Eminent Structural Engineer: Dr C. Allin Cornell (1938–2007)

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Brief CV

1938	Born in Mobridge, South Dakota, USA
1960	A.B. Architecture, Stanford Univ.
1961	M.S. Civil Eng., Stanford Univ.
1964	Ph.D. Civil Eng., Stanford Univ.
1964–1966	Ford Foundation Fellow, MIT
1966–1983	Prof. at MIT
1968	Publication of "Engineering Seismic Risk Analysis" in the *Bulletin of the Seismological Society of America*
1971	Publication of *Probability, Statistics and Decision for Civil Engineers*
1977	Moisseiff Award, ASCE
1981	Elected to U.S. National Academy of Eng.
1983	Normal Medal, ASCE
1983–2007	Research Prof., Stanford Univ.
1986–87	President of the Seismological Society of America
1987	International Civil Eng. Risk and Reliability Assoc. CERRA Award
1988	Alfred M. Freudenthal Medal, ASCE
1999	Distinguished Lecturer of the Earthquake Eng. Research Inst.
2001	Harry Fielding Reid Medal, Seismological Society of America
2002	Elected Fellow of the American Geophysical Union
2003	George Housner Medal, ASCE

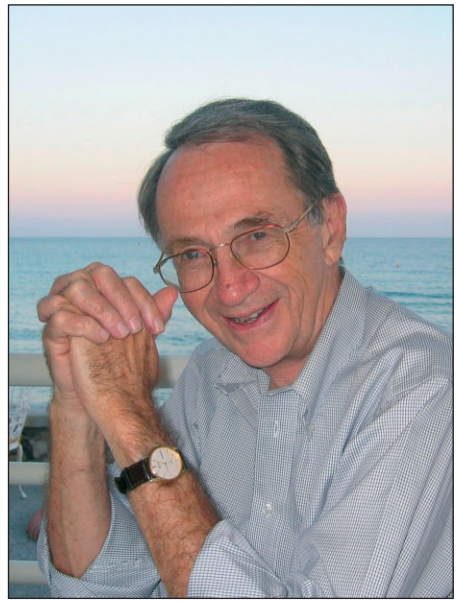

Fig. 1: Prof. C. Allin Cornell

Introduction

C. (Carl) Allin Cornell 69 (*Fig. 1*), died on December 14, 2007 after a two-year battle with cancer. Stanford University, where he was on the faculty until he passed away, called him "the father of modern earthquake risk analysis" (*Stanford Report*, December 20, 2007). More broadly, he was perhaps the leading expert in the world in structural reliability theory and application, but his work touched on wide areas of civil engineering including hydrology, geotechnology and transportation, and he influenced a generation of workers in those fields.

Keywords: C. Allin Cornell; structural engineer; seismology; earthquake engineering.

Formative Years

Allin Cornell was born in Mobridge, South Dakota in 1938. He attended Stanford University as an undergraduate, receiving his AB degree in architecture. He stayed at Stanford for graduate studies in Civil Engineering, earning his MS and PhD. His doctoral dissertation, completed in 1964 under the direction of Jack Benjamin, was entitled *Stochastic Process Models in Structural Engineering*. This thesis laid the foundation for a lifelong interest in stochastic models representing loads on structures and structural response to those loads. In the same year, Cornell became a Ford Foundation Fellow at the Massachusetts Institute of Technology (MIT), and in 1966 he received a faculty appointment. He continued to pursue probabilistic and stochastic theories applied to practical civil engineering problems. In 1971, he co-authored (with Jack Benjamin), *Probability, Statistics and Decision for Civil Engineers*, which was published by McGraw-Hill. This book remains a standard reference for students and researchers, its title reflecting his perspective that reliability and safety are not abstract concepts but the proper basis for engineering decisions.

At MIT, Cornell developed the application of quantitative probability to define structural reliability and safety. He took the early theoretical works of Alfred M. Freudenthal and developed innovative ways to make rational and practical engineering decisions. His hundreds of papers defined the field of structural reliability and safety. In 1968, the *Bulletin of the Seismological Society of America* published his paper, "Engineering Seismic Risk Analysis," which is credited with creating a firm mathematical basis for seismic risk analysis. This paper is often cited as the foundation of probabilistic seismic hazard analysis, and it served as the basis for the first seismic hazard map in the United States based on probability theory, published by the U.S. Geological Survey in 1976. This paper traced earthquake motion back to the initiating fault rupture, bringing together seismology and earthquake engineering.

His early papers on second-moment concepts established the field of probabilistically-based codified structural design. His efforts in this area had fundamental impacts on building codes and standards of practice in the design and retrofit of structures for earthquake loads (commercial buildings, dams, bridges, and power plants), for wind- and wave loads (offshore oil platforms), and for hurricanes (commercial and residential buildings).

