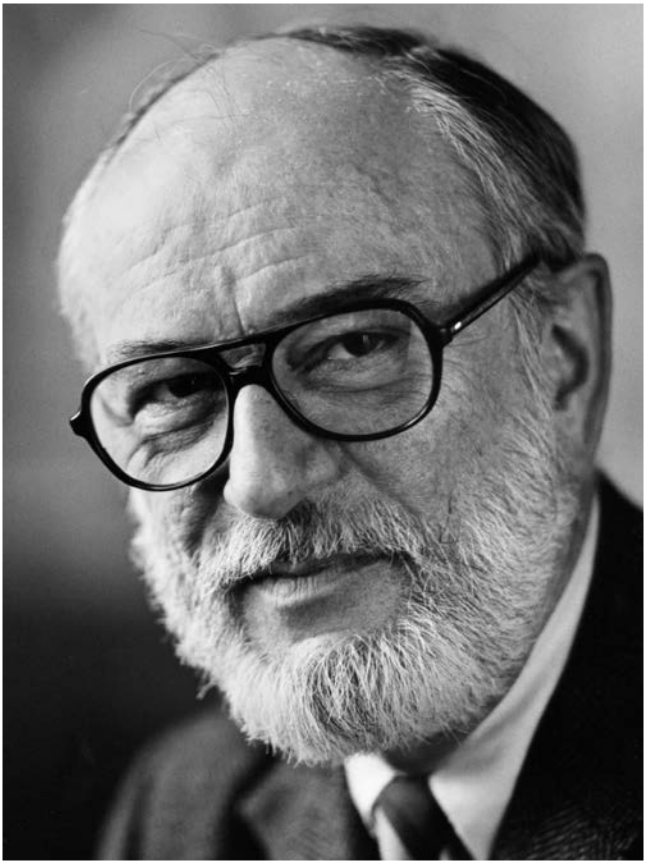

WILLIAM J. LeMESSURIER

1926–2007

Elected in 1978

"Teaching, research, and practice of structural design for buildings, with special concern for the relationship of structures to total architecture."

BY RICHARD A. HENIGE, JR.
SUBMITTED BY THE NAE HOME SECRETARY

WILLIAM JAMES LeMESSURIER, innovative structural engineer, died at age 81 on June 14, 2007, in Casco, Maine.

Bill, as he was known to family, friends, and colleagues, was born June 12, 1926, in Pontiac, Michigan, to William James LeMessurier, Sr., who owned a dry cleaning business, and the former Bertha Sherman, a homemaker. The youngest of four children, he attended the Cranbrook School for Boys (whose campus was designed by Finnish architect Eliel Saarinen) in Bloomfield Hills, where he showed an early aptitude in mathematics, music, and the arts.

For his undergraduate education, Bill decided to attend Harvard College instead of the Massachusetts Institute of Technology (MIT), largely because of Harvard's more inviting campus. He received his bachelor's degree in mathematics in 1947, then studied architecture at Harvard's Graduate School of Design (GSD) before transferring to MIT's Department of Building Engineering and Construction to study structural engineering.

At MIT he worked part-time for Albert Goldberg, an established structural engineer in Boston. After receiving his master's degree in 1953, he worked full-time for Mr. Goldberg and became a partner in Goldberg, LeMessurier Associates in the mid-1950s. In April 1961 he left to establish LeMessurier

Associates with new partners William Thoen, Emil Hervol, and James Collins. He retired in 1995.

Throughout his career Bill pioneered the use of innovative structural systems that efficiently resisted gravity, wind, and earthquake loads while respecting the aesthetic concerns of his architectural clients. In 1962 he worked with architects Gerhard Kallmann and Michael McKinnell on the design of Boston City Hall, where exposed concrete beams, columns, and walls are a prominent feature of the architectural design. In 1970 he again worked with Kallmann and McKinnell as well as Henry Wood on the design of an athletic facility for Phillips Exeter Academy in New Hampshire. For this building, the structural system featured external three-dimensional trusses that efficiently supported the roof without the visual distraction of internal trusses.

Bill developed an especially close professional relationship with architect Hugh Stubbins of Cambridge, Massachusetts, collaborating most notably on the design of Citicorp Center in New York, the Federal Reserve Bank of Boston, the Singapore Treasury Building, and the Yokohama Landmark Tower, the second-tallest building in Japan.

In the 235-meter-tall Singapore Treasury Building, 1.47-meter-deep steel plate girders cantilever 12.2 meters out from cylindrical concrete shear walls to support column-free office space. The concrete walls are the only vertical structural elements of the building, providing support for both gravity and lateral loads.

The 920-foot-tall Citicorp Center tower may be the building of which Bill was most proud. The building site presented a unique design challenge in that one corner was reserved for construction of St. Peter's Church. Hugh Stubbins' architectural response to this constraint was to elevate the base of the tower 10 floors above the plaza level. Bill's structural response was to locate structural steel "mast" columns at the center of the four sides of the tower. Eight-story-tall diagonal braces at the perimeter of the building transfer gravity and wind loads to these four columns.

Although Citicorp Center's perimeter braced frames provide a very efficient and stiff system for resisting wind loads, Bill's experience during a peer review of the John Hancock tower in Boston (designed by others) led him to believe that lateral accelerations at upper floors of the building could be disturbing to building occupants. Subsequent wind tunnel tests performed under the supervision of Alan Davenport at the University of Western Ontario Boundary Layer Wind Tunnel Laboratory confirmed that wind accelerations would likely be 60 percent greater than generally accepted comfort criteria, primarily because the building was so much taller than its neighbors.

Since wind accelerations are inversely proportional to the square root of the product of building mass, stiffness, and damping, Bill realized that this problem could be mitigated by increasing mass, stiffness, or damping by 160 percent. But the cost of doing so was prohibitive, so Bill instead proposed the use of a large tuned mass damper (TMD), which was designed with the assistance of David Wormley of MIT's Department of Mechanical Engineering and Niels Peterson of MTS Systems in Minneapolis. The TMD—a 400-ton block of concrete located at the upper mechanical floor of the building, supported by pressurized oil slide bearings and connected to the building by nitrogen gas-filled springs—reduced wind accelerations by 38 percent. Thanks to this effectiveness, TMDs have since been used by other engineers in many tall buildings throughout the world.

Bill is perhaps most widely known and admired for his ethical response to a flaw he discovered in connection details for diagonal braces in the Citicorp Center tower after construction was completed.

While preparing a lecture about the building for a course he was teaching at Harvard's GSD, he received a call from an engineering student in New Jersey whose professor had questioned the location of the perimeter columns, specifically for wind loads applied at a 45-degree angle. Bill had studied this problem earlier and realized that simultaneous application of wind loads from both orthogonal directions did not change overturning forces in the columns, but did increase forces in diagonal braces by 41 percent. Since the design of perimeter-braced frames was governed by stiffness control and not wind