4-2006

A Study on Perceptions of Civil Engineers Regarding Mandatory Continuing Education

Alee A. Sleymann
Western Michigan University

A STUDY ON PERCEPTIONS OF CIVIL ENGINEERS REGARDING MANDATORY CONTINUING EDUCATION

by

Alee A. Sleymann

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Philosophy
School of Public Affairs and Administration
Dr. Matthew Mingus, Advisor

Western Michigan University
Kalamazoo, Michigan

A STUDY ON PERCEPTIONS OF CIVIL ENGINEERS REGARDING MANDATORY CONTINUING EDUCATION

Alee A. Sleymann, Ph.D.

Western Michigan University, 2006

This study explored the perceptions of civil engineers regarding continuing professional competency requirements for license renewal. In this study, continuing professional competency is assumed to have a direct relationship to public welfare and safety. The policy of mandatory continuing education was adopted primarily for this reason. Currently, mandatory continuing education is adopted by 29 states as the method of assuring continued professional competency

Many professionals, however, have not welcomed this mandatory continuing education (MCE) policy. The reason for this opposition is the claimed ineffectiveness of this policy in fostering continued competency. In addition, the regulatory boards and policy advocates have not produced data to support that continued professional competency have resulted from mandatory continuing education.

This study is a cross-sectional quantitative type. Primary data was collected using an electronic questionnaire that was e-mailed to participants. The population of this study consisted mainly of civil engineers and land surveyors. The sampling frame was those engineers who subscribed to the *CE News* magazine newsletter "CivilConnections."

The findings of this study are:

1. The majority of the participating professionals viewed MCE positively.

2. The attitude towards mandatory continuing education was mostly positive. However, the attitude towards MCE requirements being a condition for licensing renewal was not as decisive. The participating professionals were polarized about the issue with 41% against and 43% for, with 16% neutral or undecided.

3. Regarding the issue of public safety and protection being assured by MCE, the results show that participating civil engineering professionals do not consider the impact of MCE as positive.

4. The majority of professionals preferred the voluntary continuing education method as a reassessment approach to assuring continued competency. Periodic re-examination on the other hand was the least preferred and was strongly opposed.

5. The mandating policy clearly impacted the participation level in continuing education.

6. Professional characteristics such as level of education, level of responsibility, field of practice, years of licensing, and age of professionals do not influence participation in continuing education.

7. The majority of employers support continuing education.

8. Finally, 77% of the participants attended continuing education on a voluntary basis.

ACKNOWLEDGEMENTS

"Search for knowledge even as far as China."
Prophet Mohammad

I would like to start by giving thanks to the Almighty for all his blessings. This degree is one of such blessings. *Al-hmdu laho.*

Finishing would not have been possible without the sacrifices of my wife Nawal whose love and support carried me through the process. To my kids: Adam, Ayat, Alaa, and Zahraa, thank you for all your help in typing my papers throughout my studies. This degree is partly yours.

This achievement is dedicated to my loving parents (Ibrahim and Mohsina Aboutaam) who gave all they can for me to succeed. I know that my brothers and sisters were with me all the time.

Thanks to the dissertation committee represented by its chair Dr. Matthew S. Mingus, its members Dr. James A. Visser and Dr. Ahmad Jrade.

A very special thanks and lots of appreciation to Dr. Marianne DiPierro. She was my mentor since day one.

Another member of this team that showed a keen interest in this study is the editorial director of *CE News*, Mrs. Shanon Fauerbach. Shanon was very instrumental in editing and setting up the electronic survey on the web.

I would like also to take this opportunity to thank Dr. Peter Kobrak who was always there when I sought his counsel and advice.

My gratitude and appreciation is extended to all my friends and specially to Dr. Jianfeng Wang and to each and everyone who was not mentioned by name but has made this possible through their contribution or participation in this study.

Alee A. Sleymann

TABLE OF CONTENTS

CHAPTER

Table of Contents—continued

Table of Contents—continued

LIST OF TABLES

List of Tables—continued

LIST OF FIGURES

LIST OF ACRONYMS

CPC: Continuing Professional Competency
EEE: Education, Experience and Examination
MCE: Mandatory Continuing Education
PDH: Professional Development Hour

CHAPTER I

INTRODUCTION

Statement of the Problem

In this era, on one hand, rapid technological advances are taking place, coupled with demand for more complex projects. On the other hand, the public is expecting more accountability of professionals, and playing a bigger role in regulations than ever before. The question of continuing professional competency becomes a major focus of legislators, regulatory boards, professional associations, and educators. Although technological advances lead to the creation of more accurate designs and in making materials for more economical projects, the task of the engineer is becoming difficult and more demanding in terms of staying abreast with the dynamic changes that contribute to continuous competency. The addition of the dimension of higher accountability for public safety adds to the task. Continuing education, then, becomes an important mainstay not only for professional survival but also for public safety and well being.

> Complexity and the difficulties of managing may contribute to misapplication and unsafe practices. As the complexity in society and projects mounts, the risk to public safety, health, and welfare increases. (American Society of Professional Engineers, 2004, p. 14)

The regulatory boards of the civil engineering profession have adopted mandatory continuing education as a temporary measure for assuring continued professional competency. Shimberg (1982) cites professor Cyril O. Houle (1975) who "views mandatory

continuing education as an intermediate measure, one that will be needed only until a more comprehensive system for assessment and re-credentialing of professionals can be devised" (Shimberg, 1982, p. 129). This policy, which is not uniform in all states, is being enforced at the license renewal period. Table 1 shows the mandated numbers of hours required in states with mandatory continuing education policy.

Table 1

Mandated Numbers of Hours Required Yearly in States With MCE Policy

State	Professional Development Hours (PDH)/per year
Alabama (AL)	15
Arkansas (AR)	15
Florida (FL)	4
Georgia (GA)	15
Illinois (IL)	15
Iowa (IA)	15
Kansas (KS)	15
Louisiana (LA)	15
Maine (ME)	15
Minnesota (MN)	12
Mississippi (MS)	15
Missouri (MO)	15
Montana (MT)	15
Nebraska (NE)	15
Nevada (NV)	15
New Hampshire (NH)	15
New Mexico (NM)	15
New York (NY)	12
North Carolina (NC)	15
North Dakota (ND)	15
Oklahoma (OK)	15

Table 1—continued

State	Professional Development Hours (PDH)/per year
Oregon (OR)	15
South Carolina (SC)	15
South Dakota (SD)	15
Tennessee (TN)	12
Utah (UT)	12
West Virginia (WV)	15
Wyoming (WY)	15

Source: (McGraw Hill Construction, 2005)

This requirement that has been in place since the early 1970s in professions such as the health profession (Shimberg, 1982) and has not been proven to be effective in increasing professional competency (de Aristizabal, 2000). In the civil engineering profession, the case is similar: more than half of the state boards have mandated continuing education as a requisite for licensure renewal (McGraw Hill Construction, 2005). The professionals are divided about this issue. Some question the rationale for such mandates and state that continuing education without the term "mandatory" added is a more effective tool for professionals (Hermansen, 1999), while others state that without issuing a mandate some professionals will not participate in continuing education, hence the public and the profession will be harmed (Kehl, 1996). This debate goes on without the benefit of any research or study of the subject matter. Still, the burden is on the regulatory agency to protect the public from incompetent practice.

The mission of the California state Board for Professional Engineers and Land Surveyors is to safeguard the life, health, property, and welfare of the public by regu-

lating the practices of professional engineering and land surveying. The Board accomplishes its mission by:

- Licensing qualified individuals as professional engineers and land surveyors.
- Anticipating changes in the engineering and land surveying professions to ensure that the laws and regulations are contemporary, relevant, and responsive.
- Establishing regulations and promoting professional conduct.
- Enforcing laws and regulations.
- Providing information so that the public can make informed decisions regarding utilizing professional engineering and land surveying services (State of California Board for Professional Engineers and Land Surveyors [BPEL], 2003).

To accomplish its mission, the Board starts the licensing process initially by ensuring that those intending to practice engineering meet minimum competency requirements set forth in the law. These include completing formal education requirements, gaining professional experience under the supervision of a licensed engineer, and passing two eight-hour examinations, in addition to establishing other requirements by some states such as minimum age, evidence of good moral character, and residency.

Unless the professionals are continually in the practice, their initial competency level could deteriorate, their knowledge could become outdated, and their skills could feasibly no longer remain within the realm of accepted practice. Once these licensed professionals enter the profession, they are supposedly licensed for a lifetime and their licenses can then be kept in active status by just paying the stipulated fees regardless of what specialized field of engineering they are practicing. Yet, as long as no complaint is filed with the regulatory board against the engineer, the license will stay active and no

investigation as to their competency level will be carried out. The credentialing process at the initial stage is uniformly applied in all states to all prospective applicants and a standard of measure of competency is clearly defined. After that stage, however, the issue of measuring or ensuring continued competency becomes more complex. This complexity is due to the diversity of the fields of practice within the civil engineering discipline, as well as to the lack of a well-defined minimum acceptable standard of continued competency required for licensure renewal. In addition, engineering organizations are continually providing mandated training to their employees in order to keep their competitive edge and minimize their exposure to litigation as well as to safeguard public well-being.

Although the state boards ensure minimum competency at the initial stage of licensure, complaints of incompetent practice are continuously being filed against both licensed and unlicensed individuals. In a report by the Institute of Social Research (2002) at the California State University, Sacramento, the majority of complaints and action suits were against Civil Engineers (43%) among other engineering disciplines, and the major source for the complaint was competency/negligence (56%) (Institute of Social Research, 2002). In a survey by the National Council of Examiners of Engineers and Surveyors (NCEES), the majority of the states' boards reported a similar trend in rates of competency/negligence (National Council of Examiners of Engineers and Surveyors [NCEES], 2003a).

The focus of this research was on the stage of continuing professional competency as a mandated requirement for licensure renewal. In the case of civil engineering, the issue of public safety is more critical when compared to other disciplines such as electri-

cal or mechanical engineering. This is due to the nature of the service provided and the extent to which a single incident impacts the safety of the public. For instance, civil engineers design bridges that are used by millions of people daily, and any negligence in such design could have grave consequences not only in the loss of life, which is the most important, but also great economic loss and disruption to human living. Therefore, the issues of competency and public safety are so intertwined that improvements in competency will exert a positive impact on public safety; and, any deterioration in competency will have dire consequences on public safety. These probable scenarios, coupled with society's demand for increased public safety, have prompted the regulatory boards to seek more effective methods of ensuring licensees' competency.

In line with the requirements of education, experience, and examination (EEE) for licensing at the initial stage, a reassessment method to ensure continuous competency would have to include one or more of the three established requirements requisite for licensure renewal. Some of the reassessment methods found in the literature include the following: periodic reexamination, case simulation (a procedure that is mostly used in the health professions), peer review and audit, portfolio development, self-assessment, and mandatory continuing education (MCE). MCE was the chosen method by regulatory boards for assuring continued competency by professionals. This method was also proposed by the professional societies "as a practical interim solution to the continued competency issue" (Shimberg, 1982, p. 122). Having been sanctioned by the relevant professional societies and been a requirement in many other professions such as medicine, law, and accounting, MCE was adopted as the requirement for licensure renewal in the civil engineering profession.

This requirement was considered the least demanding from the time and cost standpoint when compared with the reexamination approach where time preparation is long and the pressure of examination is high. The peer review approach, where the specialty of the applicant may differ from that of the peer-tester, was not readily accepted as a viable method of measuring competency. In many respects, the process of implementing an appropriate testing mechanism to establish competency appeared to be flawed and drew into question methodologies or procedures appropriate to the task.

Opposition to the mandatory educational requirements began by questioning the justification for such requirements. Dr. Knud E. Hermansen, a national leader in the field of continuing education, opposes the concept of "mandatory continuing education" for the very reason that it is compulsory. Hermansen (1999) questions the very existence of a problem that is looking for a "fix." He states that "to require 100% of the licensed population to be bound by a regulation that attempts to alleviate a possible problem that is caused by less than 1% of the population would be absurd" (Hermansen, 1999, p. 1). He describes the regulation as "using the elephant gun to kill a mouse" (Hermansen, 1999, p. 1).

The opposition from other professions such as medicine (Holm, 1998) and psychology also centers on the lack of evidence that supports the adoption of such requirements. It has often been mentioned that no studies have been done to show the benefits of continuing education. In an article entitled "Why MCE Is a Bad Idea" (Ad Hoc Committee on Mandatory Continuing Education for Michigan Psychologists, 2005) it is argued that there "is no proof of a competency problem" and that "it is irresponsible to spend taxpayers' money on a process for which a benefit has not been established. The burden of showing that such a benefit exists rightly lies with those who advocate MCE"

(Ad Hoc Committee on Mandatory Continuing Education for Michigan Psychologists, 2005, p. 3).

In 1979, the board of professional engineers in the state of Iowa was the first in the nation to adopt the policy of mandatory continuing education requirements for licensure renewal. Fourteen years later, the state of Alabama followed. Currently, twenty-nine (29) states have adopted the mandatory educational requirement for the sake of keeping the civil engineering professionals updated on new developments and technology in their various specializations (McGraw Hill Construction, 2005). In accordance with the new model rule by NCEES, the term "mandatory continuing education" will be changed to the new term "continuing professional competency (CPC)," which will be used from this point forward.

The public has the right to demand that safe and effective engineering services be rendered only by competent engineering professionals. At the initial stage of licensure, competency is assured by making sure that the applicant's qualifications meet or exceed minimum competency requirement standards. Prior to 1979, when Iowa mandated CPC for licensure renewal, licensed practitioners were, and in some states still are, licensed for life by just paying renewal fees. Professionals voluntarily keep up with their field through reading journals, attending conferences and in-house training sessions, and choosing and taking courses as their need or practice demand. With technological changes taking place so rapidly, reliance on the voluntary approach to continuing education was questioned (Shimberg, 1982). In order to assure that a professional is continually competent, several regulatory boards have enacted mandatory continuing education requirements. Kerka (1994) described the competent professional as one who "has the attributes—knowledge,

skills, abilities (KSA)—necessary for performing a job to appropriate standards" (Kerka, 1994, p. 2). In its administrative law, The Iowa Engineering and Land Surveying Examining Board has defined continuing education as,

> Continuing education means education obtained by a licensee in order to maintain, improve, or expand skills and knowledge obtained prior to initial licensure or to develop new and relevant skills and knowledge (Engineering and Land Surveying Examining Board, 2003, 272C.1)

The law goes on to give criteria for activities that meet the continuing education requirements. These activities are consistent with those listed in the CPC Guidelines of the umbrella organization of the regulatory boards, the National Council of Examiners of Engineers and Surveyors (NCEES, 2004a).

The National Council of Examiners of Engineers and Surveyors defined these activities, shown below in Table 2, as "Any qualifying course or activity with a clear purpose and objective which will maintain, improve, or expand the skills and knowledge

Table 2

Typical Qualifying Activities Accepted for CPC Requirements

1. Successful completion of college courses.
2. Successful completion of continuing education courses.
3. Successful completion of correspondence, televised, videotaped, and other short courses/ tutorials.
4. Presenting or attending qualifying seminars, in-house courses, workshops, or professional or technical presentations made at meetings, conventions, or conferences.
5. Teaching or instructing in (1) through (4) above.
6. Authoring published papers, articles, books, or accepted licensing examination items.
7. Active participation in professional or technical societies.
8. Patents.

Source: National Council of Examiners of Engineers and Surveyors, 2004a, p. 6

relevant to the licensee's field of practice" (National Council of Examiners of Engineers and Surveyors, 2004a, p. 4).

It also defines those activities that do not qualify as professional development activities, shown below in Table 3.

Table 3

Typical Non-Qualifying Activities for CPC Requirements

• Regular employment
• Real estate licensing courses
• Personal, estate, or financial planning
• Self-study
• Personal self-improvement
• Service club meetings or activities
• Equipment demonstrations or trade show displays
• Topics not relevant to engineering or surveying professions
• Enrollment without attendance at courses, seminars, etc.
• Repetitive attendance or teaching of the same course
• Attending committee meetings or general business meetings of any organization
• Conversational language courses for personal use

Source: National Council of Examiners of Engineers and Surveyors (2004a), p. 7

The above definitions and criteria of qualifying and non-qualifying activities are broad by design in order to be "flexible," but they did not clearly identify the specific criteria of the minimum competency level to be maintained, unlike the well defined criteria such as those at the initial licensing process. This vagueness in the requirements creates confusion for engineers, and hence apprehension toward such a policy.

In summary, the following issues are relevant:

- First, the rationale for mandating educational requirements is not convincing for many professionals. It is claimed that there have not been any studies that positively correlate a problem of competency. In addition, the criterion for the minimum competency level that is the stated objective of the mandatory continuing educational requirements is not defined.
- Second, mandatory continuing education violates the adult learning principles where the professional is "supposed to be autonomous, self managed and responsible for the mastery of knowledge" (Kerka, 1994, p. 1). Voluntary continuing education is what committed professionals have been doing to keep up-to-date with changes and new technologies in their respective field of practice (Chlebicki, 2000). The mere participation in a course does not translate into competent performance.
- Third, the policy of mandatory continuing education has been enacted for more than a decade in some states such as Iowa and Alabama; yet the effectiveness of such a policy has not been measured or evaluated.

Significance of the Research

The purpose of this research is: (a) to explore the perception of civil engineers toward the CPC requirements, (b) to identify the assessment method that civil engineering professionals prefer in meeting their license renewal requirements, (c) to examine perceptions of civil engineers on the impact of mandatory continuing education on the public safety, and (d) to identify certain demographic and professional characteristics that influence participation in continuing education. Currently, continuing education has

become the instrument that regulatory agencies use to assure public safety and continued professional competency. However, the effectiveness of such policy has not been studied or proven. It is in the public interest and in the interest of the profession that an important issue such as public safety is assured and is entrusted only to competent professional individuals. Civil engineering is one of the professions that is related directly to public safety through the services it provides to society. The public takes for granted the safety of the infrastructures that it uses on a daily basis such as roads, bridges, and buildings, to name a few. The regulatory boards have mandated the CPC requirements for licensing renewal, not only in order to validate competency and to ensure that professionals are up-to-date with advances in the sciences and knowledge related to their professions, but also to ensure public safety.

The significance of the research stems from its direct relation to the welfare and safety of the public at large. The fact that an important issue such as CPC that has a direct impact on public welfare and safety is being assured through CPC requirements, without any evaluation or exploration of the impact of such requirements on the competency level, makes this research significant and timely. In addition, the issue of competency and public safety is at the heart of the civil engineering profession by virtue of the first canon of the American Society of Civil Engineers' code of ethics which states: "Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties" (American Society of Civil Engineers [ASCE], 1914, p. 1).

Currently, a lacuna exists in the literature regarding the perceptions of civil engineers toward the mandatory continuing education policy. There are, however, prior

studies on the subject from other professions such as accounting, psychology, nursing, and social work, among others.