Personal Experience

At the same time that he was quickly rising to be a leader in the area of structural reliability, Prof. Cornell became a guide, a friend, a supporter and a quiet inspiration and a role model. The authors of this tribute have many wonderful and personal experiences with Prof. Cornell over those early years. Corotis came to MIT as an undergraduate in 1963, and the next year Cornell became his advisor. Cornell then served as the advisor for a master's thesis developing live load theory and calibrating it with recent load surveys in the U.S. and the U.K. Cornell also served as the doctoral advisor for Corotis, on nonstationary vibrations in seismic building response. Cornell also had a wonderful sense of humor; on a particular day in class, he had just finished advising the students to believe nothing of what they hear and only half of what they read. He then assigned the homework for the next hour, at which point Corotis called out that he didn't believe it. Professor Cornell smiled, turned to the board, wrote the assignment down, twice, then turned back to the class and told them to believe half of what they read.

McGuire also came to MIT as an undergraduate (in 1964) took Cornell's undergraduate probability course, and returned in 1971 to pursue a Ph.D. under Cornell in probabilistic applications in structural engineering. Throughout his career, Cornell always welcomed visiting lecturers and researchers from throughout the world, and McGuire recalls that parties at Cornell's house were always a mixture of humor and hospitality, with different accents from Europe, Asia, Latin America, Australia, and New Zealand providing welcome spice to the conversations. At the height of the cold war, Cornell could disarm even taciturn Russian visitors with the statement that the US had two secret weapons to conquer the Soviet Union. When asked what those were, he replied with a straight face, "McDonalds and Mickey Mouse."

Baecher came to MIT as a graduate student in 1968 to study geological engineering. Cornell served as an informal advisor on a master's thesis applying statistical fracture theory to crystalline rocks, and then more formally as co-advisor on a PhD thesis applying decision theory to geological exploration. One of Cornell's most noteworthy attributes was his ability to penetrate to the heart of a technical problem, even if the problem was in a field not closely related to his own. This in large measure contributed to his influence on so many different areas of engineering and on so many engineers.

Career

In 1983, Cornell moved back to Stanford to take a position of Research Professor, a half-time commitment that allowed him to pursue consulting, and blend research directions and interests with relevant problems faced by practicing engineers and earth scientists. In particular, through his industry collaboration, he became a proponent for offshore structure reliability analysis, developing a basis for the probabilistic design of drilling and exploration platforms.

Cornell's comprehensive view of earthquake engineering brought him into contact with many earth scientists as well as earthquake engineers, and his numerous professional recognitions and awards for his research reflect his efforts in those fields. He served as President of the Seismological Society of America (SSA) in 1986-1987 and was awarded the Harry Fielding Reid Medal of the SSA (its highest honor) in 2001. Additionally, he was elected a Fellow of the American Geophysical Union in 2002, an honor accorded to only a handful of engineers over the years.

Allin Cornell was elected to the U.S. National Academy of Engineering in 1981, at the age of 43. As a result of his research in structural reliability and safety techniques, he was the inaugural recipient of the International Civil Engineering Risk and Reliability Association's CERRA Award in 1987. From the American Society of Civil Engineers, he received the Moisseiff Award (1977), the Norman Medal (1983), and the Freudenthal Medal (1988) to recognize his research contributions to structural reliability problems in civil engineering. He was the Distinguished Lecturer of the Earthquake Engineering Research Institute in 1999 and received the Housner Medal (its highest honor) in 2003.

Throughout his professional career of almost 45 years, Cornell was a mentor, colleague, and friend for so many. From the highest levels of government to his graduate advisees to his undergraduate students, he gave the same even and informative attention. Those of us fortunate enough to have Cornell as a graduate research advisor soon discovered that he expected nothing less than our best. He was always ready to give colleagues proper credit for their work, and throughout his career, when publishing technical papers co-authored with graduate students, he preferred to list the student first. And whenever he or one of his students presented a paper at a conference, one could be assured of learning of a totally new and innovative concept or understanding.

Influence

The measure of a great person is his influence on others around him. In this respect, three of Cornell's doctoral students (the authors of this tribute) have been elected to the National Academy of Engineering. Surely others will follow. His wife, Elisabeth Pate-Cornell, chairs Stanford's Department of Management Science and Engineering, and is also an NAE member, making Allin and Elisabeth one of a handful of married couples sharing that honor. One can only conclude that their marriage of 25 years contributed to very positive mutual influences. Eric A. Cornell, Allin's son, was awarded the Nobel Prize in physics in 2001.

Allin Cornell was one of the nicest, most sincere, dedicated, and selfless individuals our field has known. Scholar, genius, innovator and leader - describe Allin Cornell; but so do friend, mentor, collaborator and gentleman. We honor a man who was one of the greatest inspirations to our field, to our profession and to humanity.