



### **Professor Alexander C. Scordelis (1923 – 2007)**

IN MEMORIAM Alexander C. Scordelis 1923 - 2007

Byron L. and Elvira E. Nishkian Professor of Structural Engineering, Emeritus, UC Berkeley

Alexander C. Scordelis, distinguished structural engineer, researcher and teacher, died in Berkeley on August 27, 2007, at the age of 83, following a long illness.

Alex was born in San Francisco, California, on September 27, 1923, the youngest of three children of Greek immigrants who owned a grocery store in the Marina district. He attended San Francisco public schools, graduated from Galileo High School at the age of 16 and entered the University of California, Berkeley, to study civil engineering. As a member of the ROTC Corps of Engineers, he was called to active duty to serve in World War II as an officer in the 309th Engineer Combat Battalion of the 84th Infantry Division in the European Theater of Operations (ETO). His unit fought in the Battle of the Bulge, and he was awarded the Bronze Star, Commendation Ribbon, the European Theatre Ribbon with three battlestars for his meritorious achievement, and a Purple Heart for wounds sustained in combat. His unit was among the troops that liberated concentration camps at the close of the war. He was then separated from active duty with the rank of captain, continuing in the Army Reserve for a number of years before retiring with the rank of major. The experience gained during the war at a young age accelerated the development of leadership skills that became evident in his later life.

Following his separation from the Army he returned to UC Berkeley, completing his bachelor's degree in civil engineering in 1948. A year later he earned his master's degree in civil engineering at the Massachusetts Institute of Technology.

Alex returned to Berkeley as instructor in civil engineering in 1949, beginning a distinguished faculty career of 41 years in the Department of Civil Engineering. He was promoted to assistant professor in 1951, associate professor in 1957 and professor in 1962. In 1987 he was named Byron L. and Elvira E. Nishkian Professor of Structural Engineering, a title he held until retirement in 1990.

Recognized by his colleagues as an inspirational and effective leader, Alex was called upon to serve in academic administrative positions on a number of occasions. He was assistant dean in the College of Engineering from 1962 to 1965 with responsibility for international programs. He later served as vice chairman, Division of Structural Engineering and Structural Mechanics, in the Department of Civil Engineering from 1970 to 1973 and as acting chairman of the department in 1981.

Alex Scordelis was a consummate teacher. He taught undergraduate and graduate courses in the analysis and design of structures, and his class notes on structural analysis that were accompanied by ingenious examination problems with elegant solutions became a favorite reference of students and instructors worldwide. He was known for his Socratic teaching style, engaging students in the subject matter by calling on them to answer questions, thus developing an attitude of critical thinking about the behavior of structures. Many of his students went on to notable careers in academia and professional practice.

Over a productive career spanning more than 40 years, Alex Scordelis' research and consulting made significant contributions to the analysis and design of long-span shell roofs, reinforced and prestressed concrete structures, and all types of bridges.

Early research studies in the late 1950s and early 1960s dealt with the behavior and analysis of prestressed concrete structures, which were relatively new in the Western Hemisphere in the 1950s. These studies initiated a close collaboration with Professor T. Y. Lin that was to last a lifetime and produced insightful research studies and several outstanding structures all over the world.

Inspired by the development of the finite element method for the computer analysis of structures in the late 1950s and its rapid evolution in Berkeley in the early 1960s, Alex Scordelis embarked on the development of suitable finite element analysis procedures for reinforced and prestressed concrete structures. Starting with the first landmark paper on the analysis of cracking in reinforced concrete beams in 1967, and continuing until his retirement in 1990, Alex developed computer analysis procedures for long-span shell roofs and prestressed concrete bridges. He also studied the behavior of box-girder bridges with large-scale experiments that set the standard for this type of investigation for many years to come. This intense research activity with graduate students and visiting scholars from around the world resulted in over 150 technical papers and influenced the design and analysis of all types of structures, from long-span roofs and bridges to nuclear containment structures and offshore platforms.

With this work Alex became recognized around the world as a foremost authority on the analysis of reinforced and prestressed concrete structures and was asked to serve as consultant in several noteworthy projects. Among these were the first concrete offshore platform in the Norwegian Sea and several spectacular reinforced or

prestressed concrete shell roofs, such as the 400-foot span elliptical paraboloid roof for the Oklahoma State Fair Arena, the 380-foot span circular paraboloid roof for the Arizona State Fairgrounds Coliseum in Phoenix, the 260-foot diameter inverted dome for the Garden State Art Center in New Jersey, the 140-foot-high hyperbolic paraboloid roof of St. Mary's Cathedral in San Francisco, and the 314-foot span prestressed cable net roof structure for the San Juan Coliseum in San Juan, Puerto Rico. He also served as consultant to several state and federal agencies. Noteworthy is his service for many years on the Seismic Advisory Board of the California Department of Transportation, on the Golden Gate Bridge Seismic Instrumentation Advisory Panel, and on the Governor's Board of Inquiry following the 1989 Loma Prieta Earthquake, which in 1990 issued its landmark report "Competing Against Time" on the earthquake risk assessment of California highway structures.

The contributions of Professor Scordelis to the research base for the practice of structural engineering, and his recognized international stature as a consulting engineer, have been recognized by many honors and awards. He was elected to the National Academy of Engineering in 1978 with the citation "for pioneering the development and application of advanced structural analysis to the design of record-breaking and unique structural systems." He was an honorary member of the American Society of Civil Engineers (ASCE), a fellow of the American Concrete Institute and an honorary member of the International Association for Shell and Spatial Structures (IASS).

Among his many awards are preeminent international recognitions: The Torroja Medal from IASS and the Freyssinet Medal of the International Federation for Prestressed Concrete. He was a winner of the Howard Award and a three-time winner of the Moisseiff Award of the ASCE for research papers.