The issue of regulation in general and public safety in particular is an issue of great importance in the field of public administration—the fourth arm of governing. This regulation which has been described as "a practical interim solution" (Shimberg, 1982, p. 122) is characteristically American when it comes to regulations and public policy issues. It uses the "chinking in" method of public policy that has been described by Stillman as "filling in of the cracks to make it workable" (Stillman, 1991, p. 56).

The public policy approach used in the making of this mandatory continuing education policy can be explained using the "iron triangles" concept. The agency, represented by the regulatory board, implements a policy set by the legislators, who are under the demand of interest group (the professionals) for political and electoral support. The agency benefits from more appropriation or influence, the legislators benefit from the political support, and the professionals from a favorable public policy. The result is a stable alliance of benefactors (Peters, 1999).

This research has implications on the many stakeholders that are connected with issues of public policy and regulation. These include legislators and regulatory boards, all levels of government, advocacy groups with public safety agendas, insurers, engineering educational institutions, and organizations that provide education. In addition, implications of this study will be on private and public organization and professional engineering societies. Perhaps the greatest implication is on the professionals who bear the burden of compliance. For all mentioned above, it is hoped that the findings of this study will be revealing since it is the first of its kind on the civil engineering profession.

Research Questions

The questions that this research explored are:

- What are civil engineers' perceptions regarding the mandatory Continuing Professional Competency (CPC) requirements?
- What is the position of the civil engineering professionals on mandatory education policy and its impact on professional competency and public safety?
- What reassessment method(s) do licensed civil engineering professionals prefer in meeting their CPC requirements?
- What is the relationship between demographic and professional characteristical variables (such as age, years of experience, level of education, field of practice, type of responsibility) and the attitude of civil engineers toward the mandatory continuing education policy?

Literature Review

Governmental regulations are generally made for the purpose of protecting the public from any perceived source that may bring harm. Professional occupations that provide services directly to the public are such sources. Regulatory boards have been established for the purpose of protecting the public from incompetent individuals. The licensing process is the method used initially to filter out those individuals who have not met the requirements for licensing and practice. To ensure continuing competency, some state boards have enacted a policy of CPC requirements.

This chapter reviews the following components in the literature:

- Critical studies in various professions that examined the issue of regulation as it relates to public safety.
- Critical studies that address the different competence re-assessment approaches and the licensure renewal process in other professions.
- Critical studies that explored the efficacy of mandatory continuing education policy on the competence of professionals.
- Critical studies that examined the development of national standards as influenced by the CPC requirements.
- Critical studies that address the perceptions of individuals in the professions of health care and law, who are required to engage in mandatory continuing education.

Methodology

This study explored civil engineers' perceptions toward the continuing professional competency requirements as a method of maintaining competency and assuring public safety and welfare, in accordance with the role of the professional licensing boards. It sought to identify competency reassessment approaches preferred by these professionals who are supposedly more aware of their educational needs. Furthermore, this study examined the relationship between the characteristics of the professionals (such as age, years of experience, level of education, field of practice, type of responsibility) and continuing professional competency.

This study is a cross-sectional quantitative type. Data was collected using an electronic questionnaire that was e-mailed to the participants. The population of this study was the licensed civil engineering professionals in all fifty states and territories.

The sampling frame consisted of civil engineering professionals that have a subscription with the *CE News* magazine newsletter "CivilConnections." The database consisted of electronic contact information of civil engineers, structural engineers, and bridge engineers. These professionals are representatives of the consulting industry, the construction industry, and the governmental sector.

The subjects were sent a formal electronic letter (see Appendix B) along with the link to the Internet site of the questionnaire, which explains the purpose of the study and provided them with contact information of the researcher. The letter included a statement that their confidentiality was protected by the hosting web site.

The e-mail included an electronic link to the survey site to complete the survey. Each participant was allowed access to the survey only once in order to avoid duplicate responses.

A pilot test of the survey was administered by randomly choosing ten licensed civil engineers. The purpose of this exercise was to estimate the average time needed to complete the survey and to check and test the instrument for readability and clarity as to the purpose of the questions. A revision of the questionnaire was carried out in accordance with the recommendations of the participants.

Prior to the commencement of any type of data gathering and in compliance with the policy of Western Michigan University, a Human Subjects Institutional Review Board (HSIRB) protocol was submitted for approval as shown in Appendix A.

CHAPTER II

BACKGROUND AND LITERATURE REVIEW

This chapter consists of two sections: A. Historical Background, and B. Literature Review. Section A will give a historical perspective of regulating the civil engineering profession. It will identify the major stakeholders of the regulation process, their interacting roles and the licensing process and requirements. Section B will review the literature according to the following components:

- Critical studies in various professions that examined the issue of regulation as it relates to public safety.
- Critical studies that address the different competence re-assessment approaches and the licensure renewal process in other professions.
- Critical studies that explored the efficacy of mandatory continuing education policy on the competence of professionals.
- Critical studies that examined the development of national standards.
- Critical studies that address the perceptions of individuals in the professions of health care and law, who are required to engage in mandatory continuing education.
- The independent variables used in this study to explore the perception of the professional civil engineers toward the mandated continuing competency requirements.

A. Historical Background

The profession of civil engineering in the United States is regulated through state boards that were established in all 50 states, 5 territories, and the District of Columbia. These licensing authorities regulate the practice of engineering for the purpose of protecting the health, safety, and welfare of the public. The authority is vested in the regulatory boards by means of an Engineering Practice Act and other rules to accomplish their purpose. Such laws and rules define engineering practice and establish requirements for an individual to become licensed as a professional engineer in that jurisdiction (National Council of Examiners of Engineers and Surveyors [NCEES], 2003b).

This chapter will map the history of regulations of the civil engineering profession from its inception till the present. First, the focus will be on the role of the major players who influence the regulations: The National Council of Examiners for Engineering and Surveying (NCEES); Accreditation Board for Engineering and Technology (ABET); American Society of Civil Engineers (ASCE); and the National Society of Professional Engineers (NSPE). The next section will review the historical evolution of the regulatory boards and the organizations that provide the infrastructure for the licensing process, e.g. The National Council of Examiners for Engineering and Surveying, and Accreditation Board for Engineering and Technology. Finally, an overview of historical perspective of the continuing professional competency will be presented.

The Major Stakeholders in Licensing Regulations

The National Council of Examiners for Engineering and Surveying (NCEES)

NCEES is a national non-profit organization composed of engineering and land surveying licensing boards representing all U.S. states and territories.

The mission of NCEES is to:

- Assist member boards in the promotion and promulgation of regulatory processes for engineering and land surveying which demonstrate high standards of knowledge, competence, professional development, and ethics.
- Provide services to member boards that promote uniform licensing procedures which emphasize quality education, examination, experience, and continuing professional competency.
- Coordinate and cooperate among domestic and international organizations to promote licensure of all engineers and land surveyors (National Council of Examiners of Engineers and Surveyors, 2003b).

Within the council, there is the Participating Organizations Liaison Council (POLC) that includes in its membership the Accreditation Board for Engineering and Technology (ABET) and many other professional societies such as American Society of Civil Engineers (ASCE), and the National Society of Professional Engineers (NSPE), which bring to NCEES the policies and thinking of the board of directors of the participating organizations on all matters pertaining to licensure and legal recognition of engineers and land surveyors, and also serves as a channel of communication of NCEES

policies and procedures to participating organizations (National Council of Examiners of Engineers and Surveyors, 2003b).

Accreditation Board for Engineering and Technology (ABET)

ABET serves the public through the promotion and advancement of education in applied science, computing, engineering, and technology. ABET:

- Accredits educational programs in colleges and universities.
- Promotes quality and innovation in education.
- Consults and assists in the development and advancement of education world-wide in a financially self-sustaining manner.
- Communicates with its constituencies and the public regarding activities and accomplishments.
- Anticipates and prepares for the changing environment and the future needs of constituencies.
- Manages the operations and resources to be effective and fiscally responsible.

ABET is a federation of thirty (30) professional and technical societies representing the fields of applied science, computing, engineering, and technology (Accreditation Board for Engineering and Technology, 2004). The American Society of Civil Engineers (ASCE), the National Society of Professional Engineers (NSPE), and NCEES are also among its membership.

NCEES and ABET influence each other through cross representation on different committees in both organizations.

> NCEES currently has representation on the ABET board of directors and on three of the ABET commissions. In addition, ABET personnel have been and continue to be actively involved in NCEES task forces that are examining issues of education, accreditation, and licensure qualifications. NCEES representatives also sit on ABET task forces. (National Council of Examiners of Engineers and Surveyors, 2005, p. 11).

The American Society of Civil Engineers (ASCE)

Founded in 1852, it represents more than 137,500 members of the civil engineering profession worldwide, and is America's oldest national engineering society. The mission of ASCE is to provide essential value to its members their careers, its partners, and the public through:

- Developing leadership,
- Advancing technology,
- Advocating lifelong learning, and
- Promoting the profession.

The ASCE has in past played a critical role in the development of standards and regulation of the civil engineering profession. Today it is still playing that pivotal role by looking into the future of the profession and establishing higher standards to meet the challenges in the interest of both the public and professionals alike.

The National Society of Professional Engineers (NSPE) is the only engineering society that represents individual engineering professionals and licensed engineers (PEs) across all disciplines. Founded in 1934, NSPE strengthens the engineering profession by promoting engineering licensure and ethics, enhancing the engineer image, advocating and protecting PEs' legal rights at the national and state levels, publishing news of the

profession, providing continuing education opportunities, and much more. NSPE serves some 60,000 members and the public through 53 state and territorial societies and more than 500 chapters (National Society of Professional Engineers, 2005a). These stakeholders set the course and direction of the of the civil engineering profession. They influence the entire process of licensing from education to experience to examination. Their cooperation therefore is very critical in order to advance the profession to a level that meets the high expectation of public safety.

The Role of the Licensing Board: Duties and Responsibilities

The role of the board consists of protecting the public both at the initial level of granting the license where it acts as the gatekeeper to the practice and after the licensing where it monitors the licensees' compliance with its rules. At the initial stage it protects the public by ensuring that individuals applying to practice engineering have met minimum credentialing standards set forth as a measure of minimum competency level. Licensing boards verify the qualifications of applicants and test their knowledge to see if it meets minimum standards, a procedure that has been called "preventive enforcement." The goal of preventive enforcement is to keep unqualified individuals from entering practice, thereby reducing the likelihood of their causing injury to the public (Shimberg, 1982).

At the next stage, the board also protects the public by investigating any complaints made by consumers and by conducting disciplinary action: such action could range from a simple reprimand to revocation of license and barring from practice. This exercise of accountability helps ensure that the public is served professionally and to an acceptable standard.

At this stage also, the public's interest is served by keeping professionals up to date with any technological development that takes place during the renewal period by checking the compliance of licensed professional engineers with the requirements of continuing education for licensing renewal.

Some scholars are skeptical about the effectiveness of licensing in protecting public health and safety. "In general, boards tend to be more zealous in prosecuting un-licensed practitioners than in disciplining those already licensed" (Gross, 1984, p. 148). Thousands of complaints are received by licensing boards every year, but only very few result in disciplinary action (Shimberg, 1982). Inadequate budgets, staff, and record keeping are common in agencies charged with oversight responsibilities. Cohen and Miike (1974) attributed the ineffectiveness of licensing boards to four other factors: (1) a reluctance to invoke disciplinary action against fellow practitioners; (2) the threat of law-suits; (3) the role conflict in being both rule makers and adjudicators; and (4) the usually ambiguous statutory grounds for board sanctions, leading to judicial reluctance to enforce them (Cohen & Miike, 1974).

The implications of such inefficiency suggest that public safety could be harmed if not served by the boards as was legislated. Adequate capacity for oversight of licensees is needed for the boards to be effective in carrying out their mandate.

History of Regulation

The United States Constitution gave certain powers to the states. This is evi-denced in the tenth amendment which states: "the powers not delegated to the United States by the constitution, nor prohibited by it to the states, are reserved to the states

respectively, or to the people." These powers include the right to legal jurisdiction over their sovereign territories. In order to safeguard the public's health, safety, and welfare, the states initiated legislation to regulate the engineering profession. This legislation led to the establishment of licensing boards and charged them with the responsibility of regulating the practice of engineering and land surveying as it relates to the welfare of the public in safeguarding life, health, and property. These boards were empowered by the states' legislatures to control the engineering profession by establishing registration rules and collecting fees to allow only registered engineers to identify themselves as "engineers" or "land surveyors" and to practice or deliver related services.

Regulation of the profession started with a story from the state of Wyoming, where in 1903, Clarence T. Johnston was the state engineer (Curtis, 1988). When he took office, he found that untrained people were working as engineers and land surveyors. The state law then mandated that all people who wished to use state water to irrigate land had to file an application with a permit. The law also required that that a map be filed to outline streams, canals, and reservoirs, as well as land to be irrigated. Johnston later wrote in a letter that those who were making the maps and signing them were lawyers, notaries, and others, all of whom were not disinterested parties. With the help of some colleagues, Johnston prepared a bill designed to remedy this problem. Although it met much resistance from those benefiting from the lack of regulation, the Wyoming legislature passed the bill. A few months afterward, Johnston commented "a most astonishing change took place within a few months in the characters of the maps and plans filed with the application for permit" (Curtis, 1988, p 1).

No doubt that the power of regulation has an impact on the quality of service that professionals provide to the public. More powerful, however, is the demand that professionals are made accountable for their work and kept continually competent to deliver a better service.

In 1907, Wyoming was the first state in the nation to pass the first engineering registration law. At that time, Wyoming was experiencing an era of great water development. This made Wyoming engineers concerned about the flood of people who "lacked the qualifications or experience of trained engineers but were nonetheless using the term 'engineer'" (Curtis, 1988, p 1). The law was passed so that "all the surveying and engineering pertaining to irrigation works should be properly done" (The American Academy of Water Resources Engineers, 2005, p. 1).

Table 4 shows the timeline of the registration law in the United States and its territories.

Although regulation laws were passed, these laws were not in any way uniform. Each state had different and separate requirements for registration. Each state did not recognize the registration of the other and would not allow the practice of engineering within its jurisdiction. This situation created a state of confusion for the engineering profession and a workable solution had to be sought to overcome the problem.

In 1920, the state of Iowa issued an invitation to representatives of the ten state boards in existence at the time to convene a meeting. The invitation read:

> It having developed, in the application of the laws for the registration of professional engineers, land surveyors and architects, that there should be an organized and systemized method of procedure to be followed in interstate registration, that there should be uniform basis of examination and registration, that a convention for the purpose of arriving at a working plan

> and an understanding of the scope, plan, and procedure of the several boards was desirable and practical. Further, that it appeared to be desirable to effect a form of a permanent organization to arrive at the best understanding and to facilitate the business of the state and interstate registration (Curtis, 1988, p 115).

This invitation addressed the major concerns of reciprocity and uniformity and calls for the cooperation between the states.

Table 4

Timeline of the Registration Law in the United States and Its Territories

Year	States
1907	Wyoming
1908	Louisiana
1917	Florida
1919	Colorado, Idaho, Iowa, Michigan, Nevada, Oregon
1920	New York, Virginia
1921	Arizona, Indiana, Minnesota, New Jersey, North Carolina, Pennsylvania, Tennessee, West Virginia
1922	South Carolina
1923	Hawaii
1925	Arkansas, South Dakota
1927	Puerto Rico
1928	Mississippi
1931	California
1933	Ohio
1935	Alabama, Connecticut, Maine, New Mexico, Oklahoma, Utah, Washington
1937	Georgia, Nebraska, Texas
1938	Kentucky, Rhode Island
1939	Alaska, Maryland, Vermont
1941	Delaware, Massachusetts, Missouri
1943	North Dakota
1945	Illinois, New Hampshire
1947	Montana
1950	Washington, D.C.
1960	Guam
1968	U.S. Virgin Islands
1978	Northern Mariana Island

Source: The American Academy of Water Resources Engineers, 2005, p. 2

Seven of the ten states sent representatives of the first annual meeting in Chicago. Their first order of business was to create a temporary organization to carry out the business of drafting a constitution and electing permanent officers for "the organization and operation of a council of boards of engineering examiners." At this meeting in 1920, the Council of State Boards of Engineering Examiners (CSBEE) was founded.

The constitution expressed the purpose of the council:

> to examine the state laws providing for registration of engineers and the custom and rule of procedure of the different boards in the examination of applicants with suggestions and recommendations for uniformity for practice so far as the same can legally be done by the different state boards, and to provide for reciprocal relations between the state boards for granting registration licenses to applicants from other states on equal terms of examination. (Curtis, 1988, p 3)

In 1931, the word "National" was added to the name to become the National Council of State Boards of Engineering Examiners (NCSBEE). In 1965 the first NCSBEE Fundamentals of Engineering (FE) Examination was administered; in 1966 the first NCSBEE Principles and Practice of Engineering (PE) Examination was administered; in 1984, all member boards use uniform national engineering examinations; and, in 1989, the name was changed to National Council of Examiners for Engineering and Surveying (NCEES) (National Council of Examiners of Engineers and Surveyors, 2004b).

History of Accreditation Board for Engineering and Technology (ABET)

Seven engineering societies founded the Accreditation Board for Engineering and Technology (ABET) organization and contributed to its original direction and focus: the American Society of Civil Engineers (ASCE), the American Institute of Mining and Metallurgical Engineers (now the American Institute of Mining, Metallurgical, and

Petroleum Engineers), the American Society of Mechanical Engineers (ASME), the American Institute of Electrical Engineers (now IEEE), the Society for the Promotion of Engineering Education (now ASEE), the American Institute of Chemical Engineers (AIChE), and the National Council of State Boards of Engineering Examiners (now NCEES). Within its first year of existence, Engineers Council for Professional Development (ECPD) had already begun developing itself as an accreditation agency, and, in 1936, evaluated its first engineering degree programs. Ten years later, the council began evaluating engineering technology degree programs.

In 1980, ECPD was renamed the Accreditation Board for Engineering and Technology in order to more accurately reflect its emphasis on accreditation, and it continues to place most of its emphasis on accreditation today (Accreditation Board for Engineering and Technology, 2004).

The Licensing Process

When engineers receive their professional engineer's license (P.E. license) they are receiving a stamp of approval of their credentials by the state. In order to receive a P.E. license, an individual must first meet rigid requirements established by the state.

Each state has established its own legal qualifications for individuals desiring to practice engineering for the general public. When an engineer satisfies these qualifications, the state is then confident that the life, health, property, and welfare of the general public will be protected by the P.E.

Registration as a professional engineer through a state board of registration is the only legal basis for public practice of engineering. The qualifications for the professional

engineer's license are very similar in all states. The candidate must first submit detailed personal records to the state engineering registration board. These records include the following: verification of U.S. citizenship, college transcripts, five character references (three of which must be from registered professional engineers), and detailed employment records demonstrating four or more years of progressive engineering experience.

