Eminent Structural Engineer: Professor James Marshall Kelly

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Brief CV

1935	Born on 25 May 1935.
1956	Graduated in Civil Engineering with First Class Honors from the University of Glasgow, Scotland, 1956.
1956–1957	Assistant Lecturer, Department of Civil Engineering, University of Glasgow
1959	Master of Science, Engineering Mechanics, Brown University, Providence, Rhode Island
1962	Ph.D., Civil Engineering, Stanford University, Palo Alto, California
1962–1963	Post-Doctoral Internship, Division of Engineering Mechanics, Stanford University
1963–1965	Assistant Professor, Division of Engineering Mechanics, Stanford University
1965–1969	Assistant Professor, Department of Civil Engineering, University of California at Berkeley
1969–1973	Associate Professor, Department of Civil Engineering, University of California at Berkeley
1973–1995	Professor, Department of Civil Engineering, University of California at Berkeley
1995–2004	Professor in the Graduate School, Department of Civil Engineering, University of California at Berkeley
2008	Received George W. Housner Medal from the Earthquake Engineering Research Institute

Introduction

Professor James M. Kelly (*Fig. 1*) is probably the most influential figure in the development, design and implementation of modern seismic protection technologies, that is, seismic isolation and supplemental energy dissipation.

Fig. 1: Professor James M. Kelly

Formative Years: From Glasgow to Brown and Stanford

James Kelly was born in 1935 and was raised in Motherwell, Scotland, a small industrial town 20 km south of Glasgow. The industries there at that time were coal-mining, steel and metal alloys. Fortunately, the town had an excellent high school from which many children from working class families were able to go on to university. He finished high school when he had just turned sixteen and was not admitted to Glasgow University being too young. So he worked as an apprentice at a civil engineering consulting firm in Glasgow until being admitted to the 4 year civil engineering program in Fall 1952 which he completed in 1956 with first class honors, the only one in the graduating group of that year to do so. He joined the civil department as an Assistant Lecturer (and Ph.D. candidate) immediately after graduation. A few months into the program he happened to meet another Ph.D. candidate in the department and on learning that he had been a candidate for 7 years began to explore possible graduate programs in the USA, and after applying to a few places was offered a position at Brown University in Providence, Rhode Island. He chose this because at that time he had become interested in the theory of plasticity and Brown was the leading research center for this subject. He started at Brown in Fall Semester 1957 and was amazed at the incredible quality of the teaching there. He spent 2 years at Brown taking a wide range of courses in Applied Mathematics and Mechanics, writing a Master's Thesis on the limit analysis of steel plates which included both theory and experiment. Always intending to return to Scotland after completing a doctoral degree in the USA he felt that spending 4 years in Providence, not at the time the most salubrious surroundings possible, was not a good idea, so he applied to Stanford University and was accepted.

He began his doctoral research with Prof. Wilhelm Flugge of the Division of Engineering Mechanics. At that time Prof. Flugge was becoming interested in viscoelasticity: he later wrote a textbook on the subject, which incorporated material from Prof. Kelly's thesis. The thesis focused on the effects of moving loads on viscoelastic systems, for example beams and pavements, was finished in late 1961 and was awarded distinction at the May graduation in 1962.

While working on his dissertation he was also working part time for a small high-tech company that made high-speed cameras. When the thesis was finished and being reviewed he joined this company full time. The high-speed cameras then were mechanical not electronic, the high speed being provided by spinning mirrors. He worked on the dynamic analysis of the spinning mirrors and also learned to use the cameras and did several projects photographing explosive loading and shock loading on many mechanical systems.

This was just a deviation from his goals. He was offered a fellowship to return to the Division of Engineering Mechanics as a teaching fellow which he took up and began teaching in the division in Fall 1962. The Division of Engineering Mechanics taught only graduate courses for students in the Civil, Mechanical and Aeronautical Engineering Departments and Prof. Kelly was able to teach courses in Engineering Mathematics, Dynamics and Mechanics. At the end of the fellowship year he continued there in the position of Assistant Professor (not a tenure track as the Division had only senior professors). After 2 years in this position at Stanford he was asked to join the Department of Civil Engineering at the University of California at Berkeley where he made the rest of his career and where he is to this day.

