
AC 2012-3876: THE "RAISE THE BAR" INITIATIVE: CHARTING THE FUTURE BY UNDERSTANDING THE PATH TO THE PRESENT - MODIFYING THE MODEL LAWS AND RULES FOR ENGINEERING LICENSURE

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**The “Raise the Bar” Initiative:
Charting the Future by Understanding the Path to the Present
Modifying the Model Laws and Rules for Engineering Licensure**

Abstract

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 have been working to reform civil engineering education. 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 (PS 465). PS 465 states that in the future, education beyond the baccalaureate degree will be necessary for entry into the professional practice of civil engineering. In 2002, an ASCE Board-level committee, the Committee on Academic Prerequisites for Professional Practice (CAP³), was formed to study and implement the actions that would be necessary to achieve this vision for civil engineering. The last 10 years have produced significant progress in ASCE’s “Raise the Bar” initiative.

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 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 several scholarly papers that will be written and presented in recognition of the tenth anniversary of establishing CAP³. The collective papers will provide engineering educators and practitioners with a description of the history, lessons learned, and next steps related to the “Raise the Bar” initiative. These papers will be written from six different, yet related, perspectives including the (1) overall initiative, (2) civil engineering bodies of knowledge, (3) changed university curricula, (4) experiential guidelines, (5) revised accreditation criteria, and (6) modified licensure laws and rules. This paper addresses the sixth perspective: the process of modifying the educational standards for engineering licensure in the state laws and rules.

Because ASCE considers “professional practice” to mean “licensed practice,” implementation of the “Raise the Bar” initiative must include the modification of the requirements for engineering licensure. Individual states and other U.S. jurisdictions regulate the practice of engineering through their licensure laws and rules; therefore, implementation will ultimately have to include law and rule changes at the state level. However, the National Council of Examiners for Engineering and Surveying (NCEES) maintains model documents called the *Model Law* and the *Model Rules*. These documents represent a consensus of what the licensure boards across the United States believe the law and rules should look like, and they are generally used as a guide

when jurisdictions consider statute or rule revisions. Consequently, the first step in the process of modifying the licensure requirements in the states was for NCEES to modify its models. This paper addresses the process followed by the NCEES to make these modifications. 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.

Introduction

The practice of engineering is regulated through licensure in all 50 states, the District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands. Each of these 54 jurisdictions has its own statutes and rules that establish licensure requirements to practice engineering (qualifications) and how that practice is conducted (procedures and conduct). The statutes and rules also establish that the requirements are to be administered and enforced by licensure boards, which are generally made up of both professional and public members. The boards regulate as an arm of government, but the engineering profession is represented in the regulatory process by virtue of their professional members.

In 1907, Wyoming enacted the first state statute to address engineering practice in the United States. By the end of 1919, 10 states had licensure laws, and by the end of the following year, 20 states had such laws. By 1920, significant state-to-state differences in the qualifications for licensure indicated the need for a central body to coordinate the individual state efforts, and the Council of Boards of Engineering Examiners was formed¹. Today, that organization is called the National Council of Examiners for Engineering and Surveying (NCEES).

NCEES consists of 69 licensure boards. Of these, 40 regulate both engineering and surveying, 14 regulate only engineering, 14 regulate only surveying, and one regulates only structural engineering. Each board has an equal vote on all motions at the NCEES annual meeting, whether related to engineering or surveying. NCEES is subdivided regionally into four zones: Central, Northeast, Southern, and Western. Each zone elects one vice president who serves on the NCEES board of directors, along with the other members—president, president-elect, immediate past-president, and treasurer—who are elected at large. The zones also meet independently each spring to be briefed on issues that will be considered at the NCEES annual meeting and to develop zone-sponsored positions, motions, and resolutions.^{2,3}

Although NCEES has made significant progress over the past 90 years toward uniformity in the state laws and rules, the requirements for licensed practice still vary from jurisdiction to jurisdiction. A number of factors will always result in some variability: These include conditions peculiar to a particular region or state; the type of jurisdiction and nature of its formational documents; the jurisdiction's historical approaches to regulation; politics; and the manner in which legislation and regulations are promulgated in the United States—by open debate with both political and public participation. However, NCEES continues to strive toward a greater level of uniformity. The primary way it does this is by maintaining the NCEES *Model Law* and *Model Rules (ML&MR)*. These model documents reflect a consensus of what the licensing boards from across the United States believe the licensure laws and rules should look like, and

all licensure jurisdictions are encouraged to consider them whenever their statutes and/or rules are opened for revision.

The three primary qualifications required to obtain a license to practice engineering are education, experience, and examination. Since its inception, NCEES has essentially eliminated the variability in licensure examinations by developing nationally normed examinations that are used by all jurisdictions. A few supplemental state-specific examinations still exist, but the number continues to dwindle. Experience requirements also vary somewhat, but the differences are usually coupled with different educational pathways allowed for licensure. Variations in the educational requirements also remain common, although they continue to diminish as well. For example, few jurisdictions still allow individuals to be licensed based only on experience and examination without any formal education. Twenty years ago, that pathway was still common. Although that particular pathway has nearly been eliminated, several alternate pathways allowing something less than a degree from a program accredited by the Engineering Accreditation Commission of ABET, Inc. (EAC/ABET) still exist in many jurisdictions.