The state engineering board reviews the applicants' records and requests additional information from each of the applicant's character references to verify the sophistication and/or complexity of the work; the degree of individual judgment and initiative required; the amount of individual responsibility and authority required; and the level of supervisory authority exercised. In addition, the board verifies that the moral and ethical judgments of the applicant are of the highest order.

The first exam, Fundamentals of Engineering (FE), covers mathematics, chemistry, physics, and engineering sciences. The second exam, Principles and Practice of Engineering, requires the applicant to solve engineering problems in his discipline, in addition to problems in four other disciplines within the civil engineering field. These disciplines could be: soil mechanics, environmental engineering, structural engineering, transportation engineering, etc.

If the candidates pass both exams, they are then granted the P.E. license and a registration number. The P.E. license gives engineers the authority to provide consulting engineering services in the state of registration. They are obligated to perform such services under the provisions described in laws regulating the practice of professional engineering. A P.E. license also establishes their professional standing on the basis of legal requirements. In many cases all final plans, of which designs, drawings, specifi-

cations, and reports may be a part, are required to bear the seal and signature of the P.E. in responsible charge. In these instances, the state holds the engineer professionally responsible for the work.

Receiving a P.E. license represents a personal commitment on the part of the engineers to their profession and career. It also means that they are further committed to maintaining high ethical and work standards.

The P.E. license indicates that the engineer has had his qualifications and references thoroughly checked by the state. He has a college education in an engineering science, has progressed logically through his career doing responsible engineering work, and he is knowledgeable in disciplines outside his own. A P.E. license is a mark of quality professional standards and workmanship.

Engineers Exempt From Licensure

Licensure is required only for those who provide services independently to both private and public clients, but not by those who serve in public agencies or under the supervision of a licensed engineer. The law in the state of Florida is a representative sample of those of all other states:

> 471.003 Qualifications for practice; exemptions.
>
> (2) The following persons are not required to be licensed under the provisions of this chapter as a licensed engineer:
>
> (a) Any person practicing engineering for the improvement of, or otherwise affecting, property legally owned by her or him, unless such practice involves a public utility or the public health, safety, or welfare or the safety or health of employees. This paragraph shall not be construed as authorizing the practice of engineering through an agent or employee who is not duly licensed under the provisions of this chapter.

(b)1. A person acting as a public officer employed by any state, county, municipal, or other governmental unit of this state when working on any project the total estimated cost of which is $10,000 or less.

2. Persons who are employees of any state, county, municipal, or other governmental unit of this state and who are the subordinates of a person in responsible charge licensed under this chapter, to the extent that the supervision meets standards adopted by rule of the board.

(c) Regular full-time employees of a corporation not engaged in the practice of engineering as such, whose practice of engineering for such corporation is limited to the design or fabrication of manufactured products and servicing of such products.

(d) Regular full-time employees of a public utility or other entity subject to regulation by the Florida Public Service Commission, Federal Energy Regulatory Commission, or Federal Communications Commission.

(e) Employees of a firm, corporation, or partnership who are the subordinates of a person in responsible charge, licensed under this chapter.

(f) Any person as contractor in the execution of work designed by a professional engineer or in the supervision of the construction of work as a foreman or superintendent. (The Florida Board of Professional Engineers, 2004)

License Requirements

Table 5 shows the basic route to obtaining a professional engineering license in any state or territory of the United States.

For a complete list of all boards requirements see http://www.ncees.org/licensure/licensing_boards/.

Table 5

Basic Requirements for Professional Engineering License

1. Completion of a four-year degree at an accredited college or university.
2. Pass the Fundamental of Engineering (FE) test (8 hours).
3. Four of more years of experience under the supervision of a Professional Engineer.
4. Pass the Professional Engineering (PE) test.
5. Submit work history with letters of recommendation including some from Professional Engineers.

Benefits of Licensure

Private industry and public organizations require that design documents or recommendations are stamped or sealed by a licensed professional engineer. In addition to being a required qualification, a licensed engineer can realize the following benefits:

- To go into consulting, where industrial exemptions are not an option.
- To distinguish themselves from other technical workers in companies who are being given job titles with the word "engineer" attached.
- To be in a responsible position to lead a project team.
- To become an expert witness to testify in a court of law.
- To improve chances of promotion and higher wages.

Reciprocity (Comity)

When an engineer passes the Professional Engineering exam and obtains a license in one state he or she may also be licensed in as many states as he or she wishes through a reciprocity process (also known as comity). This provision was established in order to

ease the mobility of engineers throughout the states. This type of mobility greatly reduces the barriers that engineers would have to overcome when working on projects in a different state than the one licensed in. Although there is a process to register for reciprocity, the length of time and the cost to the engineer is reduced. The board, on the other hand, benefits from the initial and yearly fees required for licensure and renewal.

History of Mandatory Continuing Engineering Education

The trend towards a Mandatory Continuing Education requirement for licensure renewal started in the state of Iowa in 1979. This state has been a forerunner in terms of engineering policy development. It was among the first states to enact engineering regulations.

The Iowa law defines the term continuing education as

> that education which is obtained by a professional or occupational licensee in order to maintain, improve, or expand skills and knowledge obtained prior to initial licensure or to develop new and relevant skills and knowledge. This education may be obtained through formal or informal education practices, self-study, research, and participation in professional, technical, and occupational societies, and by other similar means as authorized by the board. (The Iowa Legislature, General Assembly, 2003)

Iowa's regulations did not just mandate continuing education for engineers only but also for all existing licensed professional occupations and those established after 1978.

Fourteen years later, in 1993, Alabama became the second state to mandate continuing education for engineers. Table 6 below shows the timeline of the states mandating continuing education for licensure renewal.

Table 6

Timeline of the States Mandating Continuing Education for Licensure Renewal

State	PDHs per Year(s)	Year of MCE Adoption
Alabama (AL)	15	1993
Arkansas (AR)	15	1997
Florida (FL)	8 / 2 years	2000
Georgia (GA)	30/ 2 years	1997
Illinois (IL)	30 / 2 years	2002
Iowa (IA)	30 / 2 years	1979
Kansas (KS)	15	1995
Louisiana (LA)	15	1998
Maine (ME)	30 / 2 years	2005
Minnesota (MN)	12	1999
Mississippi (MS)	15	2001
Missouri (MO)	30 / 2 years	2002
Montana (MT)	15	1995
Nebraska (NE)	15	2002
Nevada (NV)	15	1997
New Hampshire (NH)	30 / 2 years	1998
New Mexico (NM)	15	1995
New York (NY)	36 / 3 years	2002
North Carolina (NC)	15	1994
North Dakota (ND)	30 / 2 years	2005
Oklahoma (OK)	15	1996
Oregon (OR)	30 / 2 years	1997
South Carolina (SC)	30 / 2 years	1996
South Dakota (SD)	30 / 2 years	1997
Tennessee (TN)	24 / 2 years	1995
Utah (UT)	24 / 2 years	2002
West Virginia (WV)	15	1994
Wyoming (WY)	15	2000

Source: National Society of Professional Engineers, 2005b

Currently, twenty-nine (29) out of the 50 states and four protectorates require mandatory CPC as a condition of professional practice or licensure.

Public demand for higher professional accountability, coupled with pressure from professional stakeholder organizations for uniformity of requirements and ease of mobility across the states, Continuing education requirements as a current approach for continued professional competency is being adopted by the states at an increasing rate as shown in Figure 1 below.

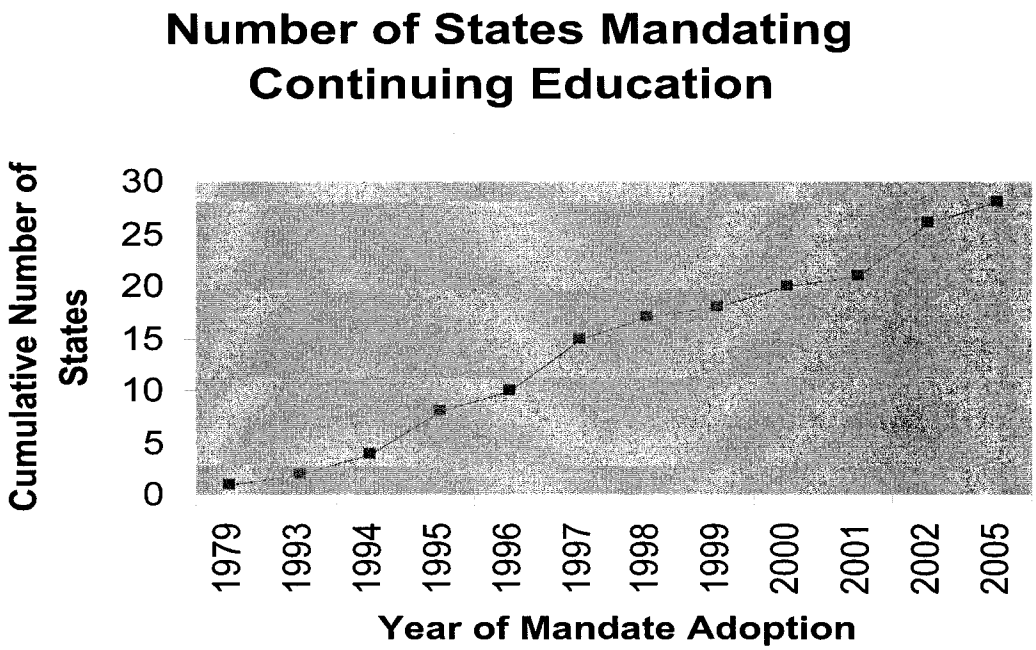


Figure 1. Timeline for the number of states that have adopted the policy of MCE (the American Academy of Water Resources Engineers, 2005, p. 5).

B. Literature Review

Introduction

Professional regulations in the United States started before the U.S. Constitution was written; according to Law and Kim (2004) and de Aristizabal, medicine was regulated by a legislative law in Virginia in 1639 (de Aristizabal, 2000; Rops, 2004). Although regulations are the result of input of many players in the policy making process, the end of the 19th century and the beginning of the 20th century witnessed a decided increase. This era was known as the progressive era when "advances in knowledge and specialization led to the emergence of modern day professions" (Law & Kim, 2004, p. 1). This decided incrementalism in regulation (Lindblom, 1992, p. 551) was due to both the industrial and scientific revolutions. The professional regulation of the continuing education as a requirement for license renewal is one such regulation that has emerged as a result of a sudden public awareness and demand on professionals after the release of a report from the heath department (Shimberg, 1982). This process of making regulation has been described by Stillman as a "chinking-in" process, where loopholes in the laws are temporarily plucked in order to keep system working (Stillman, 1991, p. 56).

Continuing professional education has become a matter of professional survival for many professions. The information revolution that started a few decades ago brought with it higher consumer awareness and demand for professional accountability. The demand for such education has created an industry that has grown into a profession that is estimated to be a several billion dollar industry (Cervero, 1988; de Aristizabal, 2000). It could be inferred that this explosive growth was the result of the continuing education

mandate that states have adopted to ensure that professionals are continually competent and public safety and well being are also continually maintained.

This section will explore the following topics:

1. Current situation of regulation regarding renewal of licenses/certifications in the civil engineering profession and in medicine, nursing, law, and airline pilots.
2. Current reassessment approaches used for re-licensing/re-certification processes to ensure competency in the above listed professions.
3. Critical studies on professional perception and the efficacy of mandatory continuing education policy on the competence of professionals, as well as the manner in which the welfare of the public is impacted will be examined.
4. Critical studies that addressed the development of national standards for these professions will be reviewed. In addition, the effects of continuing education on national standards and its on-going development will be explored.
5. Critical studies that identify the variables used in previous studies to explore the issue of professionals' perceptions regarding mandatory continuing education.

Modes of Regulations

There are more than 800 state regulated occupations in the United States (Shimberg, 1982; Kleiner & Ham, 2005). Regulations take different forms in different professions. The most common terminologies used are as follows: (a) licensing used in professions such as engineering, medicine, law, accounting etc.; (b) certification, being statutory when used by governmental agencies such as the Federal Aviation Agency (FAA) in professions such as airline pilots, or voluntary when used by private profes-

sional organizations as in medicine to certify an already licensed doctor; (c) registration is a regulatory method that requires individuals to just be registered with a governmental agency for the purpose of control (Shimberg, 1982).

Licensing is categorized as the most restrictive type of regulation and control. While it aims to protect the public from unscrupulous and incompetent practitioners, it also restricts entry into a profession and limits the supply of professionals. Licensing has also been labeled as the brainchild of professional organizations for the exclusive benefits of licensees. Shimberg (1982) cited Walter Gelhorn (1976), who stated that "In many more instances, however, the licensing has been eagerly sought—always on the purported ground that licensure protects the uninformed public against incompetence and dishonesty, but invariably with the consequence that members of the licensed group become protected against competition from the newcomers" (Shimberg, 1982, p 6). The consequence then, is higher cost paid by the consumer for goods and services, in accordance with the simple concept of supply and demand. In the last half century there has been a marked increase in licensed professions and the number of professionals has increased from 4.5% in the 1950s to about 20% of the labor force today (Kleiner & Ham, 2005).

Although licensure comes with added costs, the benefits it has brought to public safety and welfare more than outweigh the cost. One cannot imagine living without such a licensing system where anyone can claim to be what they feel like being. If the licensing process is the first step in protecting the public, the continuing education requirement is then the continuous "preventive" step. Regulations being a "chinking-in" process as described by Stillman, bureaucratic pathology and red tape are inevitable, and with the passage of time effective rules evolve into ineffective ones (Bozeman, 2000). In the latter

part of the 1970s, the public acceptance of the regulatory process started to erode after the publication of studies and reports about the impact of licensing on restricting mobility, entry barriers, and higher earning of professionals of certain occupations (Shimberg, 1982). This public dissatisfaction brought pressure to many state governments to pass the "sunset" law. The state of Colorado was the first state to pass this law in 1976, and thirty-three (33) states followed suit (Shimberg, 1982). This law required the abolishing of the regulatory agencies unless they can demonstrate that a need for regulation still exists and if they were functioning efficiently and effectively. None of the boards have been abolished as a result of the sunset laws. On the contrary, the regulatory boards are still here today and their responsibilities are ever broadening to monitor the continuous competency of professionals throughout their career lives.

Regulation of Licenses/Certifications Renewal

This section reviews the history and continuing education requirements for each of the following professions: medicine, nursing, law, airline pilots, and civil engineering. Table 7 shows a comparative summary of such requirements including the number of boards adopting such regulations.

Medicine

The medical profession started requiring continuing medical education in 1947 when the American Academy of General Practice began to require 150 hours of CME every 3 years as a condition for membership (Garner, 1981; Sklar, 2000). The first state to enact the mandatory policy of medical continuing education for license renewal was

New Mexico in 1971(Shimberg, 1982; Sklar, 2000). Currently, more than forty (40) states have enacted a similar mandatory policy but with different requirements that vary from a minimum of 12 hours to a maximum of 50 hours ever year.

Table 7

Comparative Summary of Hours Requirements and the Number of Boards Adopting MCE Regulation

Profession	Number of Boards			Range of Hours		
	Total	With Re–quirements	Without Requirements	Low	Average	High
Medicine*	54	41	13	12	31	50
Nursing*	52	29	23	10	30	50
Law**	50	40	10	10	12.5	15
Airline Pilots***	1	1	0	2	2	2
Civil Engineer-ing****	54	29	25	4	9.5	15

*(de Aristizabal, 2000)
**(American Bar Association)
***(Aircraft Owners and Pilots Association, 1996)
****(McGraw Hill Construction, 2005)

Nursing

The nursing profession started the mandatory requirements of continuing education for license renewal in 1978. Currently, twenty-nine (29) states and the District of Columbia require between ten (10) and fifty (50) hours every year. The nursing profession was one of the early professions to be regulated due to its role in personal safety and well-being of the public. The first states to start the regulation process in 1903 were North Carolina, New Jersey, New York, and Virginia. By 1910, 20 states had established such laws. However, these early laws were inconsistent and varied from state to state. In

addition, they did not define the scope and responsibilities of the practice of nursing. It wasn't until 1940 that the first national nursing examination developed (Crawford, 2001).

Law

Currently, mandatory continuous legal education policy for licensure renewal is in effect in forty (40) states (American Bar Association, 2004). The first state to adopt mandatory continuing legal education was Minnesota, effective in 1975. As of 1995, there was a total of 38 states with MCLE requirements (The Institute for Continuing Legal Education, 2003).

In June of 1989, the Standing Committee on Continuing Education of the American Bar Association developed The Model Rule for Minimum Continuing Legal Education (MCLE). This model rule requires a minimum of fifteen (15) hours of continuing legal education annually. It urges all the states that have not adopted a continuing education policy to do so and is ready to assist the states in developing mandatory continuing education programs (American Bar Association, 2004).

Airline Pilots

Unlike most other professions being regulated by state agency, airline pilots are centrally regulated by the Federal Aviation Administration (FAA). While airline pilots do not have a continuing education requirement policy for license renewal, they do have a mandatory flight review testing every twenty-four (24) calendar months. This policy came into effect on January 6, 1987 (Aircraft Owners and Pilots Association, 1996). The Federal Aviation Regulation (FAR) section 61.56 describes the requirements as follows:

> A flight review consists of a minimum of 1 hour of flight instruction and 1 hour of ground instruction.
> The review must include:
>
> 1. A review of the current general operating and flight rules of Part 91 of this chapter; and
> 2. A review of those maneuvers and procedures which, at the discretion of the person giving the review, are necessary for the pilot to demonstrate the safe exercises of the privileges of the pilot certificate. (Aircraft Owners and Pilots Association, 1996)

This requirement applies to all pilots who intend to act as pilots in command of an aircraft.

Civil Engineering

The civil engineering profession also followed suit as other professions concerned with public safety and well-being. While professional organizations such as the American Society of Civil Engineers (ASCE) and the National Society of Professional Engineers (NSPE) were opposed to any mandatory educational requirements prior to 1979, they both have approved and encouraged all state boards to adopt mandatory continuing education equipments for license renewal. Currently, twenty-nine (29) states have adopted such a policy but with varying specific requirements. The least number of required hours is in the state of Florida (four [4] hours), while the maximum is fifteen (15) hours in several states, especially those who have adopted the model law of the National Council of Examiners for Engineers and Surveyors (National Council of Examiners of Engineers and Surveyors, 2004a).

Reassessment Approaches

Ensuring continuing competency of professionals is a complex task from the assessment standpoint. The leadership of professional organizations, whose main purpose is to serve the interest of their memberships while at the same time focusing on the safety and well-being of the public, faces a tremendous task of balancing both goals. On the one hand, they must protect the image and standing of the profession in the public eye, while on the other hand they must submit to the demands of their members, many of whom have stated their disapproval to any mandatory policy and especially periodic re-examination. Although mandatory continuing education is not as demanding from the time and cost standpoint as reexamination would be, still many oppose its "mandatory" provision in the so-called self-regulated professions (Whittaker, Carson, & Smolenski, 2000).

