Mark A. Aschheim: A Collection of Personal Remembrances

Mark Aschheim, the Peter Canisius S.J. Professor in the Department of Civil, Environmental and Sustainable Engineering at Santa Clara University, died in his home on 16 June 2019 after a 2-year battle with cancer. Mark was a leading scholar in earthquake-resistant design of reinforced concrete buildings and infrastructure. Although his post-graduate career was shortened to 25 years, he had a profound effect on structural engineering and on many people with whom he interacted. He will be remembered fondly by those who came in contact with him because of his gentle, kind, and enthusiastic spirit, along with his keen insights in engineering.

Mark was born in Palo Alto, California in 1963. He spent his early years in nearby Menlo Park in the modernist space of an Eichler home, where he experienced his first low-magnitude earthquakes, and then moved with his family to places including Singapore and New York City. Mark was a born structural engineer and tinkerer. From a young age he was constantly building fantastical architectures out of pieces of wood, string, moving metal parts, and odds and ends. Family travels exposed him to a variety of cultures and building styles, such as the bamboo scaffolding lashed with rattan common in Asia.

Mark spent his undergraduate and graduate student years at the University of California, Berkeley. Jack Moehle recalls Mark as an undergraduate arriving at his office one day with an idea and a physical model for a three-way reinforced concrete slab. Recognizing a talent for independent thinking, he gladly welcomed Mark to join his graduate lab. This was the beginning of many years of friendship and professional collaboration.

This period included the 1989 Loma Prieta earthquake, 1994 Northridge earthquake, and 1995 Kobe earthquake. Mark was eager to learn from these earthquakes and took that learning to advance the profession. When the Architectural Institute of Japan (AIJ) sought to publish an English translation of its preliminary report on the Kobe earthquake, Mark and two other UC Berkeley graduate students spent ten days in Japan, working with a few young Japanese researchers, and accomplished a detailed and timely translation of the reconnaissance report. His in-depth knowledge of fundamental earthquake engineering, his curiosity to understand structural behavior, his gift for language, and his warm personality made his contributions to the English edition very efficient and meaningful. Mark continued his interest in learning from earthquakes, later serving on reconnaissance teams for the 1999 Izmit, 2001 Gujarat, and 2011 Tohoku earthquakes.

Mark's graduate research was on design and evaluation of earthquake-resistant bridge construction. Among many subjects, he studied the effects of reversed cyclic loading on the shear strength of reinforced concrete bridge columns and recommended design equations for use by Caltrans. Although Mark was dismissive of his technical contribution and never published the results of his study in archival journals, his recommended design equations for shear strength of concrete columns have been used by Caltrans continuously since the mid-1990s.

After completing his graduate studies in 1995, Mark became a faculty member in the Civil Engineering Department at the University of Illinois at Urbana-Champaign, then joined the faculty at Santa Clara University in 2003.

Mark was one of the most brilliant minds in the younger generation of structural engineers, with tremendous discernment in whatever he undertook to research and solve. He pioneered research in soil-structure interaction, in innovative steel frame designs by relocation of plastic hinges, in fragility analysis of structures, in understanding the deformation capacity of structural members, and in developing an energy-based formulation for pushover analyses. Ever practical and resourceful, Mark patented his reduced-web steel moment frame, and did it without using a patent attorney. He investigated alternative, sustainable materials such as bamboo, straw bale, and even mycelium. His straw-bale wall designs are found in several buildings in California. And Mark's intellectual thirst and curiosity ranged far beyond structural engineering – you could be as likely to find him intensely engaged in studying chaos theory, how to obtain a ham radio license, the physics of solar panel technology, or the gut microbiome, amongst many others. He took all of his interests seriously, with thought and with responsibility.

