Education Program." Paper# 1461. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

### **[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** ASCE's Civil Engineering Body of Knowledge for the 21st Century (BOK2) specifies 24 educational outcomes deemed necessary for civil engineering graduates to practice at the professional level. This paper outlines the efforts conducted by three professors at George Mason University to develop a post-BS engineering education program to satisfy those outcomes specified in BOK2 that are unattainable at the undergraduate level. The authors present their educational assumptions, the general outline of their new system of courses several examples of new courses, and discuss how industry involvement was obtained to define these new course modules

Bardet, J. and Ragusa, G. (2009). "Analysis Of Body Of Knowledge In Civil Engineering." Paper# 2293. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

### **[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper examines how the revised version of ASCE's Body of Knowledge, BOK2, applies the concept of learning taxonomy, originally developed by Bloom (1956) and later revised by Anderson and Krathwohl (2001). BOK2, which was developed using Bloom's taxonomy, is examined using Anderson and Krathwohl's revised learning taxonomy as a guide.

Barry, B.; Mehta, Y.; and St. Clair, S. (2009). "Professional Engineering Licensure And Professional Experience Among Civil Engineering Faculty: A Multi-Institutional Comparison." Paper# 366. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

### **[Topic Category]** Licensure

## Appendix B (continued)

**[Annotation]** This paper explores the research question, “Among currently licensed civil engineering faculty members, what are the perceived values of professional experience and of licensure as a professional engineer?” This paper details the research design, implementation of the study, and the results. The author feels that the findings and conclusions of this study will be of interest to a variety of academic and licensure stake-holders, including: civil engineering faculty members (both licensed and unlicensed), academic administrators, and licensing organizations such as the National Council of Examiners for Engineering and Surveying (NCEES).

Bielefeldt, A. (2009). "Mapping An Undergraduate Curriculum Onto The Environmental Engineering Body of Knowledge." Paper# 684. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper discusses the University of Colorado at Boulder's efforts to incorporate the Body of Knowledge for Environmental Engineering into their ABET-accredited Environmental Engineering curriculum. The paper addresses the current shortcomings of their program, and concerns with attempting to meet all of the Body of Knowledge outcomes in a B.S. degree. Instead of trying to focus on covering all possible topics that an Environmental Engineer might need to know in a B.S. degree, the author suggests that a better approach could be to develop critical thinking skills in the students and the ability to teach themselves during their professional careers in the context of life long learning.

Chou, K. and Nykanen, D. (2009). "Bringing Professional Experience Into The Classroom: Faculty Experiences." Paper# 2208. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** In this paper, the authors summarize the benefits of their experience teaching at the university level while at the same time holding professional positions in industry. In addition, the authors offer their perspective as a faculty-engineer and discuss the factors influencing the effectiveness of this “dual” position.

Fridley, K.; Hall, K.; Larson, D.; and Sutterer, K.; Alleman, J.; McManis K.; Bardet, J.P.; Gunnink, B.; List, G.; Smith R.; and Lenox T.A. (2009). "2009-ASEE-ABSTRACT BOKEDFC." Paper# 752. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The purpose of this paper is to provide the engineering education community with its first formal update from ASCE’s new Body of Knowledge (BOK) Educational Fulfillment Committee. The paper presents survey data illustrating how well programs, in their current design, achieve the educational outcomes of both the first and second editions of the civil engineering BOK.

Hernandez, L. and Vitton, S. (2009). "A New Approach To Soil Mechanics Laboratory Curricula: Incorporating The BOK Into A Workshop-Oriented Laboratory." Paper# 438. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

## Appendix B (continued)

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper presents an educational model developed to integrate twelve of the twenty-four BOK learning outcomes into the soil mechanics laboratory within the civil engineering curriculum. The model utilizes the cognitive domain of Bloom's Taxonomy to create a workshop-orientated laboratory that enhances student learning. The authors feel that this workshop model will help equip engineering students with the critical thinking, problem solving and technical communication skills needed in the 21st century.

Meyer, F. and Ressler, S. (2009). "Let's Get Down To Business: Preparation For ABET Under The New CE Program Criteria." Paper# 2105. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** Accreditation

**[Annotation]** ABET accreditation criteria for Civil Engineering Programs underwent major changes prior to the 2008-2009 accreditation cycle. This paper, written by Meyer and Ressler from the United States Military Academy, provides lessons learned from the preparation for an ABET visit at the USMA that occurred during the Fall of 2008 under the newly revised ABET and CE Program Criteria.

Musselman, C. (2009). "Requiring A Master's Degree Or Its Equivalent As A Model Law Prerequisite For Licensure After 2020." Paper# 1864. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** Licensure

**[Annotation]** This paper presents the modifications and rationale behind changes to the Model Law by the National Council of Examiners of Engineers and Surveyors (NCEES) for the licensure of Professional Engineers requiring an increase in educational qualifications beyond a Bachelor's Degree. The current status of on-going deliberations regarding implementation details is also discussed.

Nelson, E.; Williams, G.; Richards, P.; and Schulz, G.; Wight, T.; and Armstrong, J. (2009). "Assessing State Engineering Examining Boards And Higher Education's Response To The 2006 NCEES Model Law For Professional Engineering Licensure ." Paper# 1501. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** Licensure

**[Annotation]** The purpose of this paper is to summarize the results of a survey conducted by the graduate committee in the Department of Civil and Environmental Engineering at Brigham Young University (BYU) to ascertain if civil engineering departments at other universities were making changes in their programs and if they were taking planning actions based on the proposed changes to licensing requirements by ASCE and NCEES.

Nelson, Jon; Hornbeck, D.; Lambrechts, J.; and Manous, J.; Stevens, R.; Titus, L.; and Russell, J. (2009). "Paraprofessionals In Civil Engineering." Paper# 884. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** Paraprofessionals are individuals who have significant engineering educational qualifications and who perform important technical and non-technical roles. This paper summarizes the findings of ASCE's Paraprofessional Exploratory Task Committee (PETC), and

## Appendix B (continued)

addresses questions regarding paraprofessionals' credentials and the structure of their roles these individuals play in the civil engineering profession.

Ressler, S. and Russell, J. (2009). "The Sociology Of Professions: Application To Civil Engineering." Paper# 686. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** This paper applies the sociological theory of professions, as espoused by Abbott and Freidson, as a conceptual framework to assess the critical issues associated with the ongoing American Society of Civil Engineers' (ASCE) Policy Statement 465 initiative.

Russell, J.; Galloway, G.; Lenox, T.; and O'Brien, J. (2009). "ASCE Policy 465: Status And Next Steps." Paper# 42. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** The purpose of this paper is to discuss ASCE's current plan for implementing Policy Statement 465.

Saliklis, E.; Arens, R.; and Hanus, J. (2009). "Teaching Architects And Engineers: Up And Down The Taxonomy." Paper# 2. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The paper's hypothesis is that Engineering faculty typically move up Bloom's taxonomy of the cognitive domain, whereas Architecture faculty typically move down the taxonomy. This paper aims to determine how educators can aid students who seek larger global understanding, yet are often discouraged during their preliminary acquisition of knowledge. This thesis is explored by studying the literature surrounding the Cognitive Domain in both Civil Engineering and Architecture and providing suggestions for giving engineering students more opportunities to explore higher levels on Bloom's taxonomy in the undergraduate curriculum.