The professions are facing a tremendous pressure from the public whose confidence is very important to their reputation. With the public playing a greater role in setting regulation policies, it has the power to influence policy makers to ensure that its health and general well being are protected. The onus rests with the professions to establish methods of competency reassessment that will enhance this public confidence, and thus minimize the public role in policy making from resulting in over regulations. The professions strive to be empowered to self-regulate and make their own rules and requirements on competencies, rather than have to comply with regulations that are "impressed" upon them—not by choice.

The most basic method of assessing that education or learning has taken place has been through testing. There are many assessment approaches that have been used to test

learning. Some of these are as follows: periodic reexamination, self assessment, peer review and audit, simulation, and mandatory continuing education (Shimberg, 1982). Other suggested approaches for assuring continuing competence have included continuing education with exit testing, practical demonstrations of competency, proactive fellowship programs, and holding employers responsible for ensuring competence of their staff (Gragnola & Stone, 1997). While most state regulatory boards are still using continuing education as a method to measure continued competence, many have introduced legislation to implement other approaches. According to Whittaker et al. (2000),

> In the first quarter of the 2000 state legislative sessions alone, 11 states have introduced legislation relative to continuing competence of health professions. Most legislation would require licensees to demonstrate continuing competence to a licensure board upon re-licensure while some bills would require a provider to demonstrate competency in the workplace setting.

This departure from the current mandatory continuing education approach that requires attendance at the least, to a different approach that requires follow-up steps, is an acknowledgement of the ineffectiveness of such an approach especially with the lack of any data to establish its effectiveness. Continuing professional education was criticized early on as a method that should not be "oversold as a solution" (Kerka, 1994, p 1) and that this type of education should not violate the principles of the adult learner theory, the basic tenets of which establish the autonomy of the professional (Kerka, 1994). In a presentation titled "Maintaining Competence—How Does the Public Know?", David Sims, the lieutenant Governor-in-Council Appointee at the Professional Board of Ontario, Canada, suggested that "it is reasonable to require reports from each professional engineer on steps taken to maintain his or her competence" (The Canadian Academy of

Engineering, 2003; Sims, 2003). The Citizen Advocacy Center issued a report in 2004 titled "Maintaining and Improving Health Professional Competence," that describes a five-step model for maintaining competence: Step 1—Routine periodic assessment either by the practitioner or a third party. Step 2—Develop a personal plan based on the assessment. Step 3—Implement the personal plan. Step 4—Document the completion of the previous steps. Step 5—Demonstrate/evaluate competence. Through the repeated implementation of these steps, a life long pattern will develop and continuous competency is maintained (The Citizen Advocacy Center, 2004).

Another model is the Competency Outcomes and Performance Assessment (COPA) which was developed by Carrie Lenburg. The model is based on identifying the current essential competencies and outcomes and the most effective methods of teaching and measuring the learning. Lenburg (1999) described the model as follows:

> The basic organizing framework for the COPA Model is simple but comprehensive. It requires the faculty, and/or others responsible for program (or course) development, to analyze and respond realistically and collaboratively to four essential questions:
> 1. What are the essential competencies and outcomes for contemporary practice?
> 2. What are the indicators that define those competencies?
> 3. What are the most effective ways to learn those competencies? And,
> 4. What are the most effective ways to document that learners and/or practitioners have achieved the required competencies? (Lenburg, 1999)

The approaches that are being used by the five professions are described in Table 8.

As can be seen from above, the continuing education approach is the dominant one for ensuring continued competency in most professions. Airline pilots are the only professionals where practical demonstration of competency is required every two years. During a telephone conversation with the head of the Citizen Advocacy Center, he men-

tioned that all professions should have a license renewal procedure similar to airline pilots.

Table 8

Reassessment Approaches of Various Professions

Profession	Reassessment Approach for Continued Competence	Additional Remarks
Medicine	Continuing education	
Nursing	Continuing education	Some states require a minimum number of hours in practice
Law	Continuing education	
Airline Pilots	Practical demonstrations	
Civil Engineering	Continuing education	

Professionals' Perceptions of Mandatory Continuing Education

Mandatory continuing education is a subject that has certainly divided the professional communities. Those who perceive it positively state that it forces the "laggards" to participate in continuing education and to update their skills. While those who perceive it negatively argue that participation does not mean learning, and therefore, continuing education should be voluntary and the professionals are in the best position to determine their educational and skill needs. The following is a summary of studies on professional perception regarding mandatory continuing education:

Hatch studied the perceptions of emergency medical services personnel concerning continuing education. Using a four-point Likert scale, he found that the majority

of the respondents agreed or strongly agreed that mandatory continuing education is both a professional and ethical responsibility (Hatch, 2001).

Dew conducted a research study on perceptions of family physicians toward mandatory versus voluntary continuing medical education (CME). "A questionnaire was submitted to 121 physicians identified as Family Practitioners. A total of 68 completed questionnaires were returned, giving a response rate of 56%. The results of the survey show that most physicians feel that CME is necessary but should be voluntary and controlled by the specialty group or board rather than licensing agencies" (Dew, 1993, abstract).

Austin studied the Illinois physical therapists' preferences, attitudes toward, and perceptions of continuing education:

> [P]articipants were generally supportive of mandatory continuing education and were in favor of American Physical Therapy Association (APTA) having increased involvement in the continuing education process. They were concerned about travel distance to continuing education activities and preferred local offerings or those held at their place of employment. They placed importance on finding relevant continuing education activities that paralleled their area of practice and felt that their employer should assist with financing continuing education. Participants in both studies were also strongly opposed to re-examination as a potential re-licensure option. They also felt that continuing education should include evidence-based findings and that continuing education had the ability to promote professional competence. (Austin, 2004, abstract)

Maidenberg studied the factors that influence social workers' participation in continuing education. Her findings revealed that

> respondents in the field of mental health were more likely to participate in continuing education if they were required to do so under state licensing law. Respondents who perceived continuing education as being helpful to their practice and personally beneficial were more likely to participate in a greater number of hours in continuing education if they were not required by law to do so. Respondents who believed continuing education should

> be mandated were more likely to participate in continuing education if they were required to do so. (Maidenberg, 2001, abstract)

Mayhan (2000) conducted a research study on public policy and professional practice titled "The relationship of state regulation to continuing competency, perceptions and behaviors of occupational therapists." The research questions are: (1) Does state regulated continuing competency influence the continuing competency perceptions and behaviors of occupational therapists (OTs) and assistants (OTAs)? (2) Are the state requirements for evidence of continuing competency likely to influence practitioners to practice competently for the protection of the public?

> The results of the study indicate that state regulation does have an influence on the continued competency perceptions and participation in continued competency activities of OTs/OTAs, particularly related to the selection of continued competency activities, and perceptions about the importance of and whether or not continued competency should be mandatory. However, discernment of the relationship between state regulation and what professionals actually do in practice and how it impacts consumer safety and protection was more elusive due to the inadequacy of measures of practice available for analysis. Analysis of the impact of employer requirements for continued competency suggests that employers may have an influence. (Mayhan, 2000, abstract)

Prater conducted a research study on mandatory continuing education in nursing. The study consisted of a self-administered questionnaire that was mailed to a random sample of 500 registered nurses residing in Texas with a return rate of 25%. It was reported that

> Seventy-two percent (72%) of the responding nurses had a positive attitude toward mandatory continuing education. The nurses also felt that health care to the public had been improved by participation in the 20 hours of mandatory continuing education. Fifty-six percent of the responding nurses perceived improved performance of psychomotor skills, 83% felt cognitive skills were improved, and 72% felt affective skills were improved as a result of participation in mandatory continuing education. The greatest benefit of mandatory continuing education was that partic-

> ipation increased nurses' general knowledge base, while interest in the topic and relevance of the course content to their practice area were the most important factors when choosing a continuing education program. The majority of the respondents indicated a preference for lecture/discussion over other forms of instruction, and an independent provider of continuing education courses was the provider of choice. (Prater, 1998, abstract)

Clark did a research study on advanced registered nurse practitioners' perceptions of mandatory continuing education requirements for re-licensure in the state of Arkansas.

> Results of the study suggested that 76% of the Advanced Registered Nurse Practitioners participants support mandatory continuing education for safety of patient care because they feel that if it were not mandatory, many Advanced Registered Nurse Practitioners would not keep current. (Clark, 1995, abstract)

Studies on the engineering profession have been limited. Chlebicki (2000), in his study titled "An analysis of the professionalism of engineers in Iowa and Illinois," examined the relationships of the level of professionalism and mandatory continuing education. He found that there is a strong correlation between the level of professionalism and mandatory continuing education (MCE). MCE was then required only in the state of Iowa. Continuing education whether mandatory or voluntary provides a platform through which engineers can interact and exchange knowledge and ideas. Mandatory continuing education, however, would provide this platform to all engineers rather than to those who seek it under the voluntary option.

The following are excerpts from the results of two surveys concerning the attitudes of engineers on the issue of mandatory continuing education requirements: one conducted in June 2003 in Canada by the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC), and the other conducted in the state of Michigan by the Michigan Society of Civil Engineers (MSPE).

The survey by APEGBC revealed that the majority of its members supported the initiative of mandatory professional development "as long as it is flexible and meets their specific professional needs" (The Association of Professional Engineers and Geo-scientists of British Columbia, 2003).

On the importance of continuing professional development to a professional's level of competence, 80% of the 544 members responded as either important or very important. When asked about their own current competence level to do professional work being undertaken, 66% of respondents answered "yes" and 34% offered that improvement would be beneficial. Interestingly, when asked about the competency of others, the "yes" response dropped to 30% and almost 70% reported "not always." When asked about their opinion on the creation of a compulsory professional development program for APEGBC members, just 52% voted favorably. The survey reported that many members would vote in favor if the program was flexible in the type and format of professional development. Retired members indicated that they would not support a program (Association of Professional Engineers and Geoscientists of British Columbia, 2003).

The survey by the Michigan Society of Civil Engineers (MSPE) was conducted to gauge the position of licensed engineers and engineers in training (E.I.T.) on the issue of MCE and did not produce similar results to that by APEGBC above. The results show that the majority opposed the adoption of MCE policy with 252 opposing to 147 supporting while 24 took a neutral stand. On the subject of using another reassessment method than MCE to determine the competence of licensed engineers, 212 voted no while 40 voted yes. Here, the result of the survey reveals that the status-quo is the preferred option (Michigan Society of Civil Engineers [MSPE], 2004).

In summary, the studies mentioned above show that the majority of the professionals support mandatory continuing education, although some prefer the voluntary option and flexibility of meeting the requirements. This flexibility gives the professionals some freedom in choosing their educational programs in accordance with their professional needs. It also gives them some autonomy in steering their careers in the directions of their choosing and in making choices according to their needs.

Development of National Standards

National standards are the results of input from many actors who have an interest in the development of such standards. For instance, the model law, dated August 2004, published by the National Council of Examiners of Engineers and Surveyors, was the product of recommendations of the Engineering Licensure Qualifications Task Force (ELQTF). This task force is comprised of members from the National Council of Examiners for Engineering and Surveying, the umbrella organization that mainly consists of members representing engineering regulatory boards, and the following organizations:

American Academy of Environmental Engineers

Accreditation Board for Engineering and Technology (ABET), Inc.

American Council of Engineering Companies

American Society for Engineering Education

Engineering Deans Council

American Society of Civil Engineers

American Society of Heating, Refrigerating, and Air-Conditioning Engineers

American Society of Mechanical Engineers

Canadian Engineering Qualifications Board

Institute of Electrical and Electronics Engineers—USA

National Society of Professional Engineers

(National Council of Examiners of Engineers and Surveyors, 2003b)

In its March issue of Licensure Exchange publication, the chair of the Licensure Qualifications Oversight Group William Sutherland wrote,

> The ELQTF was designed from the outset to capture the vision of the engineering profession as represented by a variety of professional and related associations. The engagement and participation of these associations were crucial to the success of ELQTF, and their input is reflected in the committee report and results. (Sutherland, 2004)

This cooperative relationship between the regulating agency and the professional organizations has been the topic of very heated debate. This debate is between those who explain professional regulation based on public interest theory and those based on the capture theory.

Pagliero wrote, "According to public interest theory, professional licensing solves the 'lemons' problem generated by asymmetric information. In contrast, capture theory predicts that licensing aims at increasing professional salaries by restricting supply" (Pagliero, 2005, p 1).

This next paragraph is taken from Law and Sukko, who explain it best:

> Not long ago, the Governor of a midwestern state was approached by representatives of a particular trade anxious to enlist the Governor's support in securing passage of legislation to license their trade. "Governor," the men said, "passage of this licensing act will ensure that only qualified people will practice this occupation; it will eliminate charlatans, incompetents or frauds; and it will thereby protect the safety and welfare of the people of this state." The governor, from long experience, was somewhat skeptical. "Gentlemen," he asked, "are you concerned with advancing the health, safety and welfare of the people under the police

> powers of the state, or are you primarily interested in creating a monopoly situation to eliminate competition and raise prices?" The spokesman for the occupational group smiled and said, "Governor, we're interested in a little of each." (Council of State Governments, 1952, p. 1, cited in Law & Kim, 2004)

Pagliero reached the conclusion that other economists had reached: the capture theory better explains professional regulation, stating

> The main result of the paper is to test the null hypothesis of public interest theory against the alternative of capture theory. The method to identify the two theories is based on the different effect of market size and number of candidates on the optimal choice of the licensing board. The results tend to reject public interest theory in favor of capture theory. (Pagliero, 2005, p. 26)

National standards are in essence public policies, the creation of which is the work of many stakeholders. In the making of public policy, the group that stands to gain most is the one that is well organized politically and financially strong. Professional societies, trade associations, and unions are among these players that usually are able to put regulations issues on the political agenda due to their political and financial strength. Rops (2004), in his article "How Governmental Occupational Regulation Occurs," describes the process as follows:

> ...begins with a group (professional society, trade association, or labor union) interested in the legislation drafting a proposed statute that defines the occupation and activities.
>
> The next step is to find a sponsor or sponsors—members of the legislature who support the bill and are willing to campaign for it. The occupational group then puts its resources into support for the bill through:
>
> 1. Hiring lobbyists
> 2. Letter writing campaigns
> 3. Testifying before legislative committees
> 4. Meeting with individual legislators
>
> Ordinarily "protection of the public" is the primary rationale used in support of the bill. (Rops, 2004)

National standards are in essence public policies, the development of which is the result of contributions of many actors whose cooperation and their concern with issues of public safety makes them a reality. The continuous advances in knowledge and technology however, makes change to national standards the only constant.

Characteristics of Professionals

This section reviews the literature on the characteristics of a professional that enhances participation in continuing educations. Participation in any activity requires motivational triggers. These triggers can be either internal, like keenness or need for learning, external, like mandated education or market pressure, or a combination of both. Cervero (1988) stated "the transaction between the individual and external factors contributes to a state of motivational energy to engage in continuing education. As a professional's level of motivational energy increases, the likelihood that she or he would decide to participate in educative activities also increases" (Cervero, 1988, p. 63).

Educators and education providers strive to learn which internal motivational factors positively affect the participation level in order to be effective in providing continuing education. According to the literature, the personal characteristics of professionals play a significant role in their participation in continuing education. Factors that influence participation in continuing education fall in either personal or situational category (Cervero, 1988). Personal characteristics that are frequently used in research in the literature are "an internal zest for learning, age and career stage" (Cervero, 1988, p. 64). External factors are "the nature of their practice setting and the extent to which they are required to participate" (Cervero, 1988, p. 64).

Studies conducted on the subject of continuing education have found that "internal" variables such as age, years of experience, level of education, and level of responsibility influence the continuing education behavior of professionals. These studies have found that the level of responsibility played a positive role participation in continuing education. But age and years of experience played a negative role. Zest for learning on the other hand played a positive role (Chlebicki, 2000; Keltner, 1981; Maidenberg, 2001).

External factors such as the adoption of mandatory continuing education policy also played a positive role in participation. This is not surprising since the punitive consequences of not participating could be as severe as losing a professional license. Practice setting also plays a role in professionals participating in continuing education. Professionals who are involved in providing services directly to the public and assume a risk for their work are more likely to participate in continuing educative activities (Cervero, 1988).

The variables presented above and their relationship to the perceptions of civil engineers regarding the policy of mandatory continuing professional competency will be examined. The next chapter provides a list of these variables along with their classifications, operational definitions, and type of measurement.

CHAPTER III

METHODOLOGY

The purpose of this study was to explore civil engineers' perceptions of the continuing professional competency requirements as a method of maintaining competency and assuring public safety and welfare. In addition, it sought to identify competency reassessment approaches preferred by these professionals who are assumed to be more aware of their educational and training needs. Furthermore, it examined the relationship between the characteristics of the professionals (such as age, years of experience, level of education, field of practice, and type of responsibility) and continuing professional competency. The source of the data was the civil engineering professional readership of the *CE News* magazine newsletter "CivilConnections." The participants were contacted electronically and requested to respond to a 43-question survey that has been designed to answer the sought after questions in this study.

This chapter includes the following sections: (1) research questions, (2) data resource and participants, (3) research design, (4) instrument of the study, (5) risk to participants and confidentiality, (6) variables, (7) hypothesis, and (8) threats to internal and external validity.

Research Questions

The research questions that this study attempted to answer are:

- What are civil engineers' perceptions regarding the mandatory Continuing Professional Competency (CPC) requirements?
- What is the position of the civil engineering professionals on mandatory education policy and its impact on professional competency and public safety?
- What reassessment method(s) do licensed civil engineering professionals prefer in meeting their CPC requirements?
- What is the relationship between demographic and professional characteristical variables (such as age, years of experience, level of education, field of practice, type of responsibility) and the attitude of civil engineers toward the mandatory continuing education policy?

Data Resource and Participants

The population of this study was the licensed civil engineering professionals in all fifty states. The sampling frame consisted of civil engineering professionals who had a subscription with the *CE News* magazine newsletter "CivilConnections." The database consists of electronic contact information of civil engineers, structural engineers, and bridge engineers. These professionals are representatives of the consulting industry, the construction industry, and the governmental sector. Electronic contact information was obtained from *CE News* magazine database. Due to the electronic nature of data collection, there was no sampling; the entire population described above was contacted. This population was divided into two categories: (1) participants in states with mandated continuing education, and (2) participants in states without mandated continuing education. The latter category was used as the control group of the study.

Research Design

This study is a quantitative, cross-sectional study that collected data on all relevant variables at one time (O'Sullivan & Rassel, 1995). A cross-sectional study was chosen for its suitability because of the many variables involved, the large population, and the geographical dispersion of the participants (O'Sullivan & Rassel, 1995).