Before 2006, the NCEES *ML&MR* allowed three educational pathways to licensure. The basic pathway required a bachelor's degree (B.S.) from a program accredited by EAC/ABET. Two other pathways relating to post-baccalaureate degrees (masters and doctorates) existed, but these also had some connections to accreditation by EAC/ABET. Consequently, the minimum educational standard for licensure as expressed in the NCEES *ML&MR* was essentially the EAC/ABET B.S.⁴

Starting in 2001, movements—with roots in both ASCE and NCEES—were initiated to raise the level of the educational qualification for licensure to something beyond an EAC/ABET B.S. ASCE's PS 465 clearly recommended change, but NCEES also had its own concerns. The two movements grew concurrently and led to changes to the NCEES model documents. ASCE does not claim credit for the changes—the changes were clearly for NCEES to make—but ASCE was appreciative of the opportunities to participate in the process and did work to promote the outcome.

Early History

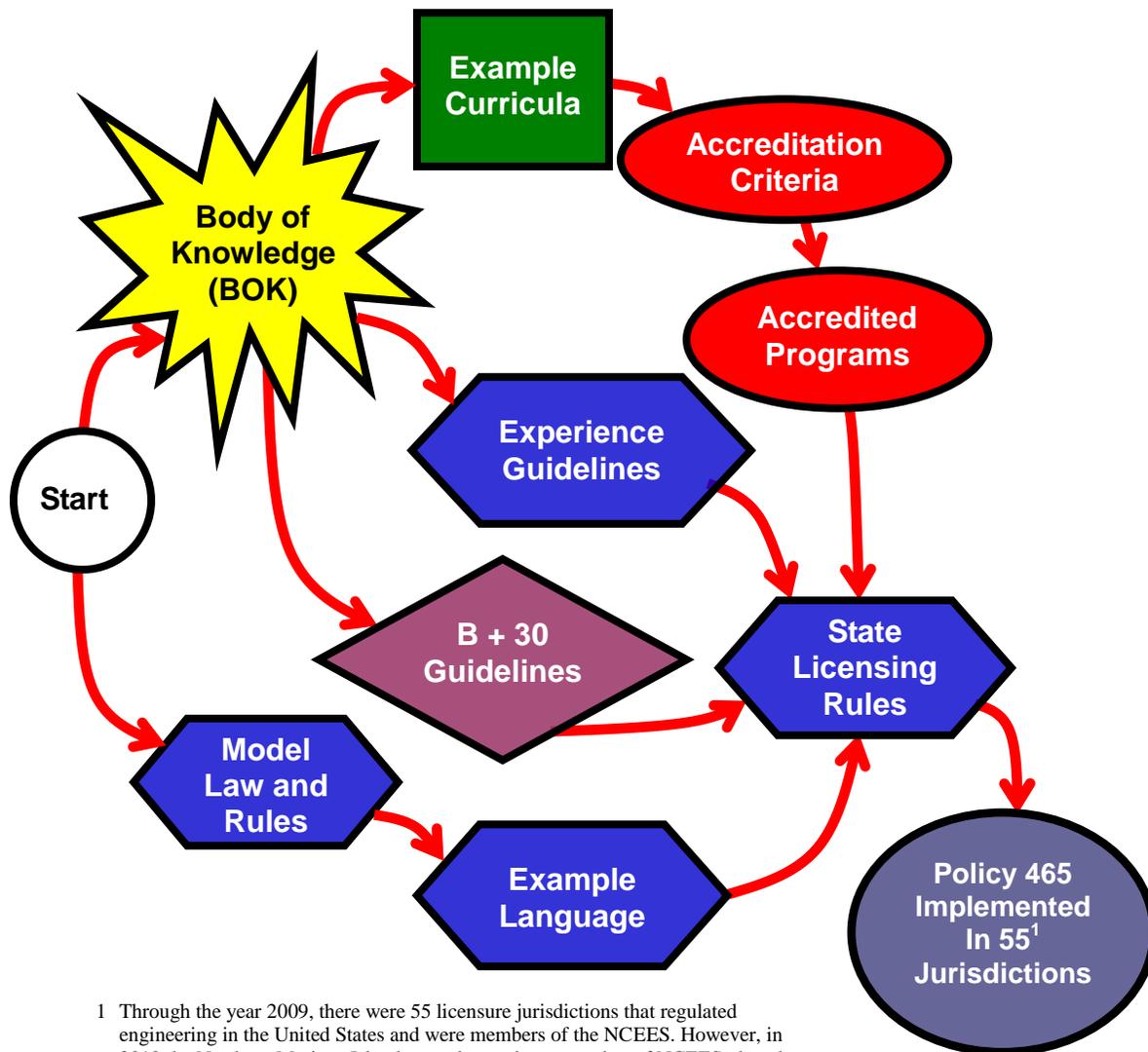
The American Society of Civil Engineers (ASCE) began a process to consider the state of civil engineering education in 1995 by convening the Civil Engineering Education Conference (CEEC '95). The report prepared by the CEEC '95 noted many changes confronting the civil engineering profession and suggested that the profession must respond proactively. The report also concluded that the current four-year baccalaureate degree was becoming inadequate for academic preparation for the professional practice of civil engineering. CEEC '95's call for action resulted in the adoption in 1998 of the first version of ASCE Policy Statement 465, which supported the “concept of the Master's Degree as the First Professional Degree for the practice of civil engineering at the professional level.”⁵ After further committee work, in 2001 ASCE revised the preamble of the policy to say that ASCE “supports the concept of a master's degree or equivalent as a prerequisite for licensure and the practice of civil engineering at the professional level.”⁶ This statement equated “practice at the professional level” with “licensed practice” and thus made licensure an important part of the initiative.

Immediately after adoption of the second version of PS 465, ASCE formed a task committee to implement the policy. Later, the group was elevated to a full board committee called the Committee on Academic Prerequisites for Professional Practice (CAP³).⁷ As shown in Figure 1, the CAP³ plan for the implementation of PS 465 includes several activity paths, all of which culminate with the modification of the statutes and rules governing engineering practice in all licensure jurisdictions.⁸ All of the paths have to be completed for ASCE to realize full implementation. The bottom path was handled by the Licensure Subcommittee of CAP³. The first step in that path was to work with the NCEES in amending the *ML&MR* to reflect the additional education requirements consistent with the provisions of PS 465. This paper addresses ASCE's involvement in the process to complete and maintain this first step.