Sutterer, K. (2009). "Developing A Body Of Knowledge For Civil Engineering Specialization: Geotechnical Engineering ." Paper# 1815. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The paper presents a systematic process that could be used to assess the appropriate body of knowledge for students seeking technical specialization in geotechnical engineering. The paper supports permitting individual departments to define the appropriate body of knowledge for Technical Specialization, but encourages programs to engage in a systematic process to develop appropriate bodies of knowledge for their civil engineering sub disciplines as a service to their students.

Welch, R. (2009). "Integrating Professional Topics and Engineering Constraints Across The Curriculum ." Paper# 734. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** BOK (via Education and/or Experience)

## Appendix B (continued)

**[Annotation]** This paper discusses the way to integrate professional topics into the engineering curriculum throughout a student's undergraduate career. The author claims that topics must be introduced and wrestled with early in the curriculum, sustained through additional application during intermediate years, and engrained through integrated application during senior design.

Welch, R. (2009). "Surviving ABET Under The New Criteria - From The Eyes Of New Chair In A New CE Department." Paper# 733. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** Accreditation

**[Annotation]** This paper covers the processes, experiences, and lessons learned by a new department chair preparing for an ABET visit for the first time in a brand new department under the new 2008 Civil Engineering (CE) program criteria at the University of Texas at Tyler. The goal of this paper is to not only assist new department chairs and chairs of new departments, but also chairs of well established departments that have had a visit with some type of weakness at the exit statement.

Welker, A. (2009). "Lessons Learned From The Recent Accreditation Cycle." Paper# 1231. *Proceedings of the 2009 Conference of the American Society for Engineering Education*, June 2009, Austin, TX.

**[Topic Category]** Accreditation

**[Annotation]** This paper describes the accreditation of the Civil Engineering program at Villanova University during the fall of 2008. The author, an associate professor in the Department of Civil and Environmental Engineering at Villanova University, discusses the evolution of the assessment process from the accreditation criteria used in 1999 vs. the new accreditation criteria adopted in 2008. The paper discusses the key factors that led to a successful evaluation of the Civil Engineering Program at Villanova University and highlights changes to the Villanova curriculum and outcomes of the new program criteria.

Banzley, S.; Terry, R.; and Hotchkiss, R. (2010). "Achieving Civil Engineering BOK2 Outcomes Of Globalization, Leadership, Professional and Ethical Responsibility and Team Work In A General Education Class." Paper# 239. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper provides motivation from both the National Academy of Engineering and the American Society of Civil Engineers for engineering educators to provide more content in leadership, professional ethics, knowledge of global technical issues, and a more complete understanding of the world's cultures. The paper continues by describing the university criteria these courses must satisfy to be approved to fulfill both Social Science and Global and Cultural Awareness general education requirements and explains the various course modules that address the Civil Engineering BOK2 outcomes of globalization, leadership, professional and ethical responsibility, and teamwork.

Bielefeldt, A. (2010). "Student Perceptions Of The Civil Engineering Body Of Knowledge." Paper# 351. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** BOK (via Education and/or Experience)

## Appendix B (continued)

**[Annotation]** This paper summarizes student feedback on the revised version of the Body of Knowledge (BOK2) at the University of Colorado at Boulder. Students surveyed were freshmen and seniors, and their responses and commentary are presented in this paper with respect to the adequacy of the curriculum at CU when compared to the outcomes defined in the BOK2.

Doran, M.; Quagliana, C.; Doll, N.; and Russell, J.; and Harrington, G. (2010). "Strengthening The Body Of Knowledge – How Integration Of Practicing Engineers As Adjunct Faculty Can Enhance Educational Outcomes." Paper# 548. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The purpose of this paper is to describe why the University of Wisconsin-Madison's Department of Civil & Environmental Engineering has worked to integrate practitioners from multiple disciplines who possess extensive professional practice experience within the faculty team as Adjunct Faculty, how this is being done, and the unique aspects the Adjunct Faculty are contributing to the educational process.

Fridley, K. (2010). "How The Civil Engineering BOK2 Is Being Implemented At The University Of Alabama." Paper# 330. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The purpose of this paper is to provide a comprehensive analysis of the University of Alabama's civil engineering curriculum with respect to the second edition of the BOK2, or more specifically the BOK2 outcomes associated with the baccalaureate degree since the BOK2 includes outcomes for baccalaureate and post-baccalaureate formal education as well as pre-licensure experience.

Gunnink, B. (2010). "How The Civil Engineering BOK2 Can Be Implemented At Montana State University." Paper# 964. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The purpose of this paper is to provide a comprehensive analysis of Montana State University's Civil Engineering curriculum with respect to the second edition of the Civil Engineering Body of Knowledge for the 21st Century (BOK2), or more specifically the BOK2 outcomes associated with the baccalaureate degree since the BOK2 includes outcomes for baccalaureate and post baccalaureate formal education as well as pre-licensure experience.

Hall, K. (2010). "The Challenge Of Implementing The Civil Engineering BOK2 At [University A]." Paper# 1136. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper presents a comprehensive analysis of [University A's] civil engineering curriculum with respect to the BOK2 outcomes at the levels of achievement associated with the baccalaureate degree. The author claims the current curriculum addresses, in some fashion, all 24 BOK2 outcomes, however the program only addresses, to the recommended level of achievement, 6 of the 24 BOK2 outcomes; the remaining 18 BOK2 outcomes are not addressed to the specified level of achievement for the baccalaureate level.

## Appendix B (continued)

Hildreth, J. and Gehrig, B. (2010). "A Body Of Knowledge For The Construction Engineering and Management Discipline ." Paper# 1584. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper describes the process of defining a Body of Knowledge for Construction Engineering and Management undergraduate degrees. As part of a longitudinal review of the construction curriculum, a BOK regarding the technical aspects of construction management is defined based on a review of the requirements of multiple accrediting bodies. The BOK and the curriculum development process presented are independent of any accreditation body, which allows both to be used by any CM program regardless of current or future accreditation requirements.

Larson, D. and Hewes, J. (2010). "A Possible Civil Engineering BOK2 Curriculum." Paper# 275. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The purpose of this paper is threefold: (1) provide an analysis of Northern Arizona University's current undergraduate civil engineering curriculum with respect to the BOK2 with attention given to the challenging outcomes; (2) propose a revised BOK2-orientated curriculum within Northern Arizona University's context; and (3) provide an analysis of that curriculum.

List, G. (2010). "How The Civil Engineering BOK2 Could Be Implemented At NC State." Paper# 1648. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper discusses the way in which the ASCE's Body of Knowledge, version 2 (BOK2), might be implemented at North Carolina State in its Civil Engineering curriculum as perceived by the department head. More specifically, it examines the BOK2 outcomes that relate to the baccalaureate degree, since the plan for achieving the BOK2 outcomes includes post baccalaureate coursework and pre-licensure experience.

McManis, K. (2010). "How The Civil Engineering BOK2 Can Be Implemented At The University Of Louisiana." Paper# 327. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The purpose of this paper is to provide a comprehensive analysis of the University of Louisiana's civil engineering curriculum with respect to the second edition of the Civil Engineering Body of Knowledge for the 21st Century (BOK2), or more specifically the BOK2 outcomes associated with the baccalaureate degree since the BOK2 includes outcomes for baccalaureate and post baccalaureate formal education as well as pre-licensure experience. Specific emphasis is given to those BOK2 outcomes that previous survey data identified as being a challenge for many programs to address within current curricular design.