Research Limitations

Since the data collection process was electronically based where the questionnaire was housed on http://www.zoomerang.com/ Internet site, this study was limited to the licensed civil engineering professionals and land surveyors who have registered electronically for membership with the *CE News* Magazine newsletter "CivilConnections."

Other potential limitations could be due to:

1. A response rate of 3.5% may not be considered a good representative of the civil engineering community. One can never know if the missed opportunity of the other 96.5% of potential respondents could have made the results and conclusions reached by this study any different.
2. The self-reported perception could bring a great deal of bias into the responses and therefore into the results of the study.
3. Since this study is based on perception and attitude of professionals and not on actual measures of public safety, solid conclusions could not be reached on long-term core issues. A final potential limitation could be due to the fact that *CE News* magazine being the sponsor of the electronic survey and that its readership are

more in the know about current issues and are more experienced in this kind of survey methods.

Pilot Test of Survey

Prior to sending the survey to the entire population, a pilot study was carried out by randomly choosing ten (10) licensed civil engineers. The purpose of this exercise was to estimate the average time needed to complete the survey and to check and test the instrument for readability and clarity as to the purpose of the questions. A revision of the questionnaire was carried out in accordance with the recommendations of the participants.

HSIRB

Prior to the commencement of any type of data gathering and in compliance with the policy of Western Michigan University, a Human Subject Institutional Review Board (HSIRB) protocol was submitted and approved as shown in Appendix A.

Data Collection

The completely anonymous survey was administered by sending an electronic letter of invitation to each participant. The data collection process started by sending an invitation letter that addressed the following items:

- The purpose of the research.
- Link to www.zoomerang.com Internet site where the questionnaire will be accessed.
- Time required to complete the survey.

- Electronic and regular mail contact information of the researcher and study advisor.
- A statement that the confidentiality of the participants will be protected.
- A word of appreciation for their efforts for taking the time to participate.
- Informed consent statement.

Responses were collected by the Internet hosting site www.zoomerang.com, and were downloaded in a table format for a regression analysis using the STATA software.

Instrument of the Study

The instrument, shown in Appendix B, was converted into an electronic version and used to collect the data required for this study. The questionnaire was constructed using a combination of sources obtained from the literature on similar studies. These studies covered other professions that have similar requirements, such as nursing and social work (Keltner, 1981; Maidenberg, 2001) and engineering professionalism (Chlebicki, 2000). Some questions were modified to fit the engineering profession while others were reconstructed completely. A 5-point and 6-point Likert scale was used to gauge the attitude and perception of the participants.

The questionnaire focuses primarily on the following general areas:

1. Perception toward MCE,
2. Type of reassessment methods,
3. Professional development activities,
4. Demographics, like age, area of specialty, type of responsibility, stage of experience and level of education).

Risks to Participants and Confidentiality

Typically, any research can potentially cause unforeseen risk to the participants; the risk can either be physical or psychological. In the physical realm, participants may be inconvenienced at the time of receiving the e-mail and filing out the electronic questionnaire. The mere taking the time from their busy schedule to fill out the questionnaire is an inconvenience since it takes time resources away from other activities.

In the psychological realm, some may fear that their responses could become available to their employer or any organization that have an influence on their professional development and hence could negatively affect their livelihood.

To help minimize the possible risk of inconvenience to the potential participant, the electronic letter clearly states that participants should choose the most convenient time in their schedule to fill out the questionnaire.

To help alleviate the possible risk to respondents' confidentiality and privacy, the questionnaire was hosted by an independent vendor which would destroy the information from its server as soon as the data was transferred to the researcher.

To assure anonymity of the participants, the researcher did not have any access to the contact information. Therefore, participation in the survey was completely confidential and anonymous.

Variables

Table 9 shows the variables that were used to gauge the perception of the civil engineering professionals toward the mandated continuing competency policy.

Table 9

Study Variables

Name of Variable	Type of Variable	Conceptual Definition	Operational Definition	Type of Measure-ment
Licensed professional engineer	Screening variable	An individual who is licensed by a State board to practice within the jurisdiction of that state.	Either licensed or not. (engineers not licensed do not have to meet any minimum educational requirements)	Nominal
Age	Independent	Age of participant	i.e., 20–24, 25–29, 30–34, 35–39, etc.	Ordinal
Level of education	Independent	Bachelor of science (BS), MS, MBA, Ph.D., etc.	Participants choose a level of education	Ordinal
Years of experience	Independent	Total years of experience as a professional engineer	0–2, 3–4, 5–15, 16–25, 26+	Ordinal
Type of civil engineering discipline	Independent	Civil, environmental, hydraulic, construction management, structural, transportation, etc.	Participants choose one discipline	Nominal
Type of industry	Independent	Private consulting service, Private construction service, Public (Federal, State, local), academic and research, etc.	Participants choose one industry	Nominal
Type of responsibility	Independent	General manager (CEO, regional manager, office manager, department manager), project manager, designer, inspector	Participants choose one type of responsibility	Nominal
Gender	Independent	Female or Male	Participants choose one option	Nominal
Perception of continuing education	Independent	Professional engineers perceive continuing education as beneficial requirement towards one profession and the public at large.	Likert scale (Strongly agree, agree, etc)	Interval

Table 9—continued

Name of Variable	Type of Variable	Conceptual Definition	Operational Definition	Type of Measure-ment
Perception of mandated continuing education	Dependent	How do engineers perceive mandated continuing education from the standpoint of being beneficial for public safety. Has public safety been increased or unaffected as a result of participating in such education?	Likert scale (Strongly agree, agree, etc)	Interval
Financial benefit of on-going education	Independent	Financial benefit of on-going education of professionals is based on the extra effort that a professional is expending in order to provide more safety and protect the public	Participants choose a yes or a no	Nominal
Reassessment approach	Dependent	Peer review, re-examination, mandated continuing education, voluntary continuing education, none, other.	Participants choose one or more types	Nominal

Hypotheses

H1: There is a significant relationship between participation in mandated continuing education and state mandating policy.

H2: There is a positive relationship between participation in mandated continuing education and level of education.

H3: There is a negative relationship between participation in mandated continuing education and age or years of experience.

H4: There is a positive relationship between participation in mandated continuing education and level of responsibility.

H5: There is a significant relationship between participation in mandated continuing education and the attitude towards the mandating policy.

H6: There is a positive relationship between participation in mandated continuing education and the belief that personal and professional benefits will result from such participation.

Threats to Internal and External Validity

Researchers have identified several factors that can have an influence on a research study that can limit its validity. The design of the experiment and the research can modify the effects of these factors by selecting a research design that guards against the threats to validity.

There are two types of threats to validity: (1) threats to internal validity, and (2) threats to external validity.

A study is internally valid when the results or effects on the dependent variable are attributable to the independent variable and not to other factors (see Table 10). How well these other factors are controlled is related to the internal validity of the study (Gay & Airasian, 2000).

External validity, sometimes called ecological validity, is concerned with the generalizability of the study. The degree to which the results of the study can be generalized to groups beyond the study sample is an indication of the external validity of the study. See Table 11.

Table 10

Threats to Internal Validity

Type of Threat	Definition	Applicability to This Study
History	Unexpected events occur between the pre- and posttest, affecting the dependent variable.	The collapse of a major structure in a state that does not have mandated education requirements. This threat is not a concern at this time since no such event has taken place recently.
Maturation	Changes occur in the participants, from growing older, wiser, more experienced during the study.	This threat is not a concern since there is no posttest to allow for maturation to take effect.
Testing	Taking a pretest alters the result of the posttest.	There was no pretest in this study.
Instrumentation	The measuring instrument is changed between pre- and post-testing, or a single measuring instrument is unreliable.	The measuring instrument was tested for reliability in a pilot testing exercise. No post-testing took place so there was be no changes to the instrument.
Statistical Regression	Extremely high or extremely low scorers tend to regress to the mean on retesting.	The population in this study was significantly large and the response rate that is being anticipated was also adequate. Therefore, this kind of threat although is probable, could be treated when the data is available.
Differential Selection of Participants	Participants in the experimental and control groups have different characteristics that affect the dependent variable differently	There was no selection criteria of the participants.
Mortality	Different participants drop out of the study in different numbers, altering the composition of the treatment groups.	Not applicable in this study. No post-test was carried out.
Selection-Maturation Interaction	The participants selected into treatment groups have different maturation rates. Selection interactions also occur with history and instrumentation	Not applicable to this study.

Source: Gay & Airasian, 2000

Table 11

Threats to External Validity

Type of Threat	Definition	Applicability to This Study
Pretest-Treatment Interaction	The pretest sensitizes participants to aspects of the treatment and thus influences posttest scores.	This threat is not applicable in this study. No pretest treatment of participants.
Selection-Treatment Interaction	The non-random or volunteer selection of participants limits the generalizability of the study.	Not applicable since there is no selection of participants.
Multiple Treatment Interference	When participants receive more than one treatment, the effect of prior treatment can affect or interact with later treatments, limiting generalizability.	Not applicable.
Specificity of Variables	Poorly operationalized variables make it difficult to identify the setting and procedures to which the variables can be generalized.	The researcher has expended every effort to minimize any untoward effect.
Treatment Diffusion	Treatment groups communicate and adopt pieces of each other's treatment, altering the initial status of the treatments comparison.	This threat could possibly affect the results. The effect is minimized with the size and geographic dispersion of the participants.
Experimenter Effects	Conscious or unconscious actions of the researcher affects participants' performance and responses.	This threat was minimized due to the electronic nature of the data collection process. The researcher did not directly interact with the participants. However, the magazine sponsoring this electronic survey could have an effect on the participants' responses due to being more exposed to current issues, and to this type of methodology than other professionals.
Reactive Effects	The fact of being in a study affects participants from their normal behavior.	The electronic nature of the survey could trigger the participants to respond to questions without the effort of reading them just for the sake of finishing fast. This threat can be identified only when the survey data has been checked for such behavior. However, it is assumed that the participants are professionals who are in responsible position not to let such issue sway their behavior, especially since participation is completely voluntary.

Source: Gay & Airasian, 2000

CHAPTER IV

RESULTS AND ANALYSIS

The purpose of this study was to explore the following questions:

- What are civil engineers' perceptions regarding the mandatory Continuing Professional Competency (CPC) requirements?
- What is the position of the civil engineering professionals on mandatory education policy and its impact on professional competency and public safety?
- What reassessment method(s) do licensed civil engineering professionals prefer in meeting their CPC requirements?
- What is the relationship between demographic and professional characteristical variables (such as age, years of experience, level of education, field of practice, type of responsibility) and the attitude of civil engineers toward the mandatory continuing education policy?

This chapter presents the findings and analysis of the data collected by the electronic survey in order to respond to the above questions. Data were obtained by sending an electronic invitation letter with a link to an Internet site hosting the questionnaire. The population of the study consisted of civil engineers and land surveyors who voluntarily registered to receive the electronic letter "CivilConnections" of the *CE News* magazine. The database consisted of about 48,000 participants from all fifty states and territories. Currently, twenty-nine (29) states mandate the participation in mandatory continuing

education for license renewal; the other twenty-one (21) states do not. This, therefore, naturally divides the participants into two groups: One group from states with a policy of mandatory continuing education (MCE) requirements and the other from those states without MCE requirements. The latter will be considered the control group and comparison will then be made between the two groups.

The chapter consists of the following five sections:

- Section I presents the descriptive findings of the survey.
- Section II presents the answers to the questions raised by the study.
- Section III presents the tests of the hypotheses.
- Section IV presents other findings.
- Section V presents summary of findings and the implication of the study.

Section I

Description of Sample

The number of participants who responded to the letter of invitation was 1701. This sample size is greater than 1489, the minimum sample size required based on a population of 48,000, with a margin of error of 2.5 and a confidence level of 95% (Berman, 2002; ROASOFT Inc., 2004). Table 12 shows the distribution of the participants with respect to their state of practice and registration. There were 1129 (68%) participants from states with MCE policy and 522 (32%) from states without MCE policy; the total response rate to the survey is calculated to be 3.5%. Note that professionals can only practice in a state where they are licensed.

Table 12

Response Distribution According to State Registration

(States with MCE policy are shown shaded. Note that a respondent could be registered in more than one state)

State/Territory	Numbers of Responses	% of Respondents	PDHs Per Year(s)
Alabama (AL)	105	6.0%	15 / year
Alaska (AK)	41	2.0%	0
Arizona (AZ)	103	6.0%	0
Arkansas (AR)	64	4.0%	15 / year
California (CA)	238	14.0%	0
Colorado (CO)	119	7.0%	0
Connecticut (CT)	71	4.0%	0
Delaware (DE)	54	3.0%	0
District of Columbia (DC)	42	2.0%	0
Florida (FL)	196	12.0%	8 / 2 years
Georgia (GA)	137	8.0%	30 / 2 years
Hawaii (HI)	22	1.0%	0
Idaho (ID)	56	3.0%	0
Illinois (IL)	170	10.0%	30/ 2 years
Indiana (IN)	119	7.0%	0
Iowa (IA)	87	5.0%	30 / 2 years
Kansas (KS)	71	4.0%	15 / year
Kentucky (KY)	96	6.0%	0
Louisiana (LA)	84	5.0%	15 / year
Maine (ME)	53	3.0%	30 / 2 years
Maryland (MD)	134	8.0%	0
Massachusetts (MA)	96	6.0%	0
Michigan (MI)	156	9.0%	0
Minnesota (MN)	85	5.0%	12 / year
Mississippi (MS)	72	4.0%	15 / year
Missouri (MO)	100	6.0%	30 / 2 years
Montana (MT)	39	2.0%	15 / year
Nebraska (NE)	65	4.0%	15 / year
Nevada (NV)	75	4.0%	15 / year

Table 12—continued

State/Territory	Numbers of Responses	% of Respondents	PDHs Per Year(s)
New Hampshire (NH)	57	3.0%	30 / 2 years
New Jersey (NJ)	175	10.0%	0
New Mexico (NM)	56	3.0%	15 / year
New York (NY)	202	12.0%	36 / 3 years
North Carolina (NC)	147	9.0%	15 / year
North Dakota (ND)	35	2.0%	30 / 2 years
Ohio (OH)	204	12.0%	0
Oklahoma (OK)	69	4.0%	15 / year
Oregon (OR)	88	5.0%	30 / 2 years
Pennsylvania (PA)	223	13.0%	0
Puerto Rico	17	1.0%	0
Rhode Island (RI)	35	2.0%	0
South Carolina (SC)	97	6.0%	30 / 2 years
South Dakota (SD)	37	2.0%	30 / 2 years
Tennessee (TN)	109	6.0%	24 / 2 years
Texas (TX)	181	11.0%	15 / year
Utah (UT)	64	4.0%	24 / 2 years
Vermont (VT)	42	2.0%	0
Virginia (VA)	172	10.0%	0
Washington (WA)	132	8.0%	0
West Virginia (WV)	84	5.0%	15 / year
Wisconsin (WI)	120	7.0%	0
Wyoming (WY)	40	2.0%	15 / year

Demographics

The demographic characteristics of the sample are shown in Table 13. The sample is predominately male (94%), married (87%), and the majority of the professionals (59%) are between 40 and 59 years of age.

Table 13

Demographic Characteristics of the Sample

Gender	%	Age on Last Birthday	%	Marital Status	%
Female	6	20-39	25	Married	87
Male	94	40-49	28	Single	12
		50-59	31	Other	2
		60+	16		
Total $N = 1674$		Total $N = 1685$		Total $N = 1668$	

Educational Characteristics

The level of education of the sample as presented in Table 14 shows that the majority (55%) held a bachelor degree while (37%) held a master's level education and (4%) held a doctorate degree.

Table 14

Educational Characteristics of the Sample

Highest Degree	%
Bachelor's	55
Master's	37
Doctorate	4
Other	4
Total $N = 1684$	

Type of Licensure

Licensure characteristics of the sample shown in Table 15 reveal that the great majority are licensed professional engineers who have been licensed for many years,

mostly more than 26 years. The participants in the sample are shown to have had many years of practical experience in their field.

In addition, the majority of the participants have multiple licenses (i.e., licensed in more than one state). Table 16 shows the distribution of participants with respect to the

Table 15

Licensure Characteristics of the Sample

Type of License	%	Number of Years Licensed	%
Professional Engineer (P.E.)	71	0–2	4
Structural Engineer (S.E.)	7	3–4	7
Professional Surveyor (P.S., P.L.S.)	6	5–15	25
Both Professional Engineer and Land Surveyor (P.E., P.L.S.)	6	16–25	28
Engineer in Training (E.I.T.)	6	26+	36
Not Licensed	6		
Total $N = 1702$		Total $N = 1551$	

Table 16

Distribution of Professionals Based on Number of Registration

Number of Licenses	Total Number of Participants	Participants in State with No MCE	Participants in State with MCE
1	675	309	366
2	285	82	181
3	154	25	121
4	98	14	78
5	59	5	53
6	48	4	42
7	21	3	17
8	33	3	30
9	19	2	16
10	21	2	19

number of licensed and to the states mandating category. The data sample indicates that there are participants with registration in more then ten (10) states.

Type of Industry

Table 17 shows that the sample was mostly from the private sector (66%) while (21%) were from the public sector. Also shown, the structural engineering discipline held the majority at 43% while other disciplines were also present but with a much with lower representation.

Table 17

Industrial Characteristics of the Sample

Type of Industry	%	Type of Discipline	%
Private Consulting	66	Land development/site design	15
Private Construction	5	Transportation	13
Public	21	Structural	43
Academic Institution	1	Construction Management/ Oversight	8
Research Institution	<1	Surveying	4
Land Developer	1	Environmental/Geotechnical/ Hydraulics	13
Vendors and others	6		
Total $N = 1651$		Total $N = 1698$	

Employment Characteristics

Table 18 shows that the great majority of the sample are employed (97%) and that the sample represented both the managerial and technical groups.

Table 18

Employment Characteristics

Employment Status	%	Number of Years at Company	%	Present Position, Title	%
Employed	97	0–5	31	Top Level Management (owner, CEO, vice president, principals, etc.)	44
Unemployed	3	6–15	37		
		16–25	19		
		26+	13		
Total $N = 1702$		Total $N = 1685$		Engineers (senior, chief, principals, design, staff etc.)	53
				Other	3
				Total $N = 1650$	

Employer Support of Continuing Education

Employers' support for continuing education as shown in Table 19 shows that employers generally supported continuing education by paying the expenses and allotting

Table 19

Employer Support of Continuing Education

Paying Expenses	%	Allotting Time %	Internal Training Provided	%
Never	9	7	Weekly, biweekly	4
Seldom	5	7	Monthly, bimonthly	13
Sometimes	13	19	Quarterly	10
Usually	31	38	Annually, biennially	12
Always	41	29	No training	54
			Other	7
Total $N = 1638$		Total $N = 1640$	Total $N = 1631$	

time for the employees who seek training externally. The table also shows that a large percentage of companies (54%) do not have internal training programs. This lack of internal training programs may have contributed to such support, not to mention the competitive nature of the business that drives companies to keep ahead of competition. Gaining any competitive advantage and keeping up to date with knowledge and current issues are considered good business practices.

