Submitted in 2011 Annual Report to the Governor and State Legislature

ASHSC POLICY RECOMMENDATION 2011-2

EARTHQUAKE ENGINEERING BASIC KNOWLEDGE REQUIREMENTS FOR PROFESSIONAL ENGINEERING LICENSURE

Being the most seismically active State, the safety of Alaska's populace and economy rely that the design and construction of infrastructure adequately considers the seismic hazard. Therefore, the Commission recommends that applicants for registration as a Professional Engineer practicing civil engineering in Alaska be required to have completed a university level or equivalent course addressing seismic hazards.

ABSTRACT

The mission of the Alaska Seismic Hazards Safety Commission (ASHSC) and the Alaska State Board of Registration for Architects, Engineers, and Land Surveyors (AELS) share a common goal to protect the safety and welfare of the public. Alaska is the most seismically active, and one of the highest ranked of the United States in terms of seismic risk; yet the Alaska statutes and regulations do not assure that all civil engineers registered to prepare and seal designs in Alaska have demonstrated knowledge of either seismic hazards or seismic engineering; at least by virtue of prerequisite education and experience, examination, registration by comity, or continuing education. This position paper presents the ASHSC's recommendations for simple and straightforward amendments to Alaska Administrative Code 12 ACC 36[1] (hereafter, the regulations) pertaining to minimum requisites for knowledge of seismic hazards and seismic engineering by civil engineers registered to prepare and seal designs in the state.

BACKGROUND & NEED

Alaska experiences more earthquakes than any other region in North America. Seismographs monitored by the Alaska Earthquake Information Center[2] record 50-100 earthquakes daily, with over the past few decades on average at least one magnitude (M) 6-7 event annually, and one >M8 event about every 13 years. Further, the two major Alaska population centers, Municipality of Anchorage and Fairbanks-North Star Borough, are both situated in areas characterized by very high seismic active. The codified[3] seismic ground motion parameters for designing buildings in Anchorage compare with those values used in Los Angeles and San Francisco. And while it is not possible to predict the time and location of the next large earthquake, the historic activity

[1] State Board of Registration for Architects, Engineers, and Land Surveyors.

[2] http://www.aeic.alaska.edu

[3] American Society of Civil Engineers. 2010. Minimum Design Loads for Buildings and Other Structures. ASCE/SEI Standard 7-10.

assures that major, potentially damaging earthquakes will occur in Alaska in the near future.

The Federal Emergency Management Agency (FEMA) completed a study[4] in 2008 to investigate the potential consequences, or risk, of earthquake hazard to the populace and built infrastructure (e.g. buildings, lifelines, etc.) in the United States. Based on that study: Alaska was ranked second only to California in terms of the estimated annualized earthquake loss (AEL), or damage, versus the replacement value of the total infrastructure; Anchorage was the highest ranked non-California major metropolitan area in terms of AEL versus building replacement value; and, the risk along the rail belt (Anchorage to Fairbanks) compared with that in the greater Los Angeles and San Francisco metropolitan areas in terms of AEL per capita.

These attributes clearly point to the importance and need for engineers preparing and sealing civil and structural designs in Alaska to possess a basic understanding and appreciation of seismic hazards (e.g. earthquake sources and activity, earthquake-induced ground motions and ground failure, tsunamis, etc.), as well as seismic engineering (i.e. evaluation and design to mitigate seismic risk to the populace and infrastructure). However, the ASHSC believes that the current State statutes and regulations do not necessarily assure all civil engineers registered in Alaska have a basic knowledge of seismic hazards or seismic engineering; at least by virtue of prerequisite education and experience, examination, registration by comity, or continuing education. Accordingly, the Commission's 2011 report[5] to the Governor and Legislature included a policy recommendation (#2011-2) which read:

> "*Considering that Alaska is the most seismically active state, the safety of Alaska's populace and economy require that the design and construction of infrastructure adequately consider the seismic hazard. Therefore, the Commission recommends that applicants for registration as a Professional Engineer practicing civil engineering in Alaska be required to have completed a university level or equivalent course addressing seismic hazards*."

DISCUSSION: *ALASKA STATUTES & REGULATIONS*

The following summarizes the Commission's interpretation of the current Alaska Statute AS 08.48, and Alaska Administrative Code 12AAC36 (*regulations*), and why we believe these two documents do not presently assure that all professional engineers registered to prepare and seal civil and structural designs in Alaska have a demonstrated knowledge of seismic hazards or seismic engineering.

1. ***Specific "Statutes" for Seismic Knowledge of Registered Civil Engineers:*** The Alaska statutes for architects, engineers, and land surveyors (AS 08.48) do not include any direct mention of specific or inferred requirements relative to

[4] FEMA. 2008. HAZUS MH Estimated Annualized Earthquake Losses for the United States. FEMA 366.

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knowledge of seismic hazards or seismic engineering. Further, AS 08.48 does not even include the word 'seismic', or a synonym thereof.