## Appendix B (continued)

Nixon, W. (2010). "Using History To Reinforce Ethics and Equilibrium." Paper# 895. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper explores the value of incorporating outcome 11 of the BOK2, "Analyze the impact of historical and contemporary issues on the identification, formulation, and solution of engineering problems and analyze the impact of engineering solutions on the economy, environment, political landscape, and society" into two classes, Statics and Bridge Engineering, at the University of Iowa.

Ressler, S. (2010). "Assessing The Standards For Assessment: Is It Time To Update Criterion 3?." Paper# 1522. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** Accreditation

**[Annotation]** In 2009 the Criteria Committee of the ABET Engineering Accreditation Commission initiated a continuous quality improvement process for its accreditation criteria. The purpose of this paper is to support the EAC Criteria Committee's initiative by providing a preliminary assessment of Criterion 3 outcomes in the context of the strategic direction of the engineering profession. The scope of the paper includes: (1) background on the initial formulation of Criterion 3, (2) a review of recent strategic vision statements that suggest a need for changes to Criterion 3, (3) a discussion of potential barriers to change, and (4) recommendations for aligning Criterion 3 with an emerging consensus about the essential attributes of future engineering professionals.

Rogers, G. (2010). "Continuous Quality Improvement In Engineering Education: Fact Or Fiction?." Paper# 1176. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** Accreditation

**[Annotation]** This paper examines how "continuous quality improvement" (CQI) processes should be demonstrated in engineering education and explores some of the common mistakes which can lead to considerable effort on the part of faculty with little evidence that the results are useful in understanding the strengths and weaknesses of student learning.

Sutterer, K. (2010). "The Civil Engineering BOK2 And Challenges To Implementation In A Private Undergraduate Engineering Institute." Paper# 1096. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** The purpose of this paper is to provide a comprehensive analysis of the civil engineering curriculum at Rose-Hulman Institute of Technology with respect to the second edition of the BOK2 and the outcomes described therein associated with the baccalaureate degree.

Tocco, J. and Carpenter, D. (2010). "Adopting The BOK2: The Quest To Slay The Multi-Headed Hydra." Paper# 667. *Proceedings of the 2010 Conference of the American Society for Engineering Education*, June 2010, Louisville, KY.



## Appendix B (continued)

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper provides an overview of the challenges faced and the various approaches taken by the Civil Engineering Department at Lawrence Technological University in its mission to integrate the BOK2 into the civil engineering program during the spring of 2008 as part of its annual program objectives/outcomes review process.

Bollo M. and Ventura, C. (2011). "A Model For The Post-Bachelor's Degree Education Of Structural Engineers Through A Collaboration Between Industry and Academia." Paper# 590. *Proceedings of the 2011 Conference of the American Society for Engineering Education*, June 2011, Vancouver, British Columbia.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** This paper presents a model developed in British Columbia, Canada, for preparing structural engineers for practice, especially in consulting firms, through a series of courses organized and offered through a collaborative effort between local practicing engineers and university faculty members.

Fridley, K. (2011). "Today's BSCE: A Survey Of Credit Hour Requirements." Paper# 1436. *Proceedings of the 2011 Conference of the American Society for Engineering Education*, June 2011, Vancouver, British Columbia.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** The purpose of this paper is to present the results of a survey and analysis of today's civil engineering and closely related curricula in terms of credit hours required for degree. The paper provides a comprehensive description of current degree requirements including both total credit hour requirements for degrees as well as a breakdown of the credit hours required in various major topic areas/categories such as mathematics and basic sciences, general engineering topics, and general education.

Kunberger, T.; Burian, S.; Lutey, W.; and Morse, A.; O'Neill, R.; Sanford-Bernhardt, K.; and Welker, A. (2011). "Twenty-First Century Civil Engineering: An Overview of Who, What, And Where." Paper# 619. *Proceedings of the 2011 Conference of the American Society for Engineering Education*, June 2011, Vancouver, British Columbia.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** The primary objective of this paper is to analyze the recent past and current demographics of the civil engineering work force and its sub-disciplines and use the information to draw conclusions on future trends and needs. The paper includes predictions into the next decade on the outlook for civil engineering as a function of location, type of industry, and comparison to other engineering disciplines.

Musselman, C.; Nelson, Jon; and Phillips, M. (2011). "Engineering Licensure Laws And Rules, Today and Tomorrow." Paper# 163. *Proceedings of the 2011 Conference of the American Society for Engineering Education*, June 2011, Vancouver, British Columbia.

**[Topic Category]** Licensure

**[Annotation]** The purpose of this paper is to provide a basic description of engineering licensure in the United States including the education, experience, examination, and continuing professional development qualifications required in order to acquire and maintain a license as a Professional Engineer, now and in the future. The paper also describes the legal context of

## Appendix B (continued)

engineering licensure, the form and function of state Boards of Licensure of Professional Engineers and selected current topics in engineering licensure.

O'Brien, J.; Wei, C.; and Coward, D. (2011). "What Does The Civil Engineering World Look Like? Let's Show It By The Numbers." Paper# 1453. *Proceedings of the 2011 Conference of the American Society for Engineering Education*, June 2011, Vancouver, British Columbia.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** This paper presents the civil and other engineering education enrollment and degree data from 1969 to 2009

Ressler, S. and Lynch, D. (2011). "The Civil Engineering Body Of Knowledge And Accreditation Criteria: A Plan For Long-Term Management Of Change." Paper# 668. *Proceedings of the 2011 Conference of the American Society for Engineering Education*, June 2011, Vancouver, British Columbia.

**[Topic Category]** Accreditation

**[Annotation]** This paper proposes a plan for long-term management of updates to the Civil Engineering BOK and the associated ABET accreditation criteria. In developing this proposal, the authors first summarize the chronological development of the Civil Engineering BOK and its associated accreditation criteria, demonstrate that continuous change is a defining characteristic of any professional BOK, and propose a long-term schedule of future BOK and criteria updates that will ensure the relevance of the BOK while enhancing predictability.

Russell, J.; Rogers, J.; Lenox, T.; and Coward, D. (2011). "Civil Engineering Master's Programs: A Comprehensive Review Of Types And Requirements." Paper# 602. *Proceedings of the 2011 Conference of the American Society for Engineering Education*, June 2011, Vancouver, British Columbia.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** This paper provides fundamental, statistical information on domestic civil engineering master's programs based upon a survey of 121 civil engineering departments completed in March 2011. The paper describes the range of existing civil engineering master's programs to include their names, types (research, project, and/or course only), entry requirements, number of credits required for degree, mode of delivery (on-campus vs. off-campus and face-to-face vs. on-line), and areas of specialization.

Nelson, J.K.; Fridley, K.; and Hall, K. (2012). "The Raise the Bar Initiative: Charting the Future by Understanding the Path to the Present -- How Are BSCE Curricula Responding?." Paper# TBD. *Proceedings of the 2012 Conference of the American Society for Engineering Education*, June 2012, San Antonio, TX.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper provides a review of the recommendations for formal education resulting from the "Raise the Bar" initiative that impact the undergraduate curriculum. The paper evaluates the effectiveness of efforts to implement the recommendations of the Raise the Bar Initiative based on a survey identifying changes made to civil engineering undergraduate curricula in three specific BSCE programs.