Type of Training

Since the engineering profession is basically a technically oriented one, the type of training that the participants preferred was courses with technical contents as shown in Table 20. Non-technical courses and hands-on training programs were also sought. The table also shows that continuing education did not necessarily translate into monetary gains for participants, and that participants were divided about whether or not participation should have monetary incentive.

Table 20

Type of Training and Anticipated Benefits of Continuing Education

Content and Type	**%**	**Has it resulted in increase of compensation?**	**%**	**Should it result in compensation increase?**	**%**
Technical	90	Yes	7	Yes	36
Non-Technical (ethics, legal, managerial, etc.)	71	No	88	No	37
		Neutral	5	Neutral	27
Hands-on	63				
Total $N = 1513$		Total $N = 1699$		Total $N = 1565$	

Voluntary Education

Participation in continuing education on a voluntary basis as presented in Table 21 shows that the majority participate in continuing education either formally through classes or informally by reading professional journals.

Table 21

Voluntary Professional Development

Attendance of Voluntary Education/Training	**%**	**Number of Journals Read Per Month**	**%**
Yes	77	None	5
No	23	1	11
		2 to 3	59
		4 to 6	21
		7+	5
Total $N = 1688$		Total $N = 1685$	

Section II

Perception and Attitudes

The first research question was: How do licensed civil engineers perceive continuing professional competency requirements for licensing renewal? Although the responses to the survey questions measuring the professionals' attitudes towards mandatory continuing education were mostly positive with a ratio of 2 to 1 as shown in Table 22, their response to the question that dealt directly with the licensing renewal being conditioned on completing the mandatory education requirement did not receive the same approval ratio. The professionals were polarized about the issue with 41% against and 43% for and 16% neutral or undecided as shown in Table 23.

Table 22

Evaluation of Mandatory Continuing Education (MCE) Attended by Professionals in the Past Two Years

	Disagree %	Neutral %	Agree %
MCE improved professional practice	22	21	58
Applied at least one idea from MCE	28	20	52
MCE provided personal benefit in recognizing training needs	30	25	45
MCE provided personal benefit through professional contact	22	26	51
MCE is beneficial overall	26	28	48
MCE provided professional benefit in issue awareness	19	24	57
MCE attended is recommended to others	27	28	45
MCE have resulted in less learning	34	26	39
MCE did not improve professional practice	51	19	29
MCE did not improve professional skills	54	20	27

Table 23

Attitude Towards Mandatory Continuing Education for License Renewal

Content and Type	Against %	Neutral/ Undecided %	For %
All States	41	16	43
States without MCE	45	18	37
States with MCE	40	14	46

Further dissecting the data between the two groups, it reveals that states with MCE show that a slight majority of the participants favor the policy (46%) while 40% are against. However, in states without MCE, the opposite is true, and the percentage of participants on the neutral side is higher by a small margin.

The second research question was: What is the position of the licensed civil engineers regarding mandatory education for practicing professionals? The majority of professionals view MCE positively with respect to both the profession as a whole and the individual practicing professional. The results shown in Table 22 above reveal that mandatory continuing education has generally provided both personal and professional benefits, improved professional practice, and ensured that learning has taken place by the application of ideas learned in the process. Learning, however, was not up to their expectation. This could be due to either the provider did not deliver as expected and/or the professionals having higher expectations that exceed the provider's instructional program. Table 24 shows the results of the survey of those professionals who have attended mandatory continuing education in order to meet state requirements. This is basically an evaluation of the MCE attended in the past two years.

Table 24

Attitude Towards Mandatory Continuing Education (MCE)
(States Without MCE/States With MCE)

	Disagree %	**Neutral/ Undecided %**	**Agree %**
MCE is good for the profession	25 *26/24*	18 *19/17*	57 *53/58*
MCE is good for the majority of the professionals	25 *28/26*	19 *16/19*	55 *56/55*
MCE is good for the individual professionals	23 *24/23*	20 *18/19*	57 *57/57*
CE should be mandatory	43 *48/41*	18 *14/15*	39 *34/42*

Regarding the attitude of the professionals towards MCE, more than 50% of professionals agree that MCE is beneficial to both the profession and the individual. In Table 24 note how close the percentages are when broken down into the two groups. Results indicate that all professionals perceive that MCE is beneficial. However, when asked about mandating continuing education, the difference between agree and disagree reduces to only 4% on the total of both groups, 1% in states with MCE and in states without MCE the majority are not in favor of mandating.

On the issue of public protection safety resulting from MCE, the results in Table 25 show that civil engineering professionals do not positively correlate continuing competency with public safety and well-being. A majority (50%) does not agree that continuing competency requirements has an impact on public safety, and that MCE is not a good measure for protecting the public or to be used just for those who violate professional or ethical practice.

Table 25

Attitude Towards the Impact of Mandatory Continuing Education (MCE) on Public Protection

(States Without MCE/States With MCE)

	Disagree %	**Neutral/ Undecided %**	**Agree %**
MCE is good for protecting the public from incompetent individuals	50 *47/52*	20 *19/18*	30 *33/29*
MCE is good as a disciplinary measure for violators	40 *35/40*	25 *20/23*	37 *40/34*

Methods of Assuring Continued Competency

In response to the question of which reassessment method for assuring continued competency is preferred by civil engineering professionals, the voluntary continuing education method was by far the most favored. This is evident in the response throughout the survey. In the previous section, it was shown that the majority perceived that MCE is generally beneficial, but when asked if it should be mandated that majority disappeared. This leads one to conclude that professional engineers recognize the benefits of education but do not prefer its imposition on them. Periodic re-examination on the other hand was the least favored as shown below in Table 26. Mandatory continuing education was again a method that divided the participants near the middle while the peer review method was clearly not favored. However, the majority (47%) favored some method of assurance as shown in the graph for no method labeled as "None of the above" and supposedly that the method is the voluntary education one.

Table 26

Attitude Towards Different Methods of Assuring Competence

Type of Method	Disagree %	Neutral/ Undecided %	Agree %
Peer review	45	26	29
Periodic re-examination	71	17	12
Mandatory Continuing Education	38	21	41
Voluntary Continuing Education	23	20	58
None of the above	47	32	21

A breakdown comparing the percentages of both groups reveals that the majority of both groups favor voluntary education. Table 27 shows that the 61% from states with MCE are in favor while 56% of the participants from states without MCE are in favor. The mandatory education method was again the polarizing method. This method was picked as the second favored method after the voluntary method.

Table 27

Attitude Towards Voluntary and Mandatory Continuing Education Methods for Assuring Competence

Type of Method	Disagree %		Neutral/ Undecided %		Agree %	
	States w/MCE	States w/o MCE	States w/MCE	States w/o MCE	States w/MCE	States w/o MCE
Voluntary Continuing Education, $N = 1628$, $Chi^2 = 5.8135$, $pr = 0.055$	20	25	19	19	61	56
Mandatory Continuing Education, $N = 1628$, $Chi^2 = 5.5103$, $pr = 0.064$	43	37	20	20	37	43

Statistical *t* test reveals that the following methods: peer review, periodic re-examination and "none" method were not affected by the group of the participants. However, there was a significant difference in the mean between mandatory education and voluntary education methods. This means that states with MCE are different from states without MCE. See Table 28.

Table 28

t Test of the Effect of Both Groups on the Methods Assuring Professional Competency

Type of Method	*T*	*P*	*N*
Peer Review	0.8522	0.1971	1599
Periodic Re-examination	1.5632	0.0591	1618
Mandatory Continuing Education	-2.3449	0.0096*	1628
Voluntary Continuing Education	2.3371	0.0098*	1630
None	-0.7390	0.2300	1597

* significant at $p < 0.01$ level

Section III

Hypothesis Testing

Hypothesis H1a tests whether there is a significant relationship between participation in mandated continuing education and state mandating policy.

The null hypothesis Ho1 states that there is either a random or no relationship between participating in mandatory continuing education and state mandating policy.

Participation in mandatory continuing education is measured by the number of professional development hours (PDH) a professional has attended in the past two years. Most states have adopted a 30 PDH-hours requirements for license renewal every two years. The dependent variable to measure this participation is (PDHTKN). To measure the effect of the mandating policy, the independent variable (STATMNDT), *t* tests are run on both groups or participants to verify that the means of both groups are significantly different in order to attribute that difference to the mandating policy.

The result of the *t* test indicates that the null hypothesis can be rejected and that there is a statistically significant difference between the mean of professional development hours (PDH) taken for those in states with MCE as compared to those from states without MCE ($t = -16.5484$, $p = 0.0000$). This concludes that mandating has an effect on participation in continuing education.

In states without MCE about 80% of professionals participate in continuing education. In states with MCE about 45% of professionals participate in more continuing education than required compared with only 13% in states without MCE; therefore, mandating promotes more participation in continuing education. Generally, 92% of all professionals participate in some form of continuing education. States with MCE requirements have a maximum of 30-PDH every two years for renewal purposes. About 45% of professionals take more than required. In states without MCE about 81% take some kind of PDH. See Table 29.

Table 29

Number of Professional Development Hours Taken in Past Two Years (*var.* PDHTKN)

	Var. **STATMNDT**	0	1–15	16–30	31–45	46+	Don't Know
States without MCE / Control Group	# of Participants	80	234	121	28	39	19
	% of Participants	15%	**45%**	**23%**	5%	7%	4%
States with MCE	# of Participants	40	180	392	333	171	13
	% of Participants	4%	**16%**	**35%**	30%	15%	1%

Hypothesis H2a examined whether there is a significantly positive relationship between participation in mandated continuing education and level of education.

The null hypothesis Ho2 states that there is either a random or no relationship between participating in mandatory continuing education and level of education.

This hypothesis also uses the dependent variable number of professional development hours (PDHTKN) and the independent variable level of education (EDULVL). Since both of these two variables are categorical and have more than two levels, the analysis of variance (ANOVA) statistical tools will be used to test the differences between the groups' means.

The ANOVA tests of each group separately reveal that there is no significant relationship between the level of education and participation in continuing education in both groups of the states with mandating policy ($F = .22$, $p = .2994$, $N = 1114$) and without mandating policy ($F = 1.97$, $p = .1171$, $N = 512$). However, when tested aggregately, the ANOVA test reveals that there is a significant relationship between participation in continuing and educational level ($F = 2.89$, $p = .0345$, $N = 1630$). Table 30 shows that participation was not significantly affected by the level of education up to the 30 PDH

Table 30

Level of Education vs. Number of Professional Development Hours (PDH)

		Number of Professional Development Hours (PDH) Taken				
Degree	**%**	**0**	**1–15**	**16–30**	**31–45**	**46+**
Bachelor's	55	9	27	32	23	10
Master's	37	5	25	30	22	17
Doctorate	4	4	25	32	14	26
Other	4					
Total $N = 1556$						

level. Even beyond mandated requirements, the bachelor's and master's-level education were also very close.

Examining the data in Table 30 indicates that education level does not seem to have significant effect on the participation in professional development hours taken up to the level of 16–30 hours. Beyond that, at the next level (31–45), participation decreases as the level of education increases while at the 46+ hours level participation increases as the level of education increases. Hypothesis H3a examined whether there is a negative relationship between participation in mandated continuing education and age of professionals.

The null hypothesis Ho3 states that there is no relationship between participation in mandated continuing education and age of professionals.

This hypothesis uses the dependent variable number of professional development hours (PDHTKN) and the independent variable age of professionals' level of education (AGE). Since both of these two variables are categorical and have more than two levels, the analysis of variance (ANOVA) statistical tools will be used to test the differences between the groups' means.

An ANOVA statistical test of the entire sample reveals a statistically significant relationship between age and participation in continuing education ($F = 12.07$, $p = 0.0001$, $N = 1534$).

ANOVA statistical test of the group from states with mandating continuing education reveals a statistically significant relationship between age and participation in continuing education ($F = 15.05$, $p = 0.000$). However, testing the same for the control group reveals that there is no significant relationship ($F = 0.91$, $p = 0.4578$) and leads to

the conclusion that age does not affect participation. The significant relationship observed could then be due to the mandating effect not the age factor.

A closer look at the data in Tables 31 and 32 reveals the following observations: At the 0 PDH level, the data shows that there is a higher percentage of professionals from states without MCE that do not participate in continuing education than from states with MCE. The age of participants does seem to have a great effect.

At the 1–15 hours level, the same is true as for the 0 PDH level. At the 16–31 PDH level, the difference between the two groups becomes smaller; however, the percentage of professionals increases in states with MCE. This appears to be due to the effect of mandating. Age, again, does not seem to have a significant effect on the participation level.

Table 31

Age vs. Professional Development Hours (PDH) (Percentage of Each Age Group in States Without MCE Policy)

	Number of Professional Development Hours (PDH) Taken				
Age Group	**0**	**1–15**	**16–30**	**31–45**	**46+**
20–39	19	38	27	0	8
40–49	16	55	15	2	8
50–59	13	45	23	7	9
60+	16	43	23	8	6
Total $N = 521$					

Table 32

Age vs. Professional Development Hours (PDH) (Percentage of Each Age Group in States With MCE Policy)

Age Group	Number of Professional Development Hours (PDH) Taken				
	0	1–15	16–30	31–45	46+
20–39	12	40	30	12	2
40–49	4	18	34	26	17
50–59	2	15	36	33	13
60+	1	11	34	32	20
Total $N = 1122$					

Hypothesis H3b examined whether there is a negative relationship between participation in mandated continuing education and years of licensing.

The null hypothesis Ho3b states that there is a no relationship between participation in mandated continuing education and years of licensing.

This hypothesis also uses the dependent variable number of professional development hours (PDHTKN) and the independent variable years of licensing (YRSLIC). Since both of these two variables are categorical and have more than two levels, the analysis of variance (ANOVA) statistical tools will be used to test the differences between the groups' means.

ANOVA statistical test of the entire sample reveals a statistically significant relationship between years of licensing and participation in continuing education ($F = 6.30, p = 0.0001, N = 1512$).

ANOVA statistical tests of the group from states with mandating continuing education reveal a statistically significant relationship between years of licensing and

participation in continuing education ($F = 4.87$ $p = 0.0007$, $N = 1035$). However, testing the same for the control group reveals that there is no significant relationship ($F = 2.96$, $p = 0.0196$, $N = 474$) and leads to the conclusion that years of licensing does not affect participation. The significant relationship observed then was due to the mandating effect, not the years of licensing factor. The null hypothesis can be rejected. See Tables 33 and 34.

Table 33

Years Licensed vs. Professional Development Hours (PDH)
(Percentage of Each Age Group in States Without MCE Policy)

	Number of Professional Development Hours (PDH) Taken				
Years licensed	**0**	**1–15**	**16–30**	**31–45**	**46+**
0–4	17	45	18	4	13
5–15	13	54	17	5	6
16–25	10	47	23	7	10
26+	20	38	31	5	4
Total $N = 480$					

Table 34

Years Licensed vs. Professional Development Hours (PDH)
(Percentage of Each Age Group in States With MCE Policy)

	Number of Professional Development Hours (PDH) Taken				
Years Licensed	**0**	**1–15**	**16–30**	**31–45**	**46+**
0–4	6	31	30	19	14
5–15	2	15	37	30	16
16–25	2	11	39	34	14
26+	4	14	32	31	19
Total $N = 1045$					

Hypothesis H4 examined whether there is a positive relationship between participation in mandated continuing education and level of responsibility.

The null hypothesis Ho4, There is no relationship between participation in mandated continuing education and level of responsibility.

This hypothesis uses the dependent variable number of professional development hours (PDHTKN) and the independent variable level of responsibility (TITLE). Since both of these two variables are categorical and have more than two levels, the analysis of variance (ANOVA) statistical tools will be used to test the differences between the groups' means.

ANOVA statistical test of the entire sample reveals a statistically significant relationship between level of responsibility and participation in continuing education ($F = 2.36, p = 0.0382, N = 1589$).

ANOVA statistical tests of the group from states with mandating continuing education reveal a statistically significant relationship between level of responsibility and participation in continuing education ($F = 1.49, p = 0.1911, N = 1087$). However, testing the same for the control group reveals that there is no significant relationship ($F = 1.48, p = 0.196, N = 474$) and leads to the conclusion that the level of responsibility does not affect participation. The significant relationship observed then was due to the mandating effect, not the level of responsibility factor.

Tests reveal that the null hypothesis cannot be rejected: the level of responsibility does not influence participation in continuing education.

Hypothesis H5 examined whether there is a significant relationship between participation in mandated continuing education and the attitude towards the mandating policy.

The null hypothesis Ho5, There is no relationship between participation in mandated continuing and the attitude towards the mandating policy.

This hypothesis also uses the dependent variable number of professional development hours (PDHTKN) and the independent variables MCE should be mandated to retain a professional license (MCEBEMNDT) and MCE should be required for license renewal (MCERNWLMNDT). Since both of these two variables are categorical and have more than two levels, the analysis of variance (ANOVA) statistical tools will be used to test the differences between the groups' means.

ANOVA statistical tests of the group from states with mandating continuing education reveal a statistically significant relationship between mandating MCE and participation in continuing education. However, in the case of the control group, the null hypothesis cannot be rejected. See Table 35.

Hypothesis H6 examined whether there is a significant relationship between participation in mandated continuing education and the belief that personal and professional benefit will result from such participation.

The null hypothesis Ho6, There is no relationship between participation in mandated continuing and the belief that personal and professional benefits will result from such participation.

This hypothesis also uses the dependent variable number of professional development hours (PDHTKN) and the independent variables that described MCE to be bene-

ficial on both the personal and professional levels (MCEMJRTYGD, IMRVPRCT, PRSNLBENE, BENEPROF, OVRALBENE). Since all these variables are categorical and have more than two levels, the analysis of variance (ANOVA) statistical tools will be used to test the differences between the groups' means.

Table 35

ANOVA Tests for Participation in Mandatory Continuing Education and the Attitude Towards the Mandating Policy

	States With MCE Requirements		**States Without MCE Requirements**	
	F	**P**	**F**	**P**
MCE should be mandated to retain license.	3.70	0.0115**	0.97	0.4067
N	1128		519	
MCE should be required for license renewal	3.59	0.0133**	1.54	0.2031
N	1125		517	

* significant at $p < 0.01$
** significant at $p < 0.05$

ANOVA statistical tests of the group from states with mandating continuing education generally reveal a statistically significant relationship between participation in continuing education and the belief that personal and professional benefits will result. However, in the case of the control group, the null hypothesis generally cannot be rejected since only one of the variables shows a statistically significant relationship at the $p < 0.05$ level as shown in Table 36.