Since its inception, members of CAP³ have made hundreds of presentations on the initiative. The presentations helped the committee learn what the profession thought about the education issue and at the same time allowed it to share ASCE's position. CAP³ also developed a detailed body of knowledge (BOK)⁹ required for professional practice in civil engineering and assisted with establishing a vision for civil engineering in 2025 through its involvement with the preparation of the report *Vision for Civil Engineering in 2025*.¹⁰ These works led to a refinement of PS 465 in 2007 that now "supports the attainment of a Body of Knowledge (BOK) for entry into the practice of civil engineering at the professional level."¹¹

Work of the ELQTF: 2001—2003

One of the earliest presentations relating to PS 465 by CAP³ was in 2002 to an NCEES-sponsored group called the Engineering Licensure Qualifications Task Force (ELQTF). ELQTF was formed by NCEES to "assess the current licensure process (three E's) in regard to licensure qualifications and make recommendations for enhancement or change."¹² The task force was made up of two representatives from each of the four NCEES zones plus several other representatives from outside NCEES. In an attempt to have ELQTF represent the entire engineering profession, NCEES invited over 20 engineering societies to participate on the task force. Nine societies (AAEE, ABET, ACEC, ASCE, ASHRAE, ASME, EDC/ASEE, IEEE-USA, and NSPE) from the United States and one from Canada (CEQB) participated as "society members," and 11 others agreed to be "consulting members" and monitor the work of the task force. Each of the society members had full voting rights during the deliberations.¹²



1 Through the year 2009, there were 55 licensure jurisdictions that regulated engineering in the United States and were members of the NCEES. However, in 2010 the Northern Mariana Islands was dropped as a member of NCEES, thus the number of jurisdictions represented in NCEES dropped to 54.

Figure 1 – CAP³ Implementation Plan⁸

ELQTF finished its work in 2003 and made its report to NCEES at the 2003 annual meeting. One of its recommendations addressed the educational qualification for licensure. While the recommendation did not go as far as proposed by ASCE’s PS 465, it did call for strengthening the educational requirements for licensure. The task force concluded that “engineering education is falling behind other professions in preparing students for practice.” Reasons cited included a continuing decline in the credit hour requirements for engineering degrees and the loss of depth in the engineering education due to the addition of “important but nontechnical professional training.” ELQTF cited ASCE’s position and recommended “that the Model Law provide for at least a bachelor’s degree plus additional coursework in specialties related to practice.” The task force did not prescribe the number of courses or the type of additional coursework required.¹³

Modifying the NCEES *Model Law and Model Rules*

NCEES accepted the ELQTF report at its August 2003 annual meeting and formed a new committee to consider the task force recommendations. This committee, called the Licensure Qualifications Oversight Group (LQOG), consisted of only NCEES members and brought the issues in-house for internal deliberation. LQOG was charged to “research the conclusions and recommendations contained in the ELQTF report and prepare appropriate recommendations for NCEES consideration....” After reviewing ELQTF’s work, LQOG made a motion at the 2004 NCEES annual meeting to “consider initiating a process to determine specific recommendations regarding additional engineering education for the purpose of licensure and prepare an implementation plan.”¹⁴ The motion passed with 37 in favor and 24 against (some boards did not vote), and work to establish the details of the additional education requirements was initiated.¹⁵ The margin of passage indicated that a majority of NCEES member boards agreed that the educational standard for licensure needed to be strengthened but also that a significant number did not. This was a harbinger of future debates on the issue.

Following the 2004 annual meeting, LQOG was continued and charged to “recommend revisions to the *Model Law* to require additional engineering education for the purpose of licensure.” The group’s work resulted in a motion at the 2005 NCEES annual meeting to charge the NCEES Committee on Uniform Procedures and Legislative Guidelines (UPLG) with incorporating the following language into the *ML&MR*:¹⁶

“Graduation with a Bachelor of Science degree from an engineering program of four years or more accredited by EAC/ABET, or equivalent, plus 30 additional credits from an approved course provider(s) in upper-level undergraduate or graduate-level coursework in professional practice and/or technical topic areas.”

The motion passed by a 35 to 26 margin, and the language was forwarded to UPLG for incorporation into the *ML&MR*.¹⁷ UPLG is a standing committee of NCEES and serves as the custodian of the model documents. UPLG typically receives language developed by other NCEES committees/task forces and approved by vote at the annual meeting. It then fine-tunes the language and presents the motions to include the final language in the *ML&MR*. The committee maintains the intent of all language approved by NCEES but modifies the language as needed for proper incorporation into the documents.

After a year of deliberation, UPLG made a motion at the 2006 annual meeting to add to the *ML&MR* language that was effectively the same as that proposed the year before by LQOG.¹⁸ The motion was a major topic of discussion at the meeting, both formally and informally, and the debates were intense. Both opponents and proponents were well prepared with their comments. The formal debate on the floor of the meeting lasted for nearly an hour—very long by NCEES standards—until the question was called. One concern voiced by the opponents during the debate was that the proposed language was too vague for implementation. Proponents agreed with this point and noted that additional work on the language was necessary; however, they also suggested that after five years of consideration, it was time to act and to let the profession know where NCEES stood on the issue of education. The vote was 39 in favor and 27 against.¹⁹

ASCE viewed this vote as accomplishing the first step of the licensure path of the ASCE CAP³ plan for implementation of PS 465, but the effort was far from over.