## Appendix B (continued)

Nelson, J.; Musselman, C.; Conzett, M.; and Phillips, M., and Anderson, K. (2012). "The Raise the Bar Initiative: Charting the Future by Understanding the Path to the Present -- Modifying the Model Laws and Rules for Engineering Licensure." Paper# TBD. *Proceedings of the 2012 Conference of the American Society for Engineering Education*, June 2012, San Antonio, TX.

**[Topic Category]** Licensure

**[Annotation]** This paper addresses the process followed by the NCEES to make the modifications to the model laws and rules for engineering licensure.. It describes the history, the lessons learned as perceived by the authors, and the next steps for implementation of the new educational standards. It also includes the experiences, observations, reflections, and opinions of the authors: four individuals who participated in the process of changing the NCEES models.

Phillips, M. and Holly, F. (2012). "The Raise the Bar Initiative: Charting the Future Through Strengthened Experiential Guidelines." Paper# TBD. *Proceedings of the 2012 Conference of the American Society for Engineering Education*, June 2012, San Antonio, TX.

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper provides the engineering education community with a summary of ASCE's Body of Knowledge (BOK) Experiential Fulfillment Committee's (BOKExFC) initial work to improve the pre-licensure attainment of experience outcomes for engineering interns. The paper provides a summary of the BOKExFC activities, and emphasizes the guidance for engineering interns, supervisors, and mentors for documenting, validating, and reporting experience activities during the pre-licensure state of the intern's career.

Ressler, S. (2012). "The Raise the Bar Initiative: Charting the Future by Understanding the Path to the Present -- Accreditation Criteria." Paper# TBD. *Proceedings of the 2012 Conference of the American Society for Engineering Education*, June 2012, San Antonio, TX.

**[Topic Category]** Accreditation

**[Annotation]** This paper (1) summarizes the decade-long process of developing and implementing new accreditation criteria in support of the ASCE Raise the Bar initiative; (2) identifies the principal lessons learned through this process; and (3) provides recommendations for future developments in the accreditation domain of this ongoing effort to raise the educational standard for civil engineering professional practice.

Ressler, S. (2012). "To Raise the Bar or Not: Addressing the Opposition." Paper# TBD. *Proceedings of the 2012 Conference of the American Society for Engineering Education*, June 2012, San Antonio, TX.

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** This paper assesses the key points of opposition presented in the ASME position paper, "Mandatory Educational Requirements for Engineering Licensure," from two complementary perspectives: (1) validity of each specific point of opposition, based on objective evidence, logic, and recent multi-disciplinary visions of the engineering profession's future; and (2) consistency with the theoretical framework of professionalism as described in the Sociology of Professions.

Russell, J. and Lenox, T. (2012). "The Raise the Bar Initiative: Charting the Future by Understanding the Path to the Present -- An Historical Overview ." Paper# TBD. *Proceedings*

## Appendix B (continued)

*of the 2012 Conference of the American Society for Engineering Education, June 2012, San Antonio, TX.*

**[Topic Category]** Raise the Bar Initiative -- Overview/Concepts

**[Annotation]** This paper, the first of the six papers, provides an overall summary of the Raise the Bar Initiative as witnessed and experienced by two of the long-term leaders of CAP<sup>3</sup>. The other five papers were written from five different, yet closely related, perspectives including: (1) civil engineering bodies of knowledge, (2) revised accreditation criteria, (3) changed university curricula, (4) experiential guidelines, and (5) modified licensure laws and rules. Much of the summary in this first paper is presented in tabular form, not duplicating the more detailed information written in the other five papers.

Walesh, S. (2012). "A Half Brain is Good: A Whole Brain Much Better." Paper# TBD. *Proceedings of the 2012 Conference of the American Society for Engineering Education, June 2012, San Antonio, TX.*

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper asserts that engineers should be more creative and innovative, and offers ideas on how to enable them to be more creative and innovative. After offering a brief brain primer, the paper introduces tools and techniques which recognize that, while creative and innovative ideas lie within most of us, we need mechanisms to release them within individuals and groups.

Walesh, S. (2012). "The BOK and Leadership Lessons Learned." Paper# TBD. *Proceedings of the 2012 Conference of the American Society for Engineering Education, June 2012, San Antonio, TX.*

**[Topic Category]** BOK (via Education and/or Experience)

**[Annotation]** This paper provides a summary of leadership lessons learned (LLL) from the BOK element of the CAP<sup>3</sup> effort. Given that this paper summarizes LLL primarily from a decade-long major change process, it offers two potentially useful takeaways for the reader. The first is an improved understanding of the BOK and the second is ideas about how to lead any change effort.

Appendix C

**List of Selected Individuals Working With ASCE to Raise the Bar**

The authors believe, for historical reasons, that the dedicated engineering professionals who worked on the various ASCE Raise the Bar committees should be identified in this paper. To this end, the authors prepared this appendix – consolidated from the various official documents of ASCE. An examination the committee listings clearly shows that the work to the Raise the Bar for the engineering profession was not accomplished by a small group of reform-minded militants, but a robust group of dedicated, committed, and concerned professionals.

The following abbreviations (related to position in committee) are used in the listings below:

C:	Chair	SL:	ASCE Staff Leader
M:	Member	SM:	ASCE Staff Member
VC:	Vice-Chair	CCM:	CAP3 Contact Member
E:	Editor	CSC:	CAP3 Staff Contact
CM:	Corresponding Member	EOM:	Ex-Officio Member
SC:	ASCE Staff Contact		

**1993 – 1994**

**1993-1994: Workshop on Civil Engineering Education Steering Committee**

Clinton E. Parker, P.E., F.ASCE (C)	Guy E. Jester, Ph.D., P.E., F.ASCE (M)
Donald A. Dupies, P.E., F.ASCE (M)	Charles Samson, Ph.D., P.E., F.ASCE (M)
WilliamHighter, Ph.D., P.E., F.ASCE (M)	James R. Schaaf, Ph.D., P.E., F.ASCE (M)

**1994 – 1995**

**1994-1995: Civil Engineering Education Conference Steering Committee**

James T. P. Yao, Ph.D., P.E. (C)	Jerry J. Marley, Ph.D., P.E., M.ASCE (M)
David S. Gedney, P.E., F.ASCE (M)	William Neuman, Ph.D., P.E., F.ASCE (M)
William J. Hall, Ph.D., P.E., NAE, Hon.M.ASCE (M)	David A. Novick, P.E. (M)
James P. Heaney, Ph.D., P.E., D.WRE, M.ASCE (M)	James W. Poirot, P.E., Pres.94.ASCE (M)
	Sandra L. Weber, M. ASCE (M)

**1996 – 1998**

**1996-1998: Task Committee Civil Engineering Education Initiatives (TCCEEI)**

Richard J. Scranton, M.ASCE (C)	David S. Gedney, P.E., F.ASCE (M)
Rafael L. Bras, Ph.D., P.E., F.ASCE (M)	Richard Hovey, P.E., F.ASCE (M)

## Appendix C (Continued)

William E. Kelly, P.E., F.ASCE (M)  
Daniel J. McGinley (M)  
Melvin Ramey, Ph.D., P.E., M.ASCE (M)

Jeffrey S. Russell, Ph.D., P.E., F.ASCE (M)  
Marla E. Berman, P.E. (SC)