From among the many contributions he made in the field of earthquake engineering, the yield point spectra (YPS) was Mark's proposal to estimate the performance point of structural response to an earthquake. The YPS epitomizes Mark's unique ability to clarify and simplify mathematical complexity of structural mechanics to the essence of the physical problem. The method is simple, accurate, transparent, and ultimately upgradeable. Several years later, Mark saw the need to transform the concept of YPS from an intensity-basis to a risk-basis. During the summer of 2012, with a team working at Mark's favorite Los Altos Starbucks under the sound of crushing ice cubes, this culminated in the Yield Frequency Spectra (YFS), his vision for practical seismic design in a probabilistic world.

On collaborative projects and professional committees, Mark's sound judgement, witty responses, and humility made him a valued and appreciated team member. He was adept at engaging others in his intellectual pursuits, but also was quick to acknowledge the contributions of others with genuine sincerity.

Mark was active in Applied Technology Council projects that produced the FEMA 306-308 guidelines on Evaluation of Earthquake Damaged Concrete and Masonry Wall Buildings and the FEMA 440 report on Improvement of Nonlinear Static Seismic Analysis Procedures. For both projects, Mark used state-of-the-art analysis methods to identify trends in performance of existing concrete buildings. For the FEMA 306-308 reports, Mark's surprising findings on the effects of prior earthquake damage on future building performance are a standard reference for current work in this field. For the FEMA 440 project, comprehensive assessment of nonlinear analysis procedures provided a road map for further development and application.

Mark contributed over many years to the American Concrete Institute Committee 341 (Earthquake-Resistant Concrete Bridges). Readers of committee reports will immediately recognize his contribution to the sections on embankment flexibility for seismic demands on bridges. Many graduate students recall learning from Mark the elegance of including more compliant boundaries on seismic demands, and the importance thereof for design. A fond recollection is a debate with Mark on whether it was possible to consider performance-based earthquake engineering, or even performance-based evaluation, of bridges without the inclusion of the abutments in the capacity term.

As his research progressed, Mark became keenly concerned about the environment, climate change, and the need for sustainable use of natural resources. Among other projects, he worked on devising solutions for the housing needs of poor people in developing countries using local natural materials.

Fortunately, Mark synthesized many of his ideas in his book "Design of Reinforced Concrete Buildings for Seismic Performance: Practical Deterministic and Probabilistic Approaches", CRC Press, co-authored with Enrique Hernández-Montes and Dimitrios Vamvatsikos, and completed a short time before his death. The book should be required reading for all friends of Mark and for all serious students of earthquake engineering.

According to fellow professor and good friend Ed Maurer, Mark was a gift to Santa Clara University. When he arrived in 2003, he brought with him the highest level of technical competence, a commitment to advancing sustainable technologies while modeling them in his own life, and a passion for the education of students to serve their communities and the world. This alignment of institutional mission and Mark's professional and personal commitment was reflected in everything he accomplished at SCU. He conducted prolific academic research into structural performance under seismic conditions. He was a devoted teacher promoting pedagogical advances and student research. He engaged in public service as a core member of the California Straw Building Association as it drafted revisions to the International Residential Code. He served his department with dedication as chair from 2009 until 2017. It is easy to be in awe of Mark's accomplishments, though it is at least as telling how understated he was about them. He stood firmly where his values placed him, in humble service to others.

Those who got to know Mark found in him a true and faithful friend, a person whom one could rely on implicitly, even through periods with little communication. In addition to what he has taught so many in the field of earthquake engineering, Mark also demonstrated how to recover and learn from adversity, both professionally and personally. During the past two years, Mark taught us all how to bear a long illness with grace, tenacity, insight, and gratitude. In many ways, his illness only deepened his core spirit – his love of family, his curiosity for science, his passion for his work, his generosity to students and colleagues, his engagement with the community, and his sensitivity and loyalty in relationships with others.

Mark is survived by his two daughters, his wife, his two sisters, and many friends who will carry his ideas forward.

This account has been put together with contributions from the following individuals listed alphabetically:

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5 August 2019