Table 36

ANOVA Tests for Participation in Mandatory Continuing Education and the Belief That Personal and Professional Benefits Will Result

	States With MCE Requirements		States Without MCE Requirements	
	F	**P**	**F**	**P**
MCE is good for the majority of profession.	1.95	0.1192	2.66	0.0473**
N	1127		519	
MCE improved professional practice.	11.24	0.00*	1.12	0.3388
N	1085		441	
MCE have provided personal benefits	3.48	0.0313**	1.83	0.1407
N	1080		440	
MCE have provided professional benefits	9.13	0.0001*	1.27	0.2856
N	1083		441	
MCE have provided overall benefits	6.37	0.0018*	1.10	0.3492
N	1074		440	

* significant at $p < 0.01$
** significant at $p < 0.05$

Section IV

Other Findings

Since voluntary education was the most preferred method of continuing education and maintaining professional competency, the professional characteristic that has the most significant effect or relationship with attending voluntary education was found to be the level of education. The results in Tables 37 through 39 show that all other characteristics do not influence the level of attending voluntary education except the level of edu-

cation. Table 40 shows that as the level of education increases, the level of attendance decreases.

Table 37

t Test Results for the Dependent Variable Voluntary Continuing Education (VCEATT)—Complete Sample

	T	*P*	*N*
Age	1.2764	0.1010	1635
Seniority	1.0748	0.1413	1595
Years Licensed	0.6930	0.2442	1518
Education Level	-3.0905	0.0010*	1635
Discipline	1.2552	0.1048	1639
Title	0.1093	0.4650	1594

* significant at $p < 0.01$

Table 38

t Test Results for the Dependent Variable Voluntary Continuing Education (VCEATT)—States With MCE Policy

	T	*P*	*N*
Age	.5778	.2818	1116
Seniority	0.6415	0.2607	1094
Years Licensed	0.5384	0.2952	1039
Education Level	2.0027	0.0227**	1118
Discipline	1.0671	0.1431	1123
Title	0.8485	0.1982	1091

** significant at $p < 0.05$

Table 39

t Test Results for the Dependent Variable Voluntary Continuing Education (VCEATT)—States Without MCE Policy

	T	*P*	*N*
Age	.5400	0.2947	515
Seniority	0.1897	0.4248	499
Years Licensed	-0.5579	0.2886	476
Education Level	2.2703	0.0118**	513
Discipline	1.0264	0.1526	513
Title	-0.2667	0.3949	499

* significant at $p < 0.01$
** significant at $p < 0.05$

Table 40

Level of Education (EDULVL) vs. Voluntary Education Attendance (VCEATT)

Attending Voluntary Education (VCEATT)	**B.S.**	**M.S.**	**Ph.D.**	**Total**
Yes	670	499	50	1,264
	53.01%	39.48%	3.96%	100.00
No	237	117	7	371
	63.88%	31.54%	1.89%	100.00

Section V

Summary of Findings

Based on the above presented findings, the majority of the professionals viewed positively MCE as having both professional and personal benefits, improved professional practice, increased awareness of current issues, and that the training they attended can be recommended to other professionals. These findings are consistent with other studies

(Austin, 2004; Clark, 1995; Dew, 1993; Hatch, 2001; Keltner, 1981; Maidenberg, 2001; Prater, 1998). In addition, most professionals that attended continuing education responded to in affirmative about whether they had the opportunity to apply ideas from such education—a finding that is not consistent with findings in previous studies mentioned in Keltner (1981, p. 95).

Although the attitude towards mandatory continuing education was mostly positive, the respondents' attitude towards MCE requirements for licensing renewal was not decisive and the professionals were polarized about the issue with 41% against, 43% for, and 16% neutral or undecided. However, a slight majority of participants from states that have not yet adopted MCE policy were against such a policy. This is consistent with a survey conducted by the Michigan Society of Professional Engineers (MSPE) for professionals registered and Engineers in Training (E.I.T.) in the state of Michigan (a state without an MCE Policy) (Michigan Society of Civil Engineers (MSPE), 2004).

Regarding the issue of public safety and protection being assured by MCE, the results show that civil engineering professionals do not positively evaluate MCE's impact on maintaining professional competency. The same holds true to using MCE as a requirement just for those who violate professional or ethical practice.

The majority of professionals preferred the voluntary continuing education method as a reassessment approach to assuring continued competency. Periodic re-examination on the other hand was the least preferred and strongly opposed, a finding that is consistent with a study of Illinois physical therapists by Austin (2004). The mandatory continuing education method polarized the professionals near the middle and the peer review method was clearly not preferred either.

The mandating policy clearly impacted the participation level in continuing education, not only up to the level mandated by the policy but also beyond. Participants from states with MCE policy were more active in participating than those from other states without the mandating policy. Maidenberg and Mayhan arrived at a similar conclusion where respondents were more likely to participate in continuing education if required by a state mandate (Maidenberg, 2001; Mayhan, 2000).

This study concluded that professional characteristics such as level of education, level of responsibility, field of practice, years of licensing and age of professionals do not influence participation in continuing education.

The majority of employers do not have internal training programs and support continuing education provided by external sources.

Training programs or courses that are purely technical in nature were the most favored ones.

Professionals were divided about whether MCE should result in an increase of compensations.

The majority of participants participate in continuing education on a voluntary basis.

Implications

The findings of this study have implications on many groups that are associated with issues of continuing education as a method of professional regulation and public policy. For instance, legislators and regulatory boards should be aware that mandating continuing education does increase the level of participation in such education but at the

same time, professional do not believe that such participation increases the level of competency and hence public safety, the very reason for which MCE was being adopted in the first place.

Educational institutions and organizations that provide continuing education services should be aware that these professionals are more interested in technical type courses than other non-technical or hands-on courses.

Insurers and advocacy groups with public safety agendas should be aware that continuing education does not necessarily translate into increases in competency and public safety. Public safety should not be an issue that professionals need to become aware of during continuing education courses or license renewal. It is a central issue in the civil engineering profession by virtue of being the first canon of the American Society of Civil Engineers' code of ethics which states: "Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties" (American Society of Civil Engineers, 1914).

Professional engineering societies should be aware of the big divide that exists in the professional community regarding the issue of MCE. While these professionals positively perceive mandatory continuing education, they do not support the "mandatory" part of such a policy. This was evident in their preference for a voluntary continuing education where the professionals are in control of their educational and competency needs, not just participating for the sake of meeting a requirement to keep their license.

Finally, the professionals should be aware that continuing education continues to be the topic that does not win their consensus. Striking evidence was that between 20 to

25% of them did not provide an opinion on the topic; they were either neutral or undecided. In this case, a clear message is sent to the regulatory board, legislature and professional society to step in and take leadership in making a decision on their behalf. A decision that they have to live with, whether they support it or not.

CHAPTER V

DISCUSSION

The main topic of this study is exploring the perceptions of civil engineering professionals toward the mandatory continuing education (MCE) for license renewal; a policy that has currently been adopted by twenty-nine (29) states. Furthermore, This study aimed to survey the engineering professionals on the different methods of assuring their continued competency.

This chapter concludes this study by presenting an overview of the findings. In addition, it discusses the limitations within which this study was conducted and its implications on the different groups concerned with MCE. Finally, recommendations for future studies and concluding remarks are offered.

Findings Overview

Based on the data collected, the findings of this study are:

- The majority of the participating professionals viewed MCE positively. They agreed that professional and personal benefits, improved professional practice, and increased awareness of current issues has resulted. Additionally, the training courses attended were considered valuable and are recommendable to other professionals. Responding to the question regarding the expected level of learning received from such courses was not overly positive. These findings are consistent

with other studies (Austin, 2004; Clark, 1995; Dew, 1993; Hatch et al., 2001; Keltner, 1981; Maidenberg, 2001; Prater, 1998).

• Most professionals that attended continuing education responded affirmatively about having had the opportunity to apply ideas gained from such education. This gain points towards the value of continuing education. This finding is not consistent with findings in a study by Keltner (1981, p. 95).

• The attitude towards the concept of mandatory continuing education was mostly positive. However, the attitude towards MCE requirements being a condition for licensing renewal was not. The participating professionals were polarized about the issue, with 41% against and 43% for, with 16% neutral or undecided. Upon further examination of the data of participants from states that have not yet adopted MCE policy, the majority was against such a policy. This finding is consistent with a survey conducted by the Michigan Society of Professional Engineers (MSPE) for registered professionals (P.E.) and Engineers in Training (E.I.T.) in the state of Michigan (Michigan Society of Professional Engineers [MSPE], 2004). Currently Michigan does not have an MCE policy.

• Regarding the issue that public safety and protection are fundamentally assured by MCE, the results show that the participating civil engineering professionals did not perceive the impact of MCE to be positive. The same perception holds true for using MCE as a punitive or a corrective measure requirement for those who violate professional and/or ethical practice.

• The majority of professionals preferred the voluntary continuing education method as a reassessment approach to assuring continued competency. The

periodic re-examination method, on the other hand, was the least preferred and was strongly opposed, a finding that is consistent with a study of Illinois physical therapists by Austin (2004). The mandatory continuing education method polarized the professionals near the middle and the peer review method was not as preferred either. It was noticeable, however, that there was a good agreement that some kind of method of assuring professional competency is needed.

- The mandating policy clearly impacted the participation level in continuing education, not only up to the level required by the mandated policy, but also beyond. Participation from states with MCE policy was noticeably more than those from other states without a mandating policy. Maidenberg and Mayhan arrived at a similar conclusion where respondents were more likely to participate in continuing education if required by a state mandate (Maidenberg, 2001; Mayhan, 2000).
- This study also concluded that professional characteristics such as level of education, level of responsibility, field of practice, years of licensing, and age of professionals do not influence participation in continuing education. While these variables showed positive correlation with participation in states with mandating policies, they did not in states without the mandating policies. This leads to the conclusion that it was the impact of the mandating policy and not the dependent variables mentioned.
- The majority of employers do not have internal training programs, and support continuing education and training provided by external sources; they allotted time and paid expenses for their employees to attend such training. Training programs

or courses that are purely technical in nature were the most favored by the participating professionals.

- Participation in continuing education did not result in an increase in compensations. The participating professionals were divided on the issue of whether such participation should result in monetary gain.
- Finally, 77% of the participants attended continuing education on a voluntary basis, and more than 85% read at least 2 or more professional journals on a monthly basis. This result is an indicator of the level of importance that these professionals place on the issue of continuing education to stay abreast of new technologies, new materials, and new tools in their respective fields of practice.

Limitations

The sample population used in this study was restricted to those who voluntarily subscribed to the newsletter "CivilConnections" of the *CE News* magazine.

Other potential limitations could be due to:

- A response rate of 3.5% may not be considered a good representative of the civil engineering community. One can never know if the missed opportunity to survey the other 96.5% of potential respondents could have made the results and conclusions reached by this study any different.
- The self-reported perception could bring a great deal of bias into the responses and therefore into the results of the study.
- Since this study is based on perception and attitude of professionals and not on actual measures of public safety, solid conclusions could not be reached on the

long-term core issues.

- A final potential limitation could be due to the fact that *CE News* magazine being the sponsor of the electronic survey, that its readership are more in the know about current issues and are more experienced in this kind of survey methods.

Future researchers may want to expand their studies to include members of all professional societies that encompass other groups of civil engineers.

In addition, future survey questionnaires should focus on designing questions such that the "neutral or undecided" options would only be chosen as a last resort. The high percentage of neutral or undecided responses in this study should be reduced in future research in order to crystallize the position of civil engineers on a major issue such as the one explored in this study.

This study had aimed to explore the effectiveness of MCE through using another variable: the number of complaints registered with the regulatory boards against the practicing professionals before and after the adoption of MCE policy. However, the data could not be secured for many of the states because there were only a handful of states that makes such data available either electronically or in print.

Implications

The findings of this study have implications on many groups that are associated with issues of continuing education as a method of professional regulation and public policy. For instance, legislators and regulatory boards should be aware that mandating continuing education does increase the level of participation in such education but at the

same time, professional do not believe that such participation increases the level of competency and hence public safety, the very reason for which MCE was being adopted in the first place.

Educational institutions and organizations that provide continuing education services should be aware that these professionals are more interested in technical type courses than other non-technical or hands-on courses.

Insurers and advocacy groups with public safety agendas should be aware that continuing education does not necessarily translate into increase in competency and public safety. Public safety should not be an issue that professionals need to become aware of just during continuing education courses or license renewal. It is a central issue in the civil engineering profession by virtue of being the first canon of the American Society of Civil Engineers' code of ethics which states: "Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties" (American Society of Civil Engineers, 1914).

Professional engineering societies should be aware of the big divide that exists in the professional community regarding the issue of MCE. While these professionals positively perceive mandatory continuing education, they do not support the "mandatory" part of such a policy. This was evident in their preference for a voluntary continuing education where the professionals are in control of their educational and competency needs, not just participating for the sake of meeting a requirement to keep their license.

Finally, the professionals should be aware that mandatory continuing education continues to be the topic that does not win their consensus. Surprisingly, between 20 to

25% of them did not provide an opinion on the topic, they were either neutral or undecided. In this case, a clear message is sent to the regulatory board, legislature, and professional society to step in and take leadership in making a decision on their behalf. A decision that they have to live with, whether they support it or not.

Recommendations for Future Research

This study is the first of its kind dealing with the issue of perception of civil engineering professionals regarding mandatory continuing education; the literature will be well served by conducting more studies as described below:

A longitudinal study to measure the effectiveness of MCE over time. This can include investigating and studying the type and number of complaints in states where MCE has been adopted. In addition, the number of structural failures or malpractice cases can be used as variables to measure the element of continued professional competency.

Future research may want to focus on the effectiveness of the different methods currently used in teaching MCE courses such as classes, seminars, or other virtual online methods.

A study to investigate the efficacy of the methods and policies that organizations use in continuing professional education. A study that focuses on the experiences of the professionals with MCE courses. This could include evaluating the course material and topic, the providers, locations, accessibility, and cost in addition to assessing the methods of qualifying, approving, and choosing such courses.

Concluding Remarks

The vast amount of information that is beamed across professionals' desks and electronic stations is creating a huge demand for time and efforts from the professionals to keep up with current technologies. The amount of knowledge to be mastered in order to maintain competency and confidence in one's practice is more than ever before. Continuing education, then, has become the only source choice that today's professionals rely upon to keep abreast on any advancement in their field of practice.

Most professionals generally agree on the good benefits and the positive role of continuing education on their profession, but a great number of them do not support the mandatory part of continuing education.

The regulatory boards on the other hand are under pressure from the public who are demanding higher levels of safety and higher expectations and accountability from these professions. The boards are the gatekeepers of information regarding the impact of MCE on the performance of professionals. They should not delay or hesitate to analyze or make available any data that could aid in the evaluation this important public policy.

The professional societies that represent the interest of the professionals and maintain the integrity of the profession by meeting the demands of the public, must play this balancing role by assuring the public that their safety and well being are being guarded and that the professionals' interest is being enhanced by keeping continually competent through on-going education and training.

The author believes that establishing a minimum threshold of continuing competency that the professionals must maintain could be the platform that would bring

all the stakeholders together to arrive at a policy that is practical and fair for all. Traditionally, learning is measured by an exit examination at the end of a class or training session; and since no other measuring method has been devised, could this tradition be carried on to MCE?

Appendix A

Human Subjects Institutional Review Board Protocol Approval

WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

Date: November 23, 2005

To: Matthew Mingus, Principal Investigator
Alee Sleymann, Student Investigator for dissertation

From: Mary Lagerwey, Ph.D., Chair Mary Lagerwey

Re: HSIRB Project Number: 05-10-36

This letter will serve as confirmation that your research project entitled "A Study on Perceptions of Civil Engineers Regarding Mandatory Continuing Education" has been **approved** under the **exempt** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: November 23, 2006

Appendix B

Study Instrument

This is a **Civil Connection Sponsor Update**
Please see the bottom of this mailing for subscription information

Mandatory Continuing Education Survey Invitation

You are invited to participate in a research project entitled "A study on perceptions of mandatory continuing education," which is designed to analyze the attitudes of civil/structural engineers and surveyors. Your input may help in making decisions regarding the future of mandatory continuing education.

This study is being conducted by Dr. Matthew S. Mingus and Alee Sleymann, P.E., from Western Michigan University, School of Public Affairs and Administration. This research is being conducted as part of the dissertation requirements for Alee Sleymann. Completing and submitting the survey indicates your consent for use of the answers you supply. If you have any questions, you may contact Dr. Mingus at 269-387-8942, Mr. Sleymann at 269-267-7744, the Human Subjects Institutional Review Board at 269-387-8293 and hsirb@wmich.edu, or the vice president for research at 269-387-8298. This consent document has been approved for one year by the Human Subjects Institutional Review Board (HSIRB).

Click here to take the survey and voice your opinions about mandatory continuing education. The results of the survey will be published in an upcoming issue of *CE News*.

Mandatory Continuing Education Survey

1

In which state(s) or territory(s) do you practice engineering/surveying work?

- AL
- AK
- AS
- AZ
- AR
- CA
- CO
- CT
- DE
- DC
- FM
- FL
- GA
- GU
- HI
- ID
- IL
- IN
- IA
- KS

- PA
- PR
- RI
- SC
- SD
- TN
- TX
- UT
- VT
- VI
- VA
- WA
- WV
- WI
- WY

SUBMIT

Survey Page 1

Mandatory Continuing Education Survey

2

Does the state(s) where you practice mandate continuing education requirements for license renewal?

- yes
- no
- don't know

3

How many professional development hours have you attended in the past 2 years? (A PDH is a contact hour [nominal] of instruction or presentation.)

- 0
- 1-15
- 16-30
- 31-45
- 46+
- don't know

SUBMIT

Survey Page 2

Mandatory Continuing Education Survey

4

Using the scale below, please indicate your level of agreement with the following statements:

1	2	3	4	5
strongly disagree	disagree	neutral	agree	strongly agree

Continuing education programs have improved my professional practice. (For the purposes of this survey, continuing education includes all technical and non-technical education related to the practice of engineering/surveying.)

1 2 3 4 5

I have been able to apply at least one idea from each of the engineering/surveying continuing education programs that I have attended in the past two years.

1 2 3 4 5

Engineering/surveying continuing education programs have benefited me personally by helping me to better recognize my own training needs.

1 2 3 4 5

Engineering/surveying continuing education programs have resulted in less learning than expected.

1 2 3 4 5

Engineering/surveying continuing education programs have not benefited me professionally by improving job performance.

1 2 3 4 5

Engineering/surveying continuing education programs have benefited me professionally by providing professional contact with other professional engineers.

1 2 3 4 5

Overall, engineering/surveying continuing education classes I have attended have been very beneficial.

1 2 3 4 5

Engineering/surveying continuing education programs have not improved my engineering skills.

1 2 3 4 5

Engineering/surveying continuing education programs have benefited me professionally by increasing my awareness of important issues in the engineering field.

1 2 3 4 5

I would recommend most engineering/surveying continuing education classes I have attended to others in my field.

1 2 3 4 5

SUBMIT

Survey Page 5

Mandatory Continuing Education Survey

5

Has ongoing continuing competency education resulted in an increase in compensation for you?