### 1999 – 2000

#### **1999-2000: Task Committee on the First Professional Degree (TCFPD)**

Luther W. Graef, P.E., Pres.98.ASCE (C)  
Richard O. Anderson, P.E., Dist.M.ASCE (M)  
Eugene J. Fasullo, P.E., F.ASCE (M)  
Gerald E. Galloway, Ph.D., P.E., Hon.D.WRE,  
Dist.M.ASCE (M)

William E. Kelly, P.E., F.ASCE (M)  
Stuart G. Walesh, Ph.D., P.E., D.WRE,  
Dist.M.ASCE (M)  
Thomas A. Lenox, Ph.D., M.ASCE (SM)  
Michael Kupferman, P.E., M.ASCE (SL)

### 2000 - 2001

#### **2000-2001: Task Committee on the First Professional Degree (TCFPD)**

Luther W. Graef, P.E., Pres.98.ASCE (C)  
Richard O. Anderson, P.E., Dist.M.ASCE (M)  
Gerald E. Galloway, Ph.D., P.E., Hon.D.WRE,  
Dist.M.ASCE (M)  
William E. Kelly, P.E., F.ASCE (M)

Melvin R. Ramey, Ph.D., P.E., M.ASCE (M)  
Lawrence H. Roth, P.E., M.ASCE (M)  
Stuart G. Walesh, Ph.D., P.E., D.WRE,  
Dist.M.ASCE (M)  
Thomas A. Lenox, Ph.D., M.ASCE (SL)

### 2001 - 2002

#### **2001-2002: Task Cmte on Academic Prerequisites for Professional Practice (TCAP^3)**

Jeffrey S. Russell, Ph.D., P.E., F.ASCE (C)  
Richard O. Anderson, P.E., Dist.M.ASCE (M)  
Norman L. Buehring, P.E., F.ASCE (M)  
Gerald E. Galloway, Ph.D., P.E., Hon.D.WRE,  
Dist.M.ASCE (M)

Stuart G. Walesh, Ph.D., P.E., D.WRE,  
Dist.M.ASCE (M)  
Thomas A. Lenox, Ph.D., M.ASCE (SL)

### 2002 - 2003

#### **2002-2003: Task Cmte on Academic Prerequisites for Professional Practice (TCAP^3)**

Jeffrey S. Russell, Ph.D., P.E., F.ASCE (C)  
Stuart G. Walesh, Ph.D., P.E., D.WRE,  
Dist.M.ASCE (VC)  
Richard O. Anderson, P.E., Dist.M.ASCE (M)  
Norman L. Buehring, P.E., F.ASCE (M)  
Angela Desoto Duncan, P.E., M.ASCE (M)  
John E. Durrant, P.E., M.ASCE (M)  
Jonathan C. Esslinger, P.E., F.ASCE (M)

Gerald E. Galloway, Ph.D., P.E., Hon.D.WRE,  
Dist.M.ASCE (M)  
C. Gary Kellogg, P.E., S.E., F.ASCE (M)  
E. W. LeFevre, Ph.D., P.E., Dist.M.ASCE (M)  
Brook A. Maples, P.E., M.ASCE (M)  
David G. Mongan, P.E., Pres.08.ASCE (M)  
Craig N. Musselman, P.E., Dist.M.ASCE (M)  
Thomas A. Lenox, Ph.D., M.ASCE (SL)

## Appendix C (Continued)

### 2002-2003: TCAP^3 Body of Knowledge

Stuart G. Walesh, Ph.D., P.E., D.WRE,  
Dist.M.ASCE (C)  
Dale W. Sall, P.E., L.S., F.ASCE (VC)  
Abbie M. Dement (M)  
Gerald E. Galloway, Ph.D., P.E., Hon.D.WRE,  
Dist.M.ASCE (M)

Chris Hendrickson, Ph.D., Hon.M.ASCE (M)  
Ralph J. Hodek, Ph.D., P.E., F.ASCE (M)  
John S. Shearer, P.E., M.ASCE (M)  
Thomas A. Lenox, Ph.D., M.ASCE (SL)  
James J. O'Brien, P.E., M.ASCE (SC)

### 2002-2003: TCAP^3 Licensing Committee

Craig N. Musselman, P.E., Dist.M.ASCE (C)  
Dale W. Sall, P.E., L.S., F.ASCE (VC)  
Jonathan C. Esslinger, P.E., F.ASCE (M)

E. W. LeFevre, Ph.D., P.E., Dist.M.ASCE (M)  
Bobby E. Price, Ph.D., P.E., Dist.M.ASCE (M)

### 2002-2003: TCAP^3 Accreditation Committee

Richard O. Anderson, P.E., Dist.M.ASCE (C)  
Ernest T. Smerdon, Ph.D., P.E.,  
Dist.M.ASCE, NAE (VC)

Peter J. Carrato, Ph.D., P.E., F.ASCE (M)  
John W. Steadman, Ph.D. (M)  
Thomas A. Lenox, Ph.D., M.ASCE (SL)

## 2003 - 2004

### 2003-2004: Cmte on the Academic Prerequisites for Professional Practice (CAP^3)

Jeffrey S. Russell, Ph.D., P.E., F.ASCE (C)  
Stuart G. Walesh, Ph.D., P.E., D.WRE,  
Dist.M.ASCE (VC)  
Richard O. Anderson, P.E., Dist.M.ASCE (M)  
H. Edmund Bergeron, P.E., M.ASCE (M)  
Norman L. Buehring, P.E., F.ASCE (M)  
Gerald E. Galloway, Ph.D., P.E.,  
Hon.D.WRE, Dist.M.ASCE (M)  
W. Craig Helms, P.E. (M)

C. Gary Kellogg, P.E., S.E., F.ASCE (M)  
Oliver G. McGee (M)  
Craig N. Musselman, P.E., Dist.M.ASCE (M)  
Debbie A. Niemeier, Ph.D., M.ASCE (M)  
Erin E. Peterson, P.E., M.ASCE (M)  
Sheina K. Pool (M)  
Ernest T. Smerdon, Ph.D., P.E.,  
Dist.M.ASCE, NAE (M)  
Thomas A. Lenox, Ph.D., M.ASCE (SL)

### 2003-2004: CAP^3 Body of Knowledge

Stuart G. Walesh, Ph.D., P.E., D.WRE,  
Dist.M.ASCE (C)  
Michael J. Chajes, Ph.D., P.E. (M)  
Abbie M. Dement (M)  
Gerald E. Galloway, Ph.D., P.E., Hon.D.WRE,  
Dist.M.ASCE (M)  
Chris Hendrickson, Ph.D., Hon.M.ASCE (M)  
Ralph J. Hodek, Ph.D., P.E., F.ASCE (M)  
Dale W. Sall, P.E., L.S., F.ASCE (VC)

John S. Shearer, P.E., M.ASCE (M)  
Thomas Siller, Ph.D. (M)  
John Tawresey, P.E. (M)  
Stuart G. Walesh, Ph.D., P.E. (M)  
Marlee Ann Walton, P.E., LSI (M)  
Thomas A. Lenox, Ph.D., M.ASCE (SL)  
James J. O'Brien, P.E., M.ASCE (SM)