2. ***Specific "Regulations" for Seismic Knowledge of Registered Civil Engineers:*** The Alaska regulations for architects, engineers, and land surveyors (12 ACC 36) include the word 'seismic', or a synonym thereof, in only three sections (specifically 060, 103, and 110). However, the 'seismic' requirements specified in each of these three sections only apply to architects, not engineers.

   Of particular example is Section 12 AAC 36.110, titled *Arctic and Seismic Requirements*, which requires that (i) all engineers and architects registering in Alaska must first complete a "board-approved" university level course in Arctic Engineering; and (ii) architects seeking registration by comity must also pass the NCARB examination on seismic forces (note that 12 AAC 36.110 does not define any specific "seismic" requirements for engineers). There is no question that understanding the effects of a cold climate on our built environment (arctic engineering) is very important to the longevity and efficiency of civil engineered designs in Alaska. However, lack of knowledge or detail for the cold region effects in civil and structural designs do not typically present an imminent risk to the health and safety of the populace. On the other hand, failure to recognize and adequately design for the seismic hazards and forces pose, without question, an immediate and often devastating risk to the populace.

3. ***"Regulations" that Possibly 'Infer' Seismic Knowledge of Registered Civil Engineers***: The following Alaska categories of regulations may be considered to infer some degree of seismic knowledge in professional engineers; although the Commission does not believe that they necessarily apply to all civil engineers registered, or eligible for registration in the State.

   a. ***Education for Registration*** – The education requirements for registration of civil engineers are defined in 12 AAC 36.061; one of which is a degree from an accredited engineering school. While such schools likely offer courses pertaining to seismic hazards and seismic engineering, the regulations do not require such training, and therefore cannot be considered too infer that all registered civil engineers have any formal seismic engineering education.

   b. ***Examination*** – Section 12 AAC 36.100 specifies that applicants seeking registration as a professional engineer (PE) must pass the NCEES *Principals and Practices of Engineering Examination* for that branch of engineering for which the applicant is applying. The NCEES[6] examination for civil engineers was first administered in 1966, but did not include specific testing of seismic knowledge. In 2000, the NCEES exam was expanded to include five afternoon "depth" sessions, which individually address the five general sub-branches within civil engineering: structural, geotechnical, construction, transportation, and water resources and environmental. Note that only two of the five depth

[6] Personal communication, Mr. Jason Gamble, PE, NCEES, August 10, 2012

sessions of the NCEES exam, structural and geotechnical, address seismic hazards and seismic engineering; the other three depth sessions do not test for any seismic knowledge.

While not referenced directly in the current Alaska regulations, NCEES also offers an examination for civil engineers intending to be registered specifically as a "structural engineer" (SE). The NCEES structural engineering exam[6] was first administered in 1985, and has always tested for knowledge of seismic-induced lateral forces, but not specifically seismic hazards. However, the current State regulations do not stipulate that registered civil engineers eligible to prepare and seal structural designs in Alaska must have passed the NCEES's "structural" examination.

Therefore, inference of seismic knowledge by examination only applies to civil engineers who have both (i) passed the NCEES examination since the year 2000, and (ii) had opted to take either the geotechnical or structural depth portions of the exam.

c. ***Registration by Comity*** – Section 12 AAC 36.105 only infers that a registrant by comity has some knowledge of seismic hazards and seismic engineering if such knowledge was a requisite of their existing registration in another state. To the Commission's knowledge, California is the only state that has specific requirements for registered civil engineers that demonstrates their seismic knowledge (by virtue of their experience and passing a specific examination).

d. ***Continuing Education*** – Section 12 AAC 36.510 requires professional engineers accumulate at least 24 'professional development hours' of continuing education during the two-year period immediately preceding re-registration. Many of the continuing education opportunities directed specifically towards civil and structural engineers often include elements pertaining to seismic hazards and/or seismic engineering. However, the regulations do not stipulate that the continuing education must include training pertaining to any specific topic (other than being relevant to the engineer's field of practice). Therefore the continuing education requirement does not necessarily infer that registered civil engineers have knowledge of seismic hazards or seismic engineering.

In conclusion, the Commission believes that the current State statutes and regulations do not include any specific requirements for knowledge of seismic hazards or seismic engineering by civil engineers registered to prepare and seal designs in Alaska. Further, a presumption of such seismic knowledge could only be inferred if the engineer: (i) had voluntarily taken an academic course on the subject; (ii) had taken either the structural or geotechnical depth sessions of the NCEES civil engineering examination (which were not available to civil engineers tested prior to year 2000); (iii) was or is also a registered civil engineer in California; and/or (iv) has voluntarily taken continuing education training pertaining to the subject.

RECOMMENDATIONS

Based on the discussions above, the ASHSC recommends that the Alaska regulations for *professional engineers* practicing in the branches of civil and structural engineering be amended to include specific requirements to demonstrate a basic knowledge of seismic hazards and seismic engineers, by virtue of both prerequisite education or experience, and continuing education. The following summarize simple and straightforward amendments that the Commission believes would improve the regulations[7] in this regard. Note that the commissions also believes that these amendments should not have any substantial bearing on the cost or time for civil engineers to either obtain or maintain registration in Alaska.