Refining and Defending the New *Model Law and Model Rules*

In response to the concern voiced during the debate over the UPLG motion, the approved language was sent back to UPLG with the request to develop a definition for “approved credits” and “approved course providers.” UPLG developed additional language and presented the proposed additions at the NCEES zone meetings in spring 2007. The debate at the zone meetings was extensive and reflected a wide variety of opinion on the definitions. After witnessing the zone debates, the NCEES board of directors suggested that UPLG withdraw the motion it had proposed for the 2007 annual meeting and refer the issue back to the committee for additional work. This suggestion was accepted by the UPLG, and no related motion was offered by UPLG at the 2007 NCEES annual meeting.²⁰ However, the 2007 annual meeting was not without actions relative to the education issue. Two other actions were proposed.

The first proposed action was an NCEES Western Zone resolution stating that the NCEES actions over the previous three years did nothing to stop the further reduction of credits required for a bachelor’s degree. It resolved:

“That NCEES strongly urges ABET to institute a set minimum number of credits that shall be required to graduate with a bachelor’s degree in engineering;

That a set percentage of the total required credits shall be courses defined by ABET as engineering topics, consisting of engineering sciences and engineering design appropriate to the student’s field of study; and

That the professional societies that oversee the ABET accreditation of each engineering program shall determine these parameters.”

The resolution did not address just the decline in credit hour requirements. It also suggested that a process be initiated to correct the deficiencies in engineering education through the accreditation process. The resolution passed by 41 to 24 margin.²¹ The vote seemed to confirm that a significant majority of the NCEES members felt the education qualification for licensure needed to be strengthened but that accreditation should be the means of the reform. The resolution was presented to ABET by the NCEES leadership; however, as of the date of this paper, ABET has not acted on the requests included in the resolution.

The second proposed action was a floor motion from the Nevada board. It requested that the 2006 vote on the UPLG motion to amend the *ML&MR* requirements for additional education for engineering licensure be rescinded.²⁰ This was the first attempt by opponents to eliminate the new requirement. The motion failed by a vote of 19 to 40.²¹ The vote again indicated that a significant majority of the NCEES boards felt that the educational standard for licensure needed to be strengthened. However, these two votes seemed to indicate that several of the licensure boards were not completely comfortable with the approach reflected by the new language in the *ML&MR*.

After UPLG withdrew its motion in 2007, NCEES formed a new task force called the Bachelor's Plus 30 Task Force. The task force was charged with refining the language in the *ML&MR* so that the provisions could be better implemented by the licensure jurisdictions. As with ELQTF, the task force also included participation from outside engineering societies, including AIChE, ASCE, ASHRAE, ASME, NSPE, ACEC, and IEEE-USA. The societies participated in all meetings and all discussions but did not have voting rights.

The Bachelor's Plus 30 Task Force presented two motions at the 2008 NCEES annual meeting. One motion addressed additional language for the *ML&MR*. More specifically, it provided definitions of "acceptable upper-level undergraduate and/or graduate-level coursework" and "approved course providers" and recommended that the language be referred to the appropriate committee (UPLG) for incorporation into the *ML&MR*. The motion passed after some debate by a 34 to 26 margin.^{22,23} The vote seemed to reflect the same disposition of the NCEES member boards as the engineering education-related votes of 2005 and 2006.

The second motion recommended that an appropriate committee be charged with "exploring the idea of a national clearinghouse that would carry out the activities needed to implement the bachelor's plus 30 requirements for engineering licensure." The task force realized that the types of additional courses and the course providers would have to be verified and approved by some entity and that a national approach would relieve the jurisdictions of the additional work load and provide uniformity.²² The motion passed with no discussion on the floor by a vote of 55 to 7.²³

At the 2008 NCEES annual meeting, the Western Zone proposed a resolution that listed several points supporting the position of the opposition and resolved the following:

"That the development of the criteria for B+30 be **suspended** [emphasis added] until the membership of NCEES and the appropriate professional engineering organizations be provided with a written analysis of 1) the above listed points as appropriate; 2) the educational, professional, regulatory, and economic impact of B+30; and 3) any alternative solutions to the concept of additional education that have been or might be identified (including items such as additional experience before licensure in lieu of additional education, etc. The purpose of these reports would be to allow NCEES jurisdictions to make a more informed decision regarding B+30. It would be expected that this analysis could be completed by the time of the 2009 interim zone meetings with a **vote at the 2009 Annual Meeting to either continue B+30 development or discontinue the B+30 concept and remove all references to it in the NCEES Model Law**" [emphasis added].

The resolution appeared to represent another attempt to rescind the new educational requirements in the *ML&MR*. The Southern Zone offered a substitute resolution after discussion with the Western Zone. The substitute motion made some changes to the listed points and deleted the phrases that would suspend further work on the bachelor's plus 30 criteria and that would call for an up-or-down vote on the concept in 2009. The substitute resolution also proposed that the existing Bachelor's Plus 30 Task Force be charged with providing an analysis of the points and

impacts and considering alternatives.²³ The substitute resolution passed with 57 boards in favor and 6 opposed.²³

Addressing Implementation and Continuing the Defense: 2008—2009

The next year, the Bachelor's Plus 30 Task Force continued under the new name of the Engineering Education Task Force. The task force was charged to address the 2008 Southern Zone resolution (perform the analyses); explore the creation of a clearinghouse (proposed by the 2008 Bachelor's Plus 30 Task Force); develop a program and white paper to communicate the NCEES position on the educational requirements; and provide assistance to UPLG with the language proposed by the 2008 Bachelor's Plus Task Force. The Engineering Education Task Force prepared a lengthy report that addressed the analyses, offered possible alternative licensure pathways, and included a white paper. The task force also developed a flowchart to demonstrate how a national clearinghouse might function. At the 2009 NCEES annual meeting, the task force moved to charge "an appropriate committee or task force" with "further developing a national clearinghouse." The motion passed by a vote of 50 to 11.^{24,26}

UPLG also offered a motion in 2009 to incorporate into the *ML&MR* the expanded definitions of "acceptable upper-level undergraduate and/or graduate-level coursework" and "approved course providers" prepared in 2008 by the Bachelor's Plus 30 Task Force.²⁵ The motion passed by a vote of 61 to 3 with no debate.²⁶ (See Appendix A, *Model Rules Provisions*, 230.10, parts B and C for the expanded definitions.)