## Appendix C (Continued)

### 2003-2004: CAP<sup>3</sup> BOK Curricula

Stuart G. Walesh, Ph.D., P.E., D.WRE,  
Dist.M.ASCE (C)  
Kevin G. Sutterer, P.E., M.ASCE (M)  
Jeffrey C. Evans, Ph.D., P.E., M.ASCE (M)  
C. Dale Jacobson, P.E., BCEE, F.ASCE (M)  
Young C. Kim (M)  
Thomas J. Siller, Ph.D., M.ASCE (M)

James K. Nelson, Ph.D., P.E., F.ASCE (M)  
John G. Tawresey, P.E., M.ASCE (M)  
Marlee A. Walton, P.E., M.ASCE (M)  
Robert L. Mullen, Ph.D., P.E., F.ASCE (M)  
Jeffrey S. Russell, Ph.D., P.E., F.ASCE (CCM)  
James J. O'Brien, P.E., M.ASCE (SL)

### 2003-2004: CAP<sup>3</sup> Licensing Committee

Craig N. Musselman, P.E., Dist.M.ASCE (C)  
Dale W. Sall, P.E., L.S., F.ASCE (VC)  
Walter Marlowe, P.E., M.ASCE (M)

E. W. LeFevre, Ph.D., P.E., Dist.M.ASCE (M)  
Bobby E. Price, Ph.D., P.E., Dist.M.ASCE (M)  
Walter Marlowe, P.E., M.ASCE (SL)

### 2003-2004: CAP<sup>3</sup> Accreditation Committee

Richard O. Anderson, P.E., Dist.M.ASCE (C)  
Ernest T. Smerdon, Ph.D., P.E.,  
Dist.M.ASCE, NAE (VC)  
Peter J. Carrato, Ph.D., P.E., F.ASCE (M)  
H. Chik Erzurumlu, Ph.D., P.E., F.ASCE (M)

Maurice C. Mow, Ph.D., P.E., M.ASCE (M)  
John W. Steadman, Ph.D. (M)  
Thomas A. Lenox, Ph.D., M.ASCE (SL)  
James J. O'Brien, P.E., M.ASCE (SM)

## 2004 – 2005

### 2004-2005: Cmte on the Academic Prerequisites for Professional Practice (CAP<sup>3</sup>)

Jeffrey S. Russell, Ph.D., P.E., F.ASCE (C)  
Stuart G. Walesh, Ph.D., P.E., D.WRE,  
Dist.M.ASCE (VC)  
Richard O. Anderson, P.E., Dist.M.ASCE (M)  
H. Edmund Bergeron, P.E., M.ASCE (M)  
Gerald E. Galloway, Ph.D., P.E.,  
Hon.D.WRE, Dist.M.ASCE (M)  
W. Craig Helms, P.E. (M)  
E. W. LeFevre, Ph.D., P.E., Dist.M.ASCE (M)  
Craig N. Musselman, P.E., Dist.M.ASCE (M)  
James K. Nelson, Ph.D., P.E., F.ASCE (M)  
Debbie A. Niemeier, Ph.D., M.ASCE (M)  
Erin E. Peterson, P.E., M.ASCE (M)

Sheina K. Pool (M)  
James R. Schaaf, Ph.D., P.E., F.ASCE (M)  
Ernest T. Smerdon, Ph.D., P.E.,  
Dist.M.ASCE, NAE (M)  
William A. Welsh, Ph.D., P.E., F.ASCE (M)  
N. Catherine Bazan-Arias, Ph.D., P.E.,  
M.ASCE (CM)  
Robert C. Krebs, P.E., L.S., F.ASCE (CM)  
David R. Martinelli, Ph.D., A.M.ASCE (CM)  
Brandon T. Pierce, A.M.ASCE (CM)  
John W. Steadman, Ph.D. (CM)  
Thomas A. Lenox, Ph.D., M.ASCE (SL)  
Walter Marlowe, P.E., M.ASCE (SM)

### 2004-2005: CAP<sup>3</sup> Accreditation Committee

Wayne R. Bergstrom, Ph.D., P.E., F.ASCE (C)  
Stephen J. Ressler, Ph.D., P.E.,  
Dist.M.ASCE (VC)  
Peter J. Carrato, Ph.D., P.E., F.ASCE (M)  
H. Chik Erzurumlu, Ph.D., P.E., F.ASCE (M)  
Ron Harichandran, Ph.D., P.E., F.ASCE (M)  
David R. Martinelli, Ph.D., A.M.ASCE (M)

Maurice C. Mow, Ph.D., P.E., M.ASCE (M)  
Craig N. Musselman, P.E., Dist.M.ASCE (M)  
James K. Nelson, Ph.D., P.E., F.ASCE (M)  
John W. Steadman, Ph.D. (M)  
Stuart G. Walesh, Ph.D., P.E., D.WRE,  
Dist.M.ASCE (M)  
William A. Welsh, Ph.D., P.E., F.ASCE (M)



## Appendix C (Continued)

Jeffrey S. Russell, Ph.D., P.E., F.ASCE  
(CCM)

### 2004-2005: CAP<sup>3</sup> Curricula

James K. Nelson, Ph.D., P.E., F.ASCE (C)  
Thomas J. Siller, Ph.D., M.ASCE (VC)  
Thomas J. Descoteaux, P.E., M.ASCE (M)  
Jeffrey C. Evans, Ph.D., P.E., M.ASCE (M)  
Debra S. Larson, P.E., M.ASCE (M)  
Allen Estes, Ph.D., P.E., M.ASCE (M)  
Maher Tadros, Ph.D., P.E., M.ASCE (M)  
Laurence J. Jacobs, Ph.D., M.ASCE (M)  
C. Dale Jacobson, P.E., BCEE, F.ASCE (M)  
Young C. Kim (M)  
Robert C. Knox, A.M.ASCE (M)  
Randall L. Kolar, P.E., M.ASCE (M)  
Michael Kupferman, P.E., M.ASCE (M)  
Debra S. Larson, P.E., M.ASCE (M)  
Arthur C. Miller, Ph.D., P.E., L.S., D.WRE,  
F.ASCE (M)

### 2004-2005: CAP<sup>3</sup> Licensing Committee

Craig N. Musselman, P.E., Dist.M.ASCE (C)  
Dale W. Sall, P.E., L.S., F.ASCE (VC)  
E. W. LeFevre, Ph.D., P.E., Dist.M.ASCE (M)  
H. Edmund Bergeron, P.E., M.ASCE (M)  
Kerry M. Hawkins, P.E., M.ASCE (M)  
Brian R. Brenner, P.E., M.ASCE (M)

### 2004-2005: CAP<sup>3</sup> Validation & Fulfillment

Jeffrey S. Russell, Ph.D., P.E., F.ASCE (C)  
Stuart G. Walesh, Ph.D., P.E., D.WRE,  
Dist.M.ASCE (VC)  
Gerald E. Galloway, Ph.D., P.E.,  
Hon.D.WRE, Dist.M.ASCE (VC)  
Rick Barnaby (M)  
H. Edmund Bergeron, P.E., M.ASCE (M)  
Mark Brewer (M)  
Mary Leslie (M)

Thomas A. Lenox, Ph.D., M.ASCE (SL)  
James J. O'Brien, P.E., M.ASCE (SM)