1. Add to the end of Section 12 AAC 36.063 (Engineering Education and Work Experience Requirements):

   (k) Engineers registering in the branches of civil engineering or structural engineering must have passed at least one course pertaining specifically to seismic hazards or seismic engineering from an ABET accredited education program; or provide satisfactory evidence to the board of seismic knowledge by virtue of work experience.

2. Add to Section 12 AAC 36.100 (Content of Examinations), Subsection (c):

   …Applicant engineers registering in the branch of civil engineering that will be involved with design of foundations, structures and bridges must take either the "structural" or "geotechnical" depth portions of the NCEES examination.

3. Add to Section 12 AAC 36.510 (Continuing Education Requirements), Subsection (g):

   (6) At least 4 of the professional development hours for registered professional engineers practicing in the branches of civil engineering or structural engineering must be related to the subjects of seismic hazards or seismic engineering.

   Note: This amendment (#3) would be the only proposed new regulation applicable to civil and structural engineers currently registered as a professional engineer in Alaska.

4. As an alternative to recommendation #1 (and possibly also #2), the scope and content of the board-approved Arctic Engineering course could be expanded to also include review of the seismic hazards in Alaska, and basic seismic

[7] These recommendations would also apply, with some modification, to engineers registered in Alaska specifically as a *Structural Engineer*; as the Commission understands the AELS is currently considering.

engineering relative to the standard building codes adopted by the State[8]. While this alternative would certainly require the time and effort of a number of professionals to implement, the ASHSC believes it could be the most effective and efficient approach to address our concerns.

Robert L. Scher, P.E.
Chair Education, Outreach & Partnering Committee

[8] Credit for this alternative belongs to Mr. Colin Maynard, PE, who originally suggested it AELS's meeting in Anchorage on August 2, 2012.

POSITION PAPER

RECOMMENDATIONS FOR KNOWLEDGE OF SEISMIC HAZARDS AND ENGINEERING IN THE REGULATIONS FOR CIVIL ENGINEERS[1] REGISTERED IN ALASKA

Submitted to the Alaska State Board of Registration for Architects, Engineers, and Land Surveyors, by the Alaska Seismic Hazards Safety Commission
December 20, 2012

ABSTRACT

The mission of the Alaska Seismic Hazards Safety Commission (ASHSC) and the Alaska State Board of Registration for Architects, Engineers, and Land Surveyors (AELS) share a common goal to protect the safety and welfare of the public. Alaska is the most seismically active, and one of the highest ranked of the United States in terms of seismic risk; yet the Alaska statutes and regulations do not assure that all civil engineers registered to prepare and seal designs in Alaska have demonstrated knowledge of either seismic hazards or seismic engineering; at least by virtue of prerequisite education and experience, examination, registration by comity, or continuing education. This position paper presents the ASHSC's recommendations for simple and straightforward amendments to Alaska Administrative Code 12 ACC 36[2] (hereafter, the regulations) pertaining to minimum requisites for knowledge of seismic hazards and seismic engineering by civil engineers registered to prepare and seal designs in the state.

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Alaska experiences more earthquakes than any other region in North America. Seismographs monitored by the Alaska Earthquake Information Center[3] record 50-100 earthquakes daily, with over the past few decades on average at least one magnitude (M) 6-7 event annually, and one >M8 event about every 13 years. Further, the two major Alaska population centers, Municipality of Anchorage and Fairbanks-North Star Borough, are both situated in areas characterized by very high seismic active. The codified[4] seismic ground motion parameters for designing buildings in Anchorage

[1] The Commission understands the difference between a registered "professional engineer", as defined in the current Alaska statutes and regulations, and a registered "structural engineer". However, the purpose of this position paper is directed specifically to registered professional engineers in the field of *Civil Engineering*, including those practicing in the branch of structural engineering.

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The Federal Emergency Management Agency (FEMA) completed a study[5] in 2008 to investigate the potential consequences, or risk, of earthquake hazard to the populace and built infrastructure (e.g. buildings, lifelines, etc.) in the United States. Based on that study: Alaska was ranked second only to California in terms of the estimated annualized earthquake loss (AEL), or damage, versus the replacement value of the total infrastructure; Anchorage was the highest ranked non-California major metropolitan area in terms of AEL versus building replacement value; and, the risk along the rail belt (Anchorage to Fairbanks) compared with that in the greater Los Angeles and San Francisco metropolitan areas in terms of AEL per capita.

These attributes clearly point to the importance and need for engineers preparing and sealing civil and structural designs in Alaska to possess a basic understanding and appreciation of seismic hazards (e.g. earthquake sources and activity, earthquake-induced ground motions and ground failure, tsunamis, etc.), as well as seismic engineering (i.e. evaluation and design to mitigate seismic risk to the populace and infrastructure). However, the ASHSC believes that the current State statutes and regulations do not necessarily assure all civil engineers registered in Alaska have a basic knowledge of seismic hazards or seismic engineering; at least by virtue of prerequisite education and experience, examination, registration by comity, or continuing education. Accordingly, the Commission's 2011 report[6] to the Governor and Legislature included a policy recommendation (#2011-2) which read:

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