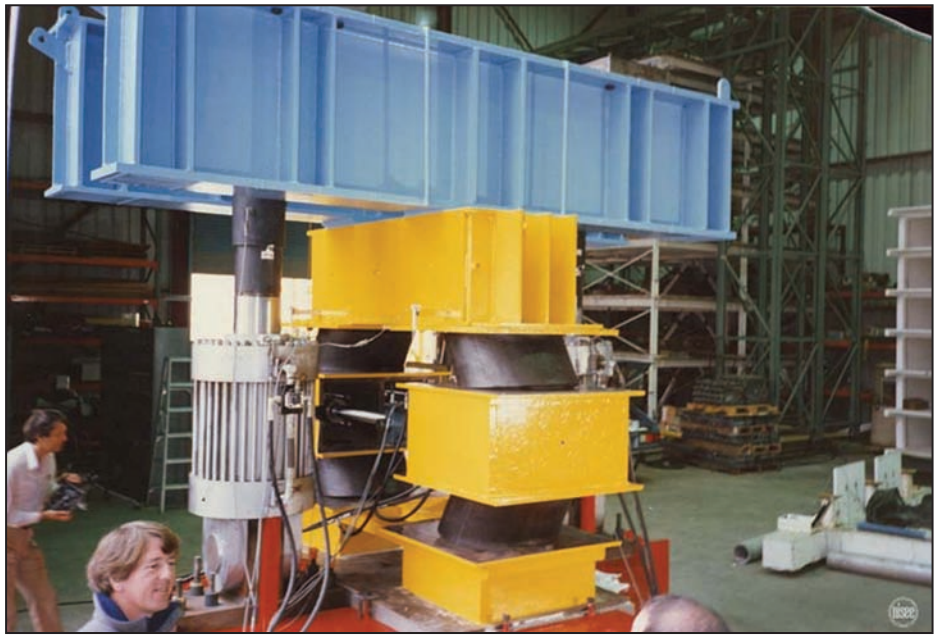

Fig. 2: Testing the behavior in shear of elastomeric bearings under vertical loading at the EERC Laboratory of the University of California, Berkeley at the Richmond Field Station (Photograph: EERC Library Collection)

University of California at Berkeley and Earthquake Engineering Research Center

As a faculty member at the University of California at Berkeley, Professor Kelly led the development of the field of seismic supplemental damping, or energy dissipation. While on sabbatical leave in New Zealand in 1971 to 1972 he developed the first energy dissipating device to be used for earthquake protection of a structure, in this case a large railway viaduct. This device was based on the yielding of mild steel and led to many more applications of steel yielding energy dissipation devices to both buildings and bridges in New Zealand. On returning to the University of California he was responsible for the first US shake table investigations of the response of structures containing energy dissipation devices, and has conducted component and system-level experimental and analytical research on many mechanisms of energy dissipation, including yielding steel, friction, viscoelastic, viscous, shape-memory alloy and electro-rheological systems. He was instrumental in several of the early US energy dissipation applications, consulting on the implementation of viscous dampers for the suspended spans of the Golden Gate Bridge, and for the first major US building damper project, the Santa Clara County Civic Center Building that was retrofit with viscoelastic dampers following the Loma Prieta earthquake.

Professor Kelly pioneered experimental investigations of elastomeric seismic v bearings at the Earthquake Engineering Research Center (EERC) at Berkeley by conducting many shake table testing programs and theoretical studies of seismically isolated structures (*Fig. 2*). In testing hundreds of bearings, he achieved numerous advances, including the application of high-damping rubber for seismic isolation bearings—used in the first US isolated building and in many structures around the world. The first base-isolated building to be built in the USA was the Foothill Communities Law and Justice Center, a legal service center for the County of San Bernardino, California, located about 97 km east of downtown Los Angeles. Professor Kelly has authored and co-authored many papers, research reports and books on the theory of seismic isolation and on the mechanics of multilayer elastomeric isolators, leading to a better understanding of the dynamic and ultimate behavior of elastomeric seismic isolation systems at large deformation.

James Kelly worked to develop seismic isolation for low-cost housing in developing countries as a consultant to the United Nations (UNIDO), and has consulted on projects in Armenia, Chile, China, India, and Indonesia, where isolation has been used in residential construction. He initiated seminal investigations on the seismic behavior of secondary systems that led to the development of methods for protection of equipment from seismic damage by the use of passive and active isolation strategies.

Professor Kelly was the first in the USA to start teaching university-level courses on seismic isolation and energy dissipation, beginning with a graduate course at UC Berkeley in 1991. He has conducted many short courses and seminars on isolation and energy dissipation worldwide.

While being an outstanding scholar, James Kelly served as a consultant to several international seismic isolation projects in Chile, China, Indonesia, Italy, Korea, and Greece; as well as to the International Atomic Energy Agency (IAEA); the EPRI on seismic performance of equipment and piping systems in power plants; the General Electric Co. on seismic isolation of liquid metal fast breeder nuclear power plants; and the Argonne National Laboratory on seismic isolation for nuclear facilities.

Recognition

During his long career, James Kelly received several awards and honors including the George W. Housner Medal (2008) and the Distinguished Lecturer Award (2001) from the Earthquake Engineering Research Institute. He is a Fellow of the American Society of Mechanics (2001), and a Honorary President of the Romanian Association of Earthquake Engineering; where he was awarded the Miller Research

Professorship (1993). Most importantly, to all of us who research and practice earthquake engineering, Professor J. M. Kelly is recognized as the father of seismic protection of structures with modern technologies.

Kelly's work, which formed the basis for significant advances worldwide in the analysis and design of isolation and energy dissipation systems, is the foundation for many of the base isolation design codes used today, including UBC, IBC, and CBC. Seismic isolation has been used for earthquake retrofit/protection of major buildings in the USA including important historic structures such as the city halls of Salt Lake City; Oakland, CA; San Francisco; Los Angeles; and the Hearst Memorial Mining Building, Berkeley, CA, for which he was a consultant. Professor Kelly's pioneering efforts have established seismic isolation and energy dissipation as important methods for earthquake protection. Various forms have been used in more than 1000 major structures worldwide.

Inspiration

Professor Kelly, well recognized as an outstanding teacher and lecturer, has directed over thirty doctoral students in their Ph.D. thesis research, who have gone on to become noted practitioners, university professors and researchers worldwide. Many Fulbright Visiting Scholars have come to Berkeley to work with him; his students and visitors (and their students) have spread worldwide his creative and innovative work on seismic protection of structures.

Publications

Professor Kelly has published more than 360 journal articles, reports and papers in conference proceedings together with four books,[1–4] which summarize his life-long contribution to the seismic protection of structures with modern technologies.

Acknowledgements

The assistance of Mr. Charles D. James, Librarian of PEER, who made available the photograph in *Fig. 2* is appreciated.

References

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