Peter Hoadley, Ph.D., P.E., F.ASCE (M)  
Gayle F. Mitchell, Ph.D., P.E., M.ASCE (M)  
J.P. Mohsen, Ph.D. (M)  
Robert L. Mullen, Ph.D., P.E., F.ASCE (M)  
Michael A. Robinson (M)  
Kevin G. Sutterer, P.E., M.ASCE (M)  
John G. Tawresey, P.E., M.ASCE (M)  
Stuart G. Walesh, Ph.D., P.E., D.WRE,  
Dist.M.ASCE (M)  
Marlee A. Walton, P.E., M.ASCE (M)  
Brian R. Brenner, P.E., M.ASCE (CM)  
Edwin R. Schmeckpeper, P.E., M.ASCE (CM)  
Jeffrey S. Russell, Ph.D., P.E., F.ASCE (CCM)  
Thomas A. Lenox, Ph.D., M.ASCE (CCM)  
James J. O'Brien, P.E. (SL)

Kerry M. Hawkins, P.E., M.ASCE (M)  
Richard Moore (M)  
Bobby E. Price, Ph.D., P.E., Dist.M.ASCE (M)  
Jeffrey S. Russell, Ph.D., P.E., F.ASCE (CCM)  
Thomas A. Lenox, Ph.D., M.ASCE (CCM)  
Walter T. Marlowe, P.E., M.ASCE (SL)

James K. Nelson, Ph.D., P.E., F.ASCE (M)  
John P. Klus, P.E., M.ASCE (M)  
Craig N. Musselman, P.E., Dist.M.ASCE (M)  
Robyn S. Colosimo, P.E., F.ASCE (M)  
John Casazza, Aff.M.ASCE (M)  
Thomas A. Lenox, Ph.D., M.ASCE (CCM)  
Walter Marlowe, P.E., M.ASCE (SC)

<b>2005 - 2006</b>
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**2005-2006: Cmte on the Academic Prerequisites for Professional Practice (CAP^3)**

<p>Jeffrey S. Russell, Ph.D., P.E., F.ASCE (C)          Gerald E. Galloway, Ph.D., P.E., Hon.D.WRE,          Dist.M.ASCE (VC)          S. G. Walesh, Ph.D., P.E., D.WRE, Dist.M.ASCE          (VC)          Reginald L. Amory, Ph.D., P.E., F.ASCE (M)          Richard O. Anderson, P.E., Dist.M.ASCE (C)          N. Catherine Bazan-Arias, Ph.D., P.E.,          M.ASCE (CM)          Wayne R. Bergstrom, Ph.D., P.E., F.ASCE (C)          Birdel F. Jackson, III, P.E., M.ASCE (M)          Robert C. Krebs, P.E., L.S., F.ASCE (CM)          E. W. LeFevre, Ph.D., P.E., Dist.M.ASCE (M)</p>	<p>David R. Martinelli, Ph.D., A.M.ASCE (M)          Craig N. Musselman, P.E., Dist.M.ASCE (M)          James K. Nelson, Ph.D., P.E., F.ASCE (M)          Sheina K. Pool (M)          Stephen J. Ressler, Ph.D., P.E., Dist.M.ASCE (CM)          James R. Schaaf, Ph.D., P.E., F.ASCE (M)          Ernest Thomas Smerdon, Ph.D., P.E.,          Dist.M.ASCE, NAE (M)          John W. Steadman, Ph.D. (M)          Thomas A. Lenox, Ph.D., M.ASCE (SL)          Walter T. Marlowe, P.E., M.ASCE (SM)          James J. O'Brien, P.E., M.ASCE (SC)</p>
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**2005-2006: CAP^3 Accreditation Committee**

<p>Wayne R. Bergstrom, Ph.D., P.E., F.ASCE (C)          Stephen Ressler, Ph.D., P.E., Dist.M.ASCE (VC)          Richard O. Anderson, P.E., Dist.M.ASCE (M)          Phillip E. Borrowman, P.E., F.ASCE (M)          Peter J. Carrato, Ph.D., P.E., F.ASCE (M)          H. Chik Erzurumlu, Ph.D., P.E., F.ASCE (M)          Ronald Harichandran, Ph.D., P.E., F.ASCE (M)          David R. Martinelli, Ph.D., A.M.ASCE (M)          Robert Mimiaga, P.E., F.ASCE (M)          Craig N. Musselman, P.E., Dist.M.ASCE (M)</p>	<p>James K. Nelson, Ph.D., P.E., F.ASCE (M)          Ernest T. Smerdon, Ph.D., P.E., Dist.M.ASCE,          NAE (M)          Daniel S. Turner, PhD., P.E., Pres.99.ASCE (M)          Stuart G. Walesh, Ph.D., P.E., D.WRE,          Dist.M.ASCE (M)          Jeffrey S. Russell, Ph.D., P.E., F.ASCE (CCM)          Thomas A. Lenox, Ph.D., M.ASCE (SL)          James J. O'Brien, P.E., M.ASCE (SC)</p>
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**2005-2006: CAP^3 Body of Knowledge**

<p>Richard O. Anderson, P.E., Dist.M.ASCE (C)          Kenneth J. Fridley, Ph.D., F.ASCE (VC)          Stuart G. Walesh, Ph.D., P.E., D.WRE,          Dist.M.ASCE (E)          Anirban De, Ph.D., P.E., M.ASCE (M)          Decker Hains, Ph.D., P.E., M.ASCE (M)          Ronald Harichandran, Ph.D., P.E., F.ASCE (M)          Manoj K. Jha, P.E., M.ASCE (M)          William R. Knocke, Ph.D., P.E., F.ASCE (M)          David A. Lange, Ph.D., P.E., M.ASCE (M)          Melanie L. Lawrence, A.M.ASCE (M)          Timothy F. Lengyel, P.E., M.ASCE (M)          Daniel R. Lynch, Ph.D., F.ASCE (M)          Robert E. Mackey, P.E., M.ASCE (M)          John M. Mason, Ph.D., P.E., M.ASCE (M)</p>	<p>JoAnn Silverstein, P.E., M.ASCE (M)          Brian R. Brenner, P.E., M.ASCE (CM)          P. Champagne, Ph.D., P.E., AM.ASCE (CM)          Karen C. Chou, Ph.D., P.E., F.ASCE (CM)          Robert Ettema (CM)          Peter Hoadley, Ph.D., P.E., F.ASCE (CM)          C. Gary Kellogg, P.E., S.E., F.ASCE (CM)          Merlin Kirschenman, P.E., M.ASCE (CM)          Kenneth W. Lamb, S.M.ASCE (CM)          Jerry J. Marley, Ph.D., P.E., M.ASCE (CM)          Paul W. McMullin, P.E., M.ASCE (CM)          Donald E. Milks, Ph.D., P.E., F.ASCE (CM)          S. J. Ressler, Ph.D., P.E., Dist.M.ASCE (CM)          Steven D. Sanders, P.E., M.ASCE (CM)          Jennifer W. Shannon, P.E., M.ASCE (CM)</p>
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## Appendix C (Continued)

Alan T. Sheppard, P.E., M.ASCE (CM)  
Johann F. Szautner, P.E., L.S., M.ASCE (CM)  
Marlee A. Walton, P.E., M.ASCE (M)

Jeffrey S. Russell, Ph.D., P.E., F.ASCE (CCM)  
Thomas A. Lenox, Ph.D., M.ASCE (SL)  
James J. O'Brien, P.E., M.ASCE (SM)