Several other motions and resolutions were offered during the 2009 annual meeting. The first was from the Western Zone, which resolved that the Engineering Education Task Force should develop an alternate pathway. Instead of adding 30 credits or a master's degree after the B.S., this new pathway would require "additional continuing education in the form of 150 contact hours and a structured mentoring program that would assure the quality of the professional experience." The Central Zone offered a substitute resolution for the Engineering Education Task Force to add the proposed alternate pathway to the proposed alternatives instead of replacing them and to develop, evaluate, and report on all of the alternatives. The Central Zone substitute resolution was accepted in lieu of the Western Zone version, but it was subsequently defeated by a vote of 29 for and 32 against.²⁶

The Southern Zone also proposed a resolution initiated by the Alabama board. It confirmed the need for further study of alternative pathways but resolved that the "study include reform to the bachelor's degree program such that a B.S. degree be modified to contain the appropriate educational requirements to practice at a professional level." The resolution was another attempt to find a way for accreditation (i.e., EAC/ABET) to address the educational concerns. The resolution passed 50 to 11 with little discussion.²⁶

The Alaska board offered the last resolution at the 2009 NCEES annual meeting. It resolved:

"That the NCEES president reconvene an ELQTF-type special task force composed of representatives of NCEES on both sides of this issue, representatives of professional societies who have voting rights on ABET and representation

from their ABET liaisons, as well as ABET, and other engineering education stakeholders, with the intent to examine the future needs of engineering curricula and creation of a roadmap for assuring that future graduate engineers are appropriately prepared for engineering careers and registration as professional engineers.”

Nevada offered an amendment to the resolution, calling for the removal of all references to additional education in the model documents pending further study. The proposed amendment and the original resolution failed by votes of 15 to 48 and 20 to 42, respectively.²⁶ The first vote indicated that a strong majority of NCEES did not want to move away from the initiative. The second vote may indicate that NCEES members were beginning to understand that accreditation cannot necessarily address their concerns. Overall, the 2009 votes reflected strong NCEES support for change to the educational requirements for licensure and the need to address the matter through the *ML&MR*. However, the votes still reflect some uncertainty over the alternatives reflected in the adopted language.

Considering Additional Alternatives: 2009—2011

Following the 2009 annual meeting, the Engineering Education Task Force continued and was charged to address potential alternative pathways to licensure. It proposed two additional alternatives for consideration at the 2010 NCEES annual meeting. One concerned bachelor degree programs that require 150 or more credit hours and meet certain requirements for content. This alternative actually reflects some existing bachelor programs, specifically within architectural engineering. The task force moved for UPLG to be charged with including this pathway in the *ML&MR*.²⁷ NCEES passed the task force motion 35 to 28.²⁸

The Engineering Education Task Force also made a motion that addressed an alternative proposed by some of the engineering societies participating on the task force to better represent engineers practicing in industrial settings. The proposed pathway required the completion of some number (to be determined) of assessed learning days (ALDs) of continuing education plus six years of progressive experience, the final three of which (the three years just prior to taking the licensure exam) would be mentored by a licensed professional engineer. The intent of this alternative was to represent the diverse nature of education acquired by engineers who work in industry. Many engineers practicing in this kind of setting learn skills that are directly related to their work while on the job. Accordingly, the ALD term was proposed to reflect continuing education that is significantly more rigorous than typical post-licensure continuing education courses.²⁷ The task force motion to charge another committee with further study of this alternative passed 46 to 13.²⁸

Following the 2010 annual meeting, a new task force was convened to study the alternate “industrial” pathway proposed for further study (ALDs plus mentored experience). The task force, called the Alternative Licensure Pathway Task Force, reviewed the proposed pathway in detail. It defined ALDs, recommended that 60 ALDs be completed in the six-year experience period, and defined the mentoring requirements. The task force made a motion at the 2011 NCEES annual meeting to refer the alternative to UPLG for incorporation into the *ML&MR*.²⁹ During the meeting, representatives of some of the societies that proposed the alternative as part

of the Engineering Education Task Force spoke against the alternative. In addition, several boards voiced concern for the different standard for the experience qualification (the mentoring) and the definition of ALDs. The motion failed by a vote of 26 to 34.³⁰

The votes of 2009, 2010, and 2011 seem to indicate an increasing comfort level within NCEES that the approach of adding requirements to the EAC/ABET B.S. prior to professional licensure may be the best way to move forward. However, it also seems clear that NCEES continues to prefer to address its educational concerns through the accreditation process to the extent possible.

The key actions (recommendations, motions and resolutions) associated with the additional education issue at NCEES are summarized in the table below.