Upon retirement he received the Berkeley Citation and the Berkeley Engineering Alumni Society Distinguished Engineering Alumnus Award.

Alex is survived by his wife of 59 years, Georgia; son Byron Scordelis and daughter-in-law Stephanie of Saratoga; daughter Karen Holtermann and son-in-law Robert of Berkeley; and four grandchildren, Marisa, Alexander and Stephen Scordelis and Wesley Holtermann.

----- Karl S. Pister, Filip C. Filippou, Edward L. Wilson

### **Another biography by Kasper Willam, University of Colorado at Boulder:**

#### **Three Computational Milestones:**

1. Scordelis, A.C. and Lo, K.S.: Computer analysis of cylindrical shells ACI Journal, 61, 1964, 539-562.
2. Scordelis, A.C. and Ngo, De: Finite element analysis of reinforced concrete beams, ACI Journal 64, 1967, 152-163.
3. Scordelis, A.C., Nilson, A.H. and Gerstle, K.: Finite Element Analysis of Reinforced Concrete, ASCE State-of-the Art Report, New York, 1982.

Early Finite Element/Finite Strip/Layered Frame Dissertations:

K.S. Lo [1964], Abu Gazaleh [1965], Art Nilson [1967], Larry Selna [1967], Kaspar Willam [1969], Andy Franklin [1970], Christian Meyer [1970], W. Knudsen [1972], C.S. Lin [1973], De Ngo [1975], A.F. Kabir [1976], Y.J. Kang [1977], Günter Müller [1977], Frieder Seible [1982], Mark Ketchum [1986], et al.

## ALEXANDER C. SCORDELIS BIOGRAPHICAL SUMMARY



Alexander C. Scordelis is the Bryon L. and Elvira E. Nishkian Professor Emeritus of Structural Engineering at the University of California at Berkeley, where he has been a member of the faculty since 1949. He has taught a large number of undergraduate and graduate courses in analysis and design of structures.

He has been actively engaged in research in a variety of fields throughout his career, including analytical and experimental investigations of reinforced and prestressed concrete beams, slabs, folded plates, and thin shell and bridge structures. The major

research contributions of Professor Scordelis have been on three principal topics: concrete thin shells, box girder bridges, and the nonlinear finite element analysis of reinforced and prestressed systems.

For concrete thin shells during the 1950s and the 1960s, he developed linear methods of analysis that could be utilized effectively with digital computers to analyze shell structures of all shapes and types. In recent years he has extended this work, using nonlinear finite element analysis to simulate the structural response of arbitrary reinforced concrete shell structures through their elastic, cracking, inelastic, and ultimate loads ranges, taking into account nonlinear materials, geometry, and the time-dependent effects of creep and shrinkage.

For many years he has conducted a continuing research program on concrete box girder bridges to study successively straight, simple, and continuous bridges, curved bridges, and skew bridges. Results of this research have been used widely in the United States and abroad. This work was then, and is now, being extended to prestressed concrete segmental box girder bridges and cable-stayed bridges. In these studies, the effects of prestressing, sequence of construction, and time-dependent effects are included in the analytical procedure.

He also has conducted a continuing research program on the finite element analysis of reinforced and prestressed concrete structures. His original papers on this subject in 1967 were the first to open up this new area of research, which is now being studied by researchers throughout the world. Results of research in

this field of study have been used in the analysis and design of bridges, buildings, nuclear containment structures, and offshore platforms.

Professor Scordelis has always had interest in applying the results of his research to practical engineering problems. During the past 40 years, he has been a consultant to various structural engineering firms and governmental agencies on more than forty major projects involving shell structures, bridge structures, reinforced and prestressed concrete structures, and computer solutions for complex structural systems.

Professor Scordelis is an Honorary Member of the American Society of Civil Engineers and a Fellow of the American Concrete Institute. He is an Honorary Member of the Association for Shell and Spatial Structures. He is also a member of the Structural Engineers Association of Northern California and the American Segmental Bridge Institute. He is a registered Civil Engineer in the State of California.

He has received many awards, including the ASCE Moissieff Award three times, in 1976, 1981, and 1992; the Western Electric Award for Excellence in Engineering Teaching in 1978; the Best Paper Award from the Canadian Society of Civil Engineers in 1982; the K. B. Woods Award of the Transportation Research Board, National Academy of Sciences in 1982; the ASCE Howard Award in 1989; and the University of California "Berkeley Citation" in 1990. In 1987 he was awarded the Bryon L. and Elvira E. Nishkian Chair as Professor of Structural Engineering, and in 1989 he was appointed by Governor Deukmejian to the Governor's Board of Inquiry on the 1989 Loma Prieta Earthquake. He is a Member of the Caltrans Seismic Advisory Board and the Chairman of the Golden Gate Bridge Seismic Instrumentation Advisory Panel. In 1994 he was appointed to the Blue Ribbon Panel for the review of the structural evaluation of the Kingdome in Seattle.

He was elected into the National Academy of Engineering in 1978 with a citation for "pioneering the development and application of advanced structural analysis to the design of record breaking and unique structural systems." In 1993 he received the highest honor of the ASBI, the Leadership Award, for "outstanding contributions in research and computer program development for analysis of segmental concrete bridges." In 1993 he received the Berkeley Engineering Alumni Society Distinguished Engineering Alumnus Award, which stated: "...who by his contributions to elegant structures and devotion to educating generations of Berkeley engineers has brought distinction to the College of Engineering and its alumni." In 1994 he received the highest honor, awarded only every three or four years, by two separate international organizations: first from IASS, the Torroja Medal, "for his contributions to the analysis and design of thin shell concrete structures"; and second from FIP, the Freyssinet Medal, "for his contribution in prestressed concrete structures."