### 2005-2006: CAP<sup>3</sup> Curricula

James K. Nelson, Ph.D., P.E., F.ASCE (C)  
Thomas J. Siller, Ph.D., M.ASCE (VC)  
Brian R. Brenner, P.E., M.ASCE (M)  
Thomas J. Descoteaux, P.E., M.ASCE (M)  
Allen Estes, Ph.D., P.E., M.ASCE (M)  
Jeffrey C. Evans, Ph.D., P.E., M.ASCE (M)  
Charles R. Glagola, Ph.D., P.E., M.ASCE (M)  
Peter Hoadley, Ph.D., P.E., F.ASCE (M)  
David H. Huddleston, P.E., M.ASCE (M)  
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### 2005-2006: CAP<sup>3</sup> Licensing Committee

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## 2006 - 2007

### 2006-2007: Cmte on the Academic Prerequisites for Professional Practice (CAP<sup>3</sup>)

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Appendix C (Continued)

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**2006-2007: CAP^3 Accreditation Committee**

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**2006-2007: CAP^3 Body of Knowledge**

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## Appendix C (Continued)

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### **2006-2007: CAP<sup>3</sup> Curricula**

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Michael A. Robinson (M)  
Edwin R. Schmeckpeper, P.E., M.ASCE (M)  
Kevin G. Sutterer, P.E., M.ASCE (M)  
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### **2006-2007: CAP<sup>3</sup> Licensing Committee**

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## 2007 - 2008

### **2007-2008: Cmte on the Academic Prerequisites for Professional Practice (CAP<sup>3</sup>)**

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Stephen Ressler, Ph.D., P.E., Dist.M.ASCE (M)  
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Appendix C (Continued)

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**2007-2008: CAP^3 Accreditation Committee**

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Ronald Harichandran, Ph.D., P.E., F.ASCE (M)  
Robert Mimiaga, P.E., F.ASCE (M)  
Ernest T. Smerdon, Ph.D., P.E., Dist.M.ASCE,  
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**2007-2008: CAP^3 Body of Knowledge**

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Dist.M.ASCE (E)  
Anirban De, Ph.D., P.E., M.ASCE (M)  
Decker Hains, Ph.D., P.E., M.ASCE (M)  
Ronald Harichandran, Ph.D., P.E., F.ASCE (M)  
Peter Hoadley, Ph.D., P.E., F.ASCE (M)  
Manoj K. Jha, P.E., M.ASCE (M)  
David A. Lange, Ph.D., P.E., M.ASCE (M)  
Melanie L. Lawrence, A.M.ASCE (M)  
Timothy F. Lengyel, P.E., M.ASCE (M)  
Robert E. Mackey, P.E., M.ASCE (M)  
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Carsten D. Ahrens, Ph.D. (CM)  
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## Appendix C (Continued)

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### **2007-2008: CAP^3 Licensing Committee**

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### **2007-2008: CAP^3 Experience Committee**

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### **2007-2008: CAP^3 BOK Educational Fulfillment Committee (BOKEdFC)**

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### **2007-2008: CAP^3 BOK Experiential Fulfillment Committee (BOKExFC)**

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## 2008 - 2009

### **2008-2009: Cmte on the Academic Prerequisites for Professional Practice (CAP^3)**

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## Appendix C (Continued)

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### **2008-2009: CAP^3 Accreditation Committee**

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### **2008-2009: CAP^3 Licensing Committee**

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Jon Nelson, P.E., M.ASCE (VC)  
Robert C. Krebs, P.E., L.S., F.ASCE (M)  
E. W. LeFevre, Ph.D., P.E., Dist.M.ASCE (M)  
Monte L. Phillips, Ph.D., P.E., F.ASCE (M)  
B. E. Price, Ph.D., P.E., Dist.M.ASCE (M)  
Jeffrey S. Russell, Ph.D., P.E., F.ASCE (M)  
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### **2008-2009: CAP^3 Body of Knowledge**

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### **2008-2009: CAP^3 BOK Educational Fulfillment Committee**

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Leslie K. Daugherty, P.E., M.ASCE (CM)  
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## Appendix C (Continued)

Merlin Kirschenman, P.E., M.ASCE (CM)  
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### **2008-2009: CAP^3 BOK Experiential Fulfillment Committee**

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## 2009 - 2010

### **2009-2010: Cmte on the Academic Prerequisites for Professional Practice (CAP^3)**

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## Appendix C (Continued)

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### **2009-2010: CAP^3 Accreditation Committee**

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### **2009-2010: CAP^3 Advocacy Committee**

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### **2009-2010: CAP^3 BOK Educational Fulfillment Committee**

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## Appendix C (Continued)

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Donald D. Carpenter, A.M.ASCE (CM)	Zane W. Mitchell, Jr., M.ASCE (CM)
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### **2009-2010: CAP<sup>3</sup> BOK Experiential Fulfillment Committee**

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Wayne R. Bergstrom, Ph.D., P.E., F.ASCE (M)	Alfred Kofi Gand, A.M.ASCE (CM)
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### **2009-2010: Task Committee on Implementing the Competency Strategy (TCICS)**

Thomas M. Rachford, Ph.D., P.E., F.ASCE (C)	Edward L. Robinson, P.E., L.S., F.ASCE (M)
Christine F. Andersen, P.E., M.ASCE (M)	Robert A. Victor, P.E., M.ASCE (M)
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Gerald E. Galloway, Jr., Ph.D., P.E., Hon.D.WRE, Dist.M.ASCE (M)	Charles (Casey) Dinges, Aff.M.ASCE (SC) :
D. Wayne Klotz, P.E., D.WRE, F.ASCE (M)	Jeff Russell, Ph.D., P.E., Dist.M.ASCE (EOM)

2010 - 2011
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**2010-2011: Cmte on the Academic Prerequisites for Professional Practice (CAP3)**

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 Jon Nelson, P.E., Dist.M.ASCE (M)  
 William J. Rahmeyer, M.ASCE (M)  
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 Robert A. Victor, P.E., M.ASCE (M)  
 Stuart G. Walesh, Ph.D., P.E., D.WRE,  
 Dist.M.ASCE (M)  
 Richard Anderson (CM)  
 N. C. Bazan-Arias, Ph.D., P.E., F.ASCE (CM)  
 Wayne R. Bergstrom, Ph.D., P.E., F.ASCE (CM)

Phillip E. Borrowman, P.E., F.ASCE (CM)  
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**2010-2011: CAP^3 Accreditation Committee**

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**2010-2011: CAP^3 Licensing Committee**

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 Kerry M. Hawkins, P.E., M.ASCE (CM)  
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**2010-2011: CAP^3 Advocacy Committee**

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## Appendix C (Continued)

### 2010-2011: CAP<sup>3</sup> Body of Knowledge

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### 2010-2011: CAP<sup>3</sup> BOK Educational Fulfillment Committee

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## Appendix C (Continued)

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## Appendix C (Continued)

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Appendix D  
**ASCE Presidents Supporting and Leading the Raise the Bar Initiative  
1998 - 2012**

The authors also wish to express their gratitude to the leaders of the American Society of Civil Engineers for their unfailing support of the Raise the Bar initiative, the Committee on the Academic Prerequisites for Professional Practice (CAP<sup>3</sup>), and the CAP<sup>3</sup> leaders since 1998. The continuity of their support, vision, and leadership was critical to the furthering of the Raise the Bar initiative.

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