Summary of Key Actions at NCEES Annual Meetings

Date	Recommendation/Motion/Resolution	Result	Vote For/Against
August 2001	ELQTF recommends additional education as a requirement for licensure	Report Accepted	No Vote
August 2003	LQOG motion to consider process to determine recommendations for additional education	Passed	37/24
August 2005	LQOG motion to have UPLG incorporate language into the <i>ML&MR</i> for additional education	Passed	35/26
September 2006	UPLG motion to incorporate specific language into the <i>ML&MR</i> for additional education	Passed	39/27
August 2007	WZ resolution to urge ABET, Inc. to set minimum number of credits for bachelor's degrees	Passed	41/24
August 2007	Nevada board resolution calling on the NCEES to rescind the vote on UPLG motion of September 2006	Failed	19/40
August 2008	B+30 TF motion to have UPLG incorporate additional definitions into the additional education language of the <i>ML&MR</i>	Passed	34/26
August 2008	B+30 TF motion to explore the idea of a national clearinghouse	Passed	55/7
August 2008	SZ substitute resolution calling for analysis of concerns for the additional education language and development of alternatives	Passed	57/6
August 2009	UPLG motion to incorporate additional definitions into the <i>ML&MR</i> for additional education	Passed	61/3
August 2009	EETF motion to further develop a national	Passed	50/11

	clearinghouse		
August 2009	CZ substitute resolution to have EETF consider an alternate pathway with 150 contact hours plus structured mentoring	Failed	29/32
August 2009	SZ resolution to study reforming the bachelor's degree for practice at the professional level	Passed	50/11
August 2009	Alaska board resolution to convene ELQTF-type special task force to examine future educational needs	Failed	20/42
August 2010	EETF motion for UPLG to add an educational pathway in the <i>ML&MR</i> for 150 credit hour programs	Passed	35/28
August 2010	EETF motion to charge a committee to further study an "industrial" pathway with additional education and mentored experience	Passed	46/13
August 2011	ALPTF motion for UPLG to add the industrial pathway to the <i>ML&MR</i>	Failed	26/34

Legend:

- ELQTF – NCEES Engineering Licensure Qualifications Task Force
- LQOG – NCEES Licensure Qualifications Task Force
- UPLG – NCEES Committee on Uniform Procedures and Legislative Guidelines
- B+30 TF – NCEES Bachelor's Plus 30 Task Force
- EETF – NCEES Engineering Education Task Force
- ALPTF – NCEES Alternative Licensure Pathway Task Force
- WZ – NCEES Western Zone
- SZ – NCEES Southern Zone
- CZ – NCEES Central Zone

Current Status

After the votes of 2009, the education issue seems to have entered a state of rest at NCEES. Current NCEES leadership appears to be interested in having the industrial alternative considered further, but the disposition of this possibility is unknown. The 2010 and 2011 NCEES annual meetings represented two consecutive meetings without significant debate over current educational provisions in the *ML&MR*. While several boards remain in vocal opposition, active opposition has—at least for the time being—subsided. The current language in the *ML&MR* is summarized in Appendix A of this paper.

ASCE's Approaches to Supporting Licensure Reform

Until the 2006 NCEES vote to officially add the additional education requirements to the NCEES *ML&MR*, ASCE had little involvement in the NCEES annual meetings. ASCE was always represented and made presentations over the implementation of PS 465 at each meeting, but it had no organized efforts to provide support. However, the 2006 UPLG motion to incorporate specific language for additional education into the model documents was the key vote, and passage with the proper language was essential.

Up to that time, the NCEES votes on education reform simply moved the process along and did not require formal commitment to the change. The UPLG vote of 2006 was to formally change the model documents, so the focus on the issue by the NCEES membership intensified. In addition, licensing boards in opposition had become more vocal at NCEES zone meetings and other engineering societies had become more involved. In response, ASCE stepped up its support of the initiative. ASCE involvement from this point forward included the following:

- ASCE continued to make presentations at workshops on issues relating to engineering education at the NCEES annual meetings. These presentations allowed for ASCE to communicate its position and disseminate information related to the upcoming votes.
- Actions and discussions at the spring NCEES zone meetings were monitored. This information provided a preview of the debates that would occur at the annual meeting and allowed ASCE to properly prepare for the meetings.
- The votes by licensure boards on each education-related issue were evaluated. This improved the understanding of where the various licensure boards stood on the issues and provided an indication of how their position may have been changing over time.
- Representatives of ASCE attended the NCEES annual meetings and engaged in informal discussions with NCEES members. Formal proposals at the meetings were monitored and recommendations offered for modification and action.
- Comments were prepared for presentations by the ASCE presidents. NCEES annual meetings included an opportunity for the leaders of major engineering societies to address the NCEES members on the meeting floor. ASCE ensured that the ASCE president was briefed on the specific issues to be addressed at the meetings and was provided recommended language that could be used in the address to affirm ASCE's support for the education initiative.

Lessons Learned

The authors cite the following lessons learned during their involvement with NCEES:

- **Communication.** Effective communication is critical when supporting change. In this case, effective communication meant clear, concise, and consistent messages delivered through a variety of avenues: personal contact instead of just formal presentations or written comments; engagement with decision-makers when opportunities presented themselves; and creation of opportunities to engage decision-makers. Repeated contact and conversation with the decision-makers was key. While the written word was also used, documents are not always read or understood. The most effective approach was through multiple, direct, and personal contacts, sometimes with a leave-behind written document.