- yes

- no
- don't know

SUBMIT

Survey Page 4

Mandatory Continuing Education Survey

6

Are you currently employed?

YES NO

SUBMIT

Survey Page 5

Mandatory Continuing Education Survey

7

Number of years you have been working at the company where you are now employed:

- 0 to 5
- 6 to 15
- 16 to 25
- 26+
- not applicable

8

Type of organization where you are now employed:

- private consulting service (engineering, surveying, multi-disciplined, etc.)

- private construction service or design builder
- public (federal, state, local, military, transportation authority, etc.)
- academic institution
- research institution
- land developer
- vendor (software developer, product manufacturer, etc.)
- Other, Please Specify

9

Does your employer pay for ALL of your expenses when you attend engineering/surveying continuing education programs (e.g., travel, meals, lodging)?

SUBMIT

Survey Page 5

Mandatory Continuing Education Survey

10

Does your employer allot time for you to pursue continuing education?

- never
- seldom
- sometimes
- usually
- always

11

What is your current or most recent position or title? (Select the one that best fits.)

- Owner/Executive/President
- Principal/Director/Senior Vice President/State Engineer
- Associate Principal/Vice President/Manager (Department, District, Division, Region, Program, Branch)/City or County Engineer/Supervising Engineer
- Associate/District Engineer/Senior Engineer/Principal Engineer/Chief Engineer/Project Manager/Assistant City or County Engineer
- Staff Engineer/Design Engineer/Project Engineer/Civil Engineer/Land Surveyor
- Other, Please Specify

12

If your organization has an internal training program that keeps you updated on new knowledge and technologies, how often does training take place?

- weekly
- biweekly
- monthly
- bimonthly
- quarterly
- annually
- biennially
- not applicable/no training
- Other, Please Specify

SUBMIT

Survey Page 7

Mandatory Continuing Education Survey

13

In which discipline do you have the most experience?

- Land development/site design
- Transportation
- Structural
- Construction management/oversight
- Surveying/mapping/GIS
- Environmental
- Hydraulics
- Geotechnical
- Other, Please Specify

SUBMIT

Survey Page 8

Mandatory Continuing Education Survey

14

Using the scale below, please indicate your level of agreement with the following statements:

1 strongly disagree	2 disagree	3 neutral	4 agree	5 strongly agree	undecided

Mandatory engineering/surveying continuing education is good for the profession.

1 2 3 4 5

Mandatory engineering/surveying continuing education is good for protecting the public from incompetent individuals.

1 2 3 4 5

Mandatory engineering/surveying continuing education is good for violators of professional ethics and those disciplined for negligent behavior.

1 2 3 4 5

Mandatory engineering/surveying continuing education is good for the majority of people in the profession.

1 2 3 4 5

Mandatory engineering/surveying continuing education is good for the individual professional.

1 2 3 4 5

Engineering/surveying continuing education should be mandated by law for professionals to retain their license to practice.

1 2 3 4 5

SUBMIT

Survey Page 6

Mandatory Continuing Education Survey

15

Do you think that ongoing continuing competency education should result in an increase in compensation?

- yes
- no
- neutral

16

What should the content of continuing education classes be? (Check all that apply.)

- technically oriented
- non-technically oriented (ethics, legal issues, etc.)

- hands-on oriented

17

Please indicate your level of agreement with the following statement:

1 strongly disagree	2 disagree	3 neutral	4 agree	5 strongly agree	undecided

Mandatory continuing education should be required for license renewal in my profession.

1 2 3 4 5

18

Do you regularly attend continuing education on a voluntary basis?

YES NO

19

Please indicate the type of license you maintain:

- professional engineer (P.E.)
- structural engineer (S.E.)
- professional surveyor, professional licensed surveyor, etc. (P.S., P.L.S., etc.)
- both professional engineer and surveyor (P.E., P.L.S.)
- not licensed, but have an E.I.T. or E.I.
- none
- Other, Please Specify

SUBMIT

Survey Page 10

Mandatory Continuing Education Survey

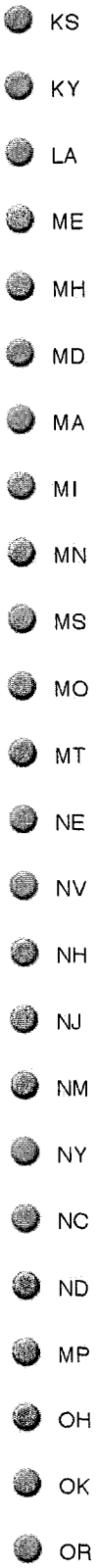
20

Number of years you have been licensed:

21

Check the state(s) in which you are licensed.

- AL
- AK
- AS
- AZ
- AR
- CA
- CO
- CT
- DE
- DC
- FM
- FL
- GA
- GU
- HI
- ID
- IL
- IN
- IA



- PW
- PA
- PR
- RI
- SC
- SD
- TN
- TX
- UT
- VT
- VI
- VA
- WA
- WV
- WI
- WY

SUBMIT

Survey Page 13

Mandatory Continuing Education Survey

22

Mandatory continuing education is only one method used to assure continuing professional competency, but there are other methods available that we'd like you to consider. Based on your experience, please indicate your level of agreement with the following statements. (Each method for assuring continuing professional competency is described in parentheses.):

1 strongly disagree	2 disagree	3 neutral	4 agree	5 strongly agree	undecided

Peer review is effective for assuring continuing professional competency. (Another professional rates your work and recommends you for renewal.)

1 2 3 4 5

Periodic re-examination is effective for assuring continuing professional competency. (Professionals are examined every renewal period.)

1 2 3 4 5

Mandatory continuing education is effective for assuring continuing professional competency. (Professionals are mandated to achieve a required number of educational hours or training per renewal period.)

1 2 3 4 5

Voluntary continuing education is effective for assuring continuing professional competency. (Professionals decide on their own the type and number of courses or training programs they will take.)

1 2 3 4 5

None of the above methods are effective for assuring continuing professional competency.

1 2 3 4 5

23

Would you recommend another method of assuring continuing professional competency?

- no
- Yes, Please Specify

SUBMIT

Survey Page 12

Mandatory Continuing Education Survey

24

Which age group reflects your age on your last birthday?

25

What is your highest degree?

- bachelor's degree
- master's degree
- doctorate degree
- Other, Please Specify

26

Identify the professional societies in which you maintain membership?

- American Society of Civil Engineers (ASCE)
- National Society of Professional Engineers (NSPE)
- American Council of Engineering Companies (ACEC)
- Society of American Military Engineers (SAME)
- American Public Works Association (APWA)
- State-level Structural Engineers Association (i.e., SEAOC, SEAoNY)
- Council of American Structural Engineers (CASE)
- National Society of Professional Surveyors (NSPS)
- American Congress on Surveying & Mapping (ACSM)
- International Federation of Surveyors (FIG)
- none
- Other, Please Specify

27

How many professional journals do you read per month?

SUBMIT

Survey Page 13

Mandatory Continuing Education Survey

28

What is your gender?

- male
- female

29

What is your marital status?

- married
- single
- other

30

Please add any comments you have.

SUBMIT

Survey Page 14

REFERENCES

Accreditation Board for Engineering and Technology [ABET]. (2004). *About ABET.* Retrieved February 12, 2005, from http://www.abet.org/mission.shtml.

Ad Hoc Committee on Mandatory Continuing Education for Michigan Psychologists. (2005). *Why MCE is a bad idea.* Retrieved June 30, 2005, from http://www.psychologymce.org/mcebad.htm.

Aircraft Owners and Pilots Association. (1996). *Pilot's guide to the flight review.* Retrieved August 10, 2005, from http://www.aopa.org/asf/publications/sa03.html.

The American Academy of Water Resources Engineers. (2005). *Change takes time: The history of licensure and continuing professional competency.* Retrieved July 2, 2005, from http://www.aawre.org/files/pdf/HistoryLicensureCPC.pdf.

American Bar Association. (2004). *The model rule for minimum continuing legal education (MCLE).* Retrieved August 10, 2005, from http://www.abanet.org/cle/ammodel.html.

American Bar Association. (n.d.) *Summary of MCLE state requirements.* Retrieved August 12, 2005, from http://www.abanet.org/cle/mcleview.html.

American Society of Civil Engineers [ASCE]. (1914). *Code of ethics.* Retrieved December 12, 2005, from https://www.asce.org/inside/codeofethics.cfm.

American Society of Professional Engineers. (2004). *Civil engineering body of knowledge for the 21st century: Preparing the civil engineer for the future.* Reston, VA: Author.

de Aristizabal, C. A. (2000). Connect or disconnect: An exploratory study of health professionals, competence and continuing education (Doctoral dissertation, Virginia Commonwealth University). *Dissertation Abstracts International, 61* (10), 4171A.

The Association of Professional Engineers and Geoscientists of British Columbia. (2003). *2003 continuing competency survey results.* Retrieved February 6, 2005, from http://www.apeg.bc.ca/prodev/cpd/CPD%20Survey%20Results.pdf.

Austin, T. M. (2004). Illinois physical therapists' preferences for, attitudes toward, and perceptions of continuing education (Doctoral dissertation, University of Illinois at Urbana-Champaign). *Dissertation Abstracts International, 66* (01), 236B.

Berman, E. M. (2002). *Essential statistics for public managers and policy analysts.* Washington, DC: CQ Press.

Bozeman, B. (2000). *Bureaucracy and red tape.* Englewood Cliffs, NJ: Prentice-Hall.

The Canadian Academy of Engineering. (2003). *Assuring competence in the Canadian engineering profession.* Retrieved August 17, 2005, from http://www.acad-eng-gen.ca/publis/rptcmp24.pdf.

Cervero, R. M. (1988). *Effective continuing education for professionals.* San Franscisco: Jossey-Bass.

Chlebicki, G. J. (2000). An analysis of the professionalism of engineers in Iowa and Illinois (Doctoral dissertation, The University of Iowa). *Dissertation Abstracts International, 61* (06), 3142B.

The Citizen Advocacy Center. (2004). *Maintaining and improving health professional competence. the Citizen Advocacy Center road map to continuing competency assurance.* Washington, DC: Author.

Clark, G. L. (1995). Advanced registered nurse practitioners' perceptions of mandatory continuing education requirements for relicensure in the state of Arkansas (Doctoral dissertation, Kansas State University). *Dissertation Abstracts International, 57* (01), 68A.

Cohen, H. S., & Miike, L. H. (1974). Toward a more responsive system of professional licensure. *International Journal of Health Services, 4*, 265–272.

Crawford, L. (2001). Regulation of the nursing profession: An American perspective. *Reflection on Nursing Leadership.* Retrieved August 19, 2005, from http://www.ncsbn.org/pdfs/In_News_regulation.pdf.

Curtis, O. B. S. (1988). *History of the National Council of Engineering Examiners.* Clemson, SC: The National Council of Engineering Examiners.

Dew, J. M. (1993). Perceptions of family physicians toward mandatory versus voluntary continuing medical education: A systems approach (Master's thesis, University of Louisville). *Master's Abstracts International, 32* (01), 339.

Engineering and Land Surveying Examining Board. (2003). *Administrative rules 2003 chapter 193C analysis index.* Retrieved August 16, 2005, from http://www.legis.state.ia.us/Rules/Current/iac/193c/193canal/193canal.pdf.

The Florida Board of Professional Engineers. (2004). *Chapter 471, Florida statutes.* Retrieved February 3, 2005, from http://www.fbpe.org/laws/index.php.

Garner, L. W. (1981). Continuing education policies of the professions: An analysis and description of content (Doctoral dissertation, Texas A&M University). *Dissertation Abstracts International, 42* (07), 2968A.

Gay, L. R., & Airasian, P. (2000). *Educational research: Competencies for analysis and application* (6th ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.

Gragnola, C. M., & Stone, E. (1997). *Considering the future of health care workforce regulation.* San Francisco, CA: USFC Center for the Health Professions.

Gross, S. J. (1984). *Of foxes and hen houses: Licensing and the health professions.* Westport, CT: Quorum Books.

Hatch, G. W., Jr. (2001). The perceptions of emergency medical services personnel concerning continuing education (Doctoral dissertation, University of Houston). *Dissertation Abstracts International, 62* (07), 2328A.

Hermansen, K. (1999). *Debate: Rebuttal to mandatory continuing education—against.* Professional surveyor online magazine. Retrieved May 31, 2005, from http://www.profsurv.com/newpsm/archive.php?issue=28&article=378.

Holm, H. A. (1998, February 21). Quality issues in continuing medical education. *British Medical Journal, 316*(7131), 621.

The Institute for Continuing Legal Education. (2003). *History of mandatory continuing legal education; statutory basis.* Retrieved August 12, 2005, from http://www.rlyeh.com/mcle/ca/online/yourmcle-2002.htm.

Institute of Social Research. (2002). *The engineering title act study: The practice title act distinction and protection of public health, safety and welfare.* Sacramento: California State University.

The Iowa Legislature, General Assembly. (2003). *Chapter 272c continuing education and regulation—professional and occupational.* Retrieved May 27, 2005, from http://www.legis.state.ia.us/IACODE/2003/272C/1.html.

Kehl, J. R. (1996). Are there benefits to continuing professional development? *Civil Engineering, 66*(10), 52.

Keltner, N. L. (1981). The impact of nursing continuing education on nursing practice as perceived by registered nurses in acute care facilities in the central valley of California (Doctoral dissertation, University of San Francisco). *Dissertation Abstracts International, 43* (03), 680A.

Kerka, S. (1994). *Mandatory continuing education.* Retrieved July 11, 2005, from http://www.academyprojects.org/kerka.htm.

Kleiner, M. M., & Ham, H. (2005). *Regulating occupations: Does occupational licensing increase earnings and reduce employment growth?* Unpublished manuscript.

Law, M. T., & Kim, S. (2004). *Specialization and regulation: The rise of professionals and the emergence of occupational licensing regulation.* Retrieved August 18, 2005, from http://www.nber.org/papers/W10467.

Lenburg, C. B. (1999). The framework, concepts and methods of the competency outcomes and performance assessment (COPA) model. *Online Journal of Issues in Nursing*. Retrieved July 25, 2005, from http://www.nursingworld.org/ojin/topic10/tpc10_2.htm.

Lindblom, C. E. (1987). The science of "muddling through." In J. M. Shafritz & A. C. Hyde (Eds.), *Classics of public administration* (2nd ed., pp. 263–275). Chicago: Dorsey Press.

Maidenberg, M. P. (2001). Factors which influence social workers' participation in continuing education (Doctoral dissertation, Yeshiva University). *Dissertation Abstracts International, 62* (07), 2572A.

Mayhan, Y. D. (2000). Public policy and professional practice: The relationship of state regulation to continuing competency perceptions and behaviors of occupational therapists (Doctoral dissertation, University of Pennsylvania). *Dissertation Abstracts International, 61* (06), 2146A.

McGraw Hill Construction. (2005). *Summary table continuing educational requirements for professional engineers*. Retrieved October 12, 2005, from http://www.construction.com/NewsCenter/Headlines/ENR/20031027e.htm.

Michigan Society of Professional Engineers [MSPE]. (2004). *Results of continuing education survey*. Retrieved June 2, 2005, from http://www.michiganspe.org/continuing%20ed%20survey%20results.htm

National Council of Examiners of Engineers and Surveyors [NCEES]. (2003a). *NCEES 2003 licensing boards survey, question 30.* NCEES. Retrieved June 20, 2005, from

http://www.ncees.org/licensure/licensing_requirements/2003_survey_results/a_30.pdf.

National Council of Examiners of Engineers and Surveyors [NCEES]. (2003b). *Report of the engineering licensure qualification task force.* Retrieved June 20, 2005, from http://www.ncees.org.

National Council of Examiners of Engineers and Surveyors [NCEES]. (2004a). *Continuing professional competency guidelines, revised November 2004.* Clemson, SC: Author.

National Council of Examiners of Engineers and Surveyors [NCEES]. (2004b). *NCEES history.* Retrieved February 18, 2005, from http://www.ncees.org/introduction/about_ncees/ history.php.

National Council of Examiners of Engineers and Surveyors [NCEES]. (2005). How is NCEES involved with ABET and accreditation? *Licensure Exchange, 9*(1). Retrieved March 6, 2005, from http://www.ncees.org/ licensure/licensure_exchange/le_2005_02.pdf.

National Society of Professional Engineers [NSPE]. (2005a). *About NSPE.* Retrieved January 28, 2005, from http://www.nspe.org/aboutnspe/ab-home.asp.

National Society of Professional Engineers [NSPE]. (2005b). *State continuing education requirements for engineers.* Retrieved February 2, 2005, from http://www.nspe.org/licensure/state_ce_requirements.pdf.

O'Sullivan, E., & Rassel, G. R. (1995). *Research methods for public administrators* (2nd ed.). New York: Longman.

Pagliero, M. (2005). *What is the objective of professional licensing? Evidence from the U.S. market for lawyers.* (Study). London, UK: London Business School, Department of Economics.

Peters, G. B. (1999). *American public policy: Promise and performance* (5th ed.). New York: Chatham House.

Prater, L. S. (1998). Mandatory continuing education in nursing: A Texas perspective (Doctoral dissertation, University of North Texas). *Dissertation Abstracts International, 59* (04), 1044A.

Roasoft Inc. (2004). *Sample size calculator.* Retrieved December 2, 2005, from http://www.raosoft.com/samplesize.html.

Rops, M. S. (2004). *White paper on occupational regulation.* Retrieved August 19, 2005, from http://apt.allenpress.com/aptonline/?request=get-abstract&issn=1086-508X&volume=044&issue=04&page=0244.

Shimberg, B. (1982). *Occupational licensing: A public perspective.* Princeton, NJ: Center for Occupational and Professional Assessment, Educational Testing Service.

Sims, David J. D. (2003). *Maintaining competence—How does the public know?* Retrieved January 21, 2005, from http://www.peo.on.ca/events/JMB2003/Sims_Competence.pdf.

Sklar, B. M. (2000). *The current status of online continuing medical education.* Retrieved May 8, 2005 from http://www.cmelist.com/mastersthesis/thesis.pdf.

State of California Board for Professional Engineers and Land Surveyors [BPEL]. (2003). *Sunset review report.* Retrieved December 7, 2004, from http://www.dca.ca.gov/pels/sunset/2003sunset.pdf.

Stillman, R. J. (1991). *Preface to public administration: A search for themes and direction.* New York: St. Martin's Press.

Sutherland, W. (2004). Changes to licensing process coming soon. *Licensure Exchange, 8*(1), 1–2.

Whittaker, S., Carson, W., & Smolenski, M. C. (2000). Assuring continued competence-policy questions and approaches: How should the professions respond? *Online Journal of Issues in Nursing.* Retrieved August 10, 2005, from http://www.nursingworld.org/ojin/topic10/tpc10_4.htm.