



# HELMUT KRAWINKLER

1940–2012

Elected in 2012

*“For development of performance-based earthquake engineering procedures for evaluating and rehabilitating buildings.”*

BY GREGORY G. DEIERLEIN

**H**ELMUT KRAWINKLER, a pioneer in performance-based earthquake engineering and the John A. Blume Professor Emeritus of Engineering at Stanford University, died on April 16, 2012, at the age of 72.

Helmut was born in Innsbruck, Austria, on April 6, 1940, and graduated from Vienna University of Technology in 1964. He was awarded a Fulbright Fellowship to study in the United States, and earned a master’s degree from San Jose State University in 1967 and a doctoral degree from the University of California, Berkeley, in 1971. He joined the faculty at Stanford University in 1973, where he conducted research and taught for more than 39 years, codirected the John A. Blume Earthquake Engineering Center (1985–1995), and directed the Stanford/USGS Institute for Research in Earthquake Engineering Seismology (1988–1998). He “retired” to emeritus status in 2007 and remained active in research, education, and professional activities until his death.

Early in his career, Helmut focused on experimental research, combining his knowledge of structural behavior, earthquake engineering, and design to make fundamental advances in engineering research and practice. His groundbreaking research on the seismic design and nonlinear behavior of steel-framed structures established principles that underlie

modern building code provisions. The “Krawinkler model,” which he developed early to simulate the nonlinear behavior of connections in steel frames, continues to be widely used and cited.

He was among the younger participants in the early US-Japan cooperative research programs on seismic design for steel and reinforced concrete structures, through which he made many lasting friendships with Japanese collaborators. His expertise grew as he made fundamental contributions to experimental methods and the development of major earthquake engineering testing facilities throughout the world.

He embraced and promoted new ideas that were often well ahead of their time. In the early 1990s he pioneered the practical application of nonlinear structural analysis for the seismic assessment and rehabilitation of existing buildings. In true professorial fashion, he wrote a classic paper on nonlinear static analysis, “Pushover Analysis: Why, How, When, and When Not to Use It.” Although he was an early promoter of simplified static analysis as a way to introduce nonlinear analysis into earthquake engineering practice, as the profession became too enamored with the procedure he was soon cautioning against its inappropriate use, advocating instead for more advanced nonlinear dynamic analysis.

After the 1994 Northridge earthquake, Helmut led the building system performance team of a major project, supported by the Federal Emergency Management Agency (FEMA), to investigate the seismic collapse safety of buildings where unexpected fractures occurred to welded connections. During this project, he began a close collaboration with C. Allin Cornell, a well-established expert in seismic risk analysis.

Starting in 1997, Helmut played a key role in establishing the Pacific Earthquake Engineering Research (PEER) Center, supported through the National Science Foundation’s Engineering Research Center program. For the next ten years, he championed the PEER Center’s initiative to develop a new methodology for performance-based earthquake engineering. His keen understanding of structural behavior, design, and earthquake engineering was the perfect complement to Allin’s

deep knowledge of probability and seismic risk analysis. With great respect for one another, their intellectual synergy led to the formalization of PEER's seismic performance assessment framework, which has been embraced by groups around the world and adopted as the basis for national guidelines on performance-based seismic design.

Throughout the 1990s and early 2000s, Helmut published many groundbreaking and influential papers, including reports of three workshops on performance-based earthquake engineering that he coorganized with his longtime friend Peter Fajfar of the University of Ljubljana. The workshops, held at Lake Bled in Slovenia in 1992, 1997, and 2004 as part of the so-called Bled Workshops, engaged researchers from around the world in discussions that helped formulate the research agenda and the basis for performance-based earthquake engineering. At the last Bled workshop, in 2011, Helmut and Peter were honored by the assembled delegates for their visionary contributions. Helmut's keynote address at that workshop, which would turn out to be his last major professional talk, provided a forward-looking view on challenges to improve earthquake resilience through performance-based earthquake engineering.

In 1994, he cofounded a consulting firm with his former student Gregory Luth, and together they pioneered creative new design concepts. Luth described Helmut as the firm's "secret weapon—bringing the state of the art to our office." Among their innovative designs is a rocking shear wall system with replaceable fuses for the School of Cinematic Arts Complex at the University of Southern California. Helmut also served as an advisor on seismic performance assessment for Risk Management Solutions, Inc. and the Applied Technology Council (ATC).

He maintained a close connection to engineering practice through professional committees, consulting, peer reviews, and other activities. Early on he had chaired technical committees of the American Society of Civil Engineers (ASCE) and Structural Engineers Association of California (SEAOC), which provided a vehicle for transferring research into practice.

Helmut's contributions were recognized through many awards, including the ASCE's State-of-the-Art Award, the American Institute of Steel Construction's Special Achievement Award, and the ATC Award of Excellence. He was president of the Consortium of Universities for Research in Earthquake Engineering (1997–1998), and was elected an honorary member (2004) of the Structural Engineers Association of Northern California and the SEAONC College of Fellows (2003). Shortly before his death, he was recognized by three of the highest honors in his profession: the 2012 Earthquake Engineering Research Institute's George Housner Medal, the 2012 ASCE Earnest E. Howard Award, and election to the National Academy of Engineering.

While Helmut made tremendous research and professional contributions, his most enduring legacy may be in educating and inspiring a generation of young structural and earthquake engineers. During his 39-year career at Stanford University, he taught hundreds of undergraduate and graduate students and directed the research of 31 doctoral students, many of whom have gone on to prominent careers in engineering practice and academia. His design courses were legendary, engaging students in broad discussions that straddled the traditional bounds of analysis, design, and behavior. His classes combined the fundamentals of equilibrium free-body diagrams and deflected shapes with state-of-the-art concepts in nonlinear analysis and seismic risk assessment. Even after "retirement," he developed a new course in performance-based earthquake engineering, which he taught to graduate students at Stanford and adapted to a professional course for practicing engineers.

At a memorial service on May 30, 2012, held at Stanford University's Memorial Church, more than 300 family members, colleagues, former students, and friends gathered to remember and celebrate Helmut's life, reminiscing about his zest for life and his infectious enthusiasm. One former student and now consulting faculty at Stanford, Piotr Moncarz, remarked, "Helmut exercised tough and demanding professional standards, and yet he was warm and fun to be with. His students over the years formed a Helmut alumni society. He

had a profound impact on our professional and personal lives. He became a close and admired friend to many of us." The memorial reunion was a heartwarming reminder of the many lives that Helmut touched.

Helmut is survived by his wife Michele, of Los Altos, California; son Marcus and daughter-in-law Julie; grandchildren Alexander and Emily; sister Gretel and brother-in-law Otto; niece Angie; and many cousins in Austria.