- **Vigilance and Tenacity.** The NCEES effort to amend the model documents did not reach its maximum intensity until after the *ML&MR* were changed, and there were many ways to undo what had been done. ASCE was vigilant and tenacious in its support of the new provisions as attempts were made to rescind the changes to the *ML&MR*. ASCE will have to remain so until licensure jurisdictions adopt the new requirements. Even then, the organization must be ready to actively support the provisions at the state level, because the state law and rules can always be changed. Continuing and active support of this initiative will likely be necessary well into the future.
- **Accreditation.** It became clear over time that most NCEES members preferred that the educational concerns of licensure be addressed through the accreditation process. The EAC/ABET-accredited B.S. had been the NCEES gold standard for decades. During the deliberations and debates, the desire for ABET to handle the issues was expressed on many occasions. Accreditation is extremely important and will remain so, but it is limited in what it can do. Only about 20 percent of EAC/ABET graduates become licensed professional engineers. The educational requirements for licensed practice and its interest in protecting the public health, safety, and welfare may not apply to the other 80 percent of graduates who pursue careers in areas exempt from licensure. The limitations and complexities of accreditation are difficult to understand and extremely difficult to communicate, and it was difficult for some NCEES members to accept that effective reform of the educational requirements for licensure had to be accomplished by adding requirements to the existing gold standard rather than trying to expand the standard itself. The lack of response to the 2007 resolution calling for ABET to implement new requirements helped NCEES members to understand the limitations. However, as new NCEES members come onto boards, it is likely that the accreditation approach will continually be raised.
- **Engineering Disciplines.** The level of interest in licensure varies significantly from discipline to discipline within the engineering profession. This is reflected by the varying percentages of engineering graduates from each discipline that eventually pursue licensure. Civil engineering represents the largest group of licensed engineers because it has higher numbers handling public projects; these individuals must be licensed to be in responsible charge of the engineering work. Other disciplines have lower numbers because higher percentages of their engineers work in areas that are traditionally exempt from licensure. This fact produced some tension between ASCE, a staunch proponent of the educational reform, and other societies that stood in opposition. ASCE views itself as a major supporter of licensure due to its numbers and its positions (such as PS 465 that equates practice at the professional level with licensed practice). However, opposition societies also view themselves as strong supporters of licensure even though they represent fewer numbers of licensed engineers. ASCE found that it must be sensitive to this situation and respect the commitment of all societies with an interest in licensure.
- **Regulators vs. Professionals.** NCEES is a unique organization in the engineering profession. It is made up of engineers (and surveyors and public members) who are appointed to the licensure boards by politicians and who serve as regulators for the state. In general, licensure board members view themselves as regulators who happen to be

professionals, not professionals who happen to be regulators, and they diligently maintain a distinction between their regulatory role and their professional role. They guard against looking like they are more interested in advancing the profession rather than in carrying out their charge of protecting the public health, safety, and welfare. While supporting the educational changes at NCEES, ASCE found that it had to be careful not to overemphasize the effect that the change would have on the profession. Instead, the proper approach was to focus on the purpose of the jurisdictional boards: “to safeguard the life, health, safety, and property and to promote the public welfare.”³¹

Going Forward

Although ASCE sees the *ML&MR* as now being appropriately modified and the debate on the issue has diminished significantly, ASCE remains vigilant and does not consider the matter resolved. NCEES membership is constantly changing, and new members need to understand the history and complexities of the engineering education issue. Also, some NCEES boards are still opposed to the concept of additional education for engineering licensure, and they can make motions or resolutions at any annual meeting to remove the additional education requirements in the model documents. The language in the *ML&MR* cannot be taken for granted until the licensure jurisdictions implement the new requirements. Even when that happens, the provisions must be fully supported at NCEES and in the state legislatures.

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APPENDIX A
PROVISIONS RELATING TO THE EDUCATIONAL REQUIREMENTS FOR LICENSURE
NCEES *MODEL LAW AND MODEL RULES*—2011 (Current)

Model Law Provisions

130 LICENSURE

130.10 General Requirements for Licensure

Education, experience, and examinations (as described in *Model Rules*) are required for licensure as a professional engineer or professional surveyor.

- A. As an Engineer Intern – The following shall be considered as minimum evidence that the applicant is qualified for certification as an engineer intern. A college senior or graduate of an engineering program of 4 years or more accredited by the Engineering Accreditation Commission of ABET (EAC/ABET), or the equivalent, or an engineering master’s program accredited by EAC/ABET shall be admitted to an examination in the fundamentals of engineering. Upon passing such examination and providing proof of graduation, the applicant shall be certified or enrolled as an engineer intern, if otherwise qualified.
- B. As a Surveyor Intern – *[Not reprinted in this appendix for brevity.]*
- C. Professional Engineer or Professional Surveyor – To be eligible for admission to the examination for professional engineers or professional surveyors, an applicant must be of good character and reputation and shall submit five references acceptable to the board with his or her application for licensure, three of which references shall be professional engineers or professional surveyors having personal knowledge of the applicant’s engineering or surveying experience.
 1. As a Professional Engineer – The following shall be considered as minimum evidence satisfactory to the board that the applicant is qualified for licensure as a professional engineer.
 - a. Licensure by Comity – *[Not reprinted in this appendix for brevity.]*
 - b. Licensure by Examination (Effective until January 1, 2020) – The following individuals shall be admitted to an examination in the principles and practice of engineering and, upon passing such examination and providing proof of graduation, shall be licensed as a professional engineer, if otherwise qualified:
 - (1) An engineer intern with a bachelor’s degree in engineering and with a specific record of 4 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (2) An engineer intern who satisfies one of the following education and experience requirements:
 - (a) Following a bachelor’s degree in engineering from an institution that offers EAC/ABET-accredited programs, earns a master’s degree in engineering and establishes a specific record of 3 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (b) Following a master’s degree in engineering from an EAC/M-ABET-accredited program, establishes a specific record of 3 years or more of

- progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
- (3) An engineer intern with an earned doctoral degree in engineering acceptable to the board and with a specific record of 2 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (4) An individual with an earned doctoral degree in engineering acceptable to the board and with a specific record of 4 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
- c. Licensure by Examination (Effective January 1, 2020)⁵ – The following individuals shall be admitted to an examination in the principles and practice of engineering and, upon passing such examination and providing proof of graduation, shall be licensed as a professional engineer, if otherwise qualified:
- (1) An engineer intern who satisfies one of the following education and experience requirements:
 - (a) Following the bachelor's degree, an acceptable amount of coursework resulting in a master's degree in engineering from an institution that offers EAC/ABET accredited programs, or the equivalent, and with a specific record of 3 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (b) Following a master's degree in engineering from an EAC/M-ABET-accredited program, a specific record of 3 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (c) Following the bachelor's degree, an acceptable amount of coursework as defined in NCEES *Model Rules* Section 230.10 D from approved course providers and a specific record of 4 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (d) Following a bachelor's degree from an EAC/ABET-accredited program that has a minimum of 150 semester credit hours, of which at least 115 are in math, science, and engineering combined and at least 75 of the 115 are in engineering, a specific record of 4 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (2) An engineer intern with an earned doctoral degree in engineering acceptable to the board and with a specific record of 2 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (3) An individual with an earned doctoral degree in engineering acceptable to the board and with a specific record of 4 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering experience of a grade and a

character which indicate to the board 71 that the applicant may be competent to practice engineering

- (4) An individual with an earned doctoral degree in engineering acceptable to the board and with a specific record of 4 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
- c. Licensure by Examination (Effective January 1, 2020)⁵ – The following individuals shall be admitted to an examination in the principles and practice of engineering and, upon passing such examination and providing proof of graduation, shall be licensed as a professional engineer, if otherwise qualified:
 - (1) An engineer intern who satisfies one of the following education and experience requirements:
 - (a) Following the bachelor’s degree, an acceptable amount of coursework resulting in a master’s degree in engineering from an institution that offers EAC/ABET accredited programs, or the equivalent, and with a specific record of 3 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (b) Following a master’s degree in engineering from an EAC/M-ABET-accredited program, a specific record of 3 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (c) Following the bachelor’s degree, an acceptable amount of coursework as defined in NCEES *Model Rules* Section 230.10 D from approved course providers and a specific record of 4 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (d) Following a bachelor’s degree from an EAC/ABET-accredited program that has a minimum of 150 semester credit hours, of which at least 115 are in math, science, and engineering combined and at least 75 of the 115 are in engineering, a specific record of 4 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (2) An engineer intern with an earned doctoral degree in engineering acceptable to the board and with a specific record of 2 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering
 - (3) An individual with an earned doctoral degree in engineering acceptable to the board and with a specific record of 4 years or more of progressive engineering experience of a grade and a character which indicate to the board that the applicant may be competent to practice engineering

⁵ The implementation of these provisions in all jurisdictions is anticipated to take a number of years, so the actual effective date will vary by jurisdiction. A minimum 8-year transition period subsequent to adoption by a jurisdiction is recommended to allow jurisdictions and prospective licensees to prepare for the new requirements. The 2020 date was selected as the earliest reasonable date for adoption by a jurisdiction based on a 4-year implementation period plus an 8-year transition period for first-time licensure candidates.

Model Rules Provisions

230 CANDIDATES FOR LICENSURE

230.10 Education Requirements Approved by the Board

A. Undergraduate Engineering Program

The term “an engineering program of 4 years or more” used in Section 130.10 A of the NCEES *Model Law* is interpreted by this board to mean:

1. A bachelor’s degree in an engineering program accredited by EAC/ABET at the time of the awarding of the degree (The board may accept the degree if accreditation is received within a prescribed period of time.)
2. A bachelor’s degree in an engineering program not accredited by EAC/ABET, such as those programs recently developed or programs offered by foreign schools, but deemed by the board to be substantially equivalent to those programs which have been accredited by EAC/ABET

B. Post-Graduate Engineering Course Providers

The term “approved course provider” used in Section 130.10 C.1.c of the *Model Law* is interpreted to mean the following:

1. An institution that has an EAC/ABET-accredited program;
2. An institution or organization accredited by an NCEES-approved accrediting body³; or
3. An institution or organization that offers specifically approved courses that are individually approved by an NCEES-approved accrediting body.⁴

C. Post-Graduate Acceptable Coursework

The term “acceptable upper-level undergraduate and/or graduate-level coursework” used in Section 130.10 C.1.c of the *Model Law* is interpreted to mean the following:

1. In technical topic areas, acceptable coursework shall be upper-level undergraduate and/or graduate-level courses in engineering.
2. Other topic areas of acceptable coursework shall be upper-level undergraduate and/or graduate-level courses relevant to the practice of engineering and may include engineering-related science, mathematics, and/or professional practice topics such as business, communications, contract law, management, ethics, public policy, and quality control.

D. Post-Graduate Minimum Required Education

The term “acceptable amount of coursework” used in Section 130.10 C.1.c of the *Model Law* is interpreted to mean the following:

1. A minimum of an additional 30 credits of coursework, none of which were used to fulfill the bachelor’s degree requirement
 2. All 30 additional credits shall be equivalent in intellectual rigor and learning assessments to upper-level undergraduate and/or graduate courses offered at institutions that have a program accredited by EAC/ABET.
 3. Of the minimum required 30 additional credits, a minimum of 15 credits must comply with Section 230.10 C.1.
 4. The term “credit” is defined as a semester hour, or its equivalent, from an approved course provider as defined in Section 230.10 B.
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- 3 This institution/organization would be approved to develop and offer courses that meet *Model Rules*, Section 230.10 C. NCEES-approved accrediting bodies may include regional accreditation bodies and other appropriate discipline accreditations.
- 4 This institution/organization would be approved to offer one or more specifically approved courses that meet *Model Rules*, Section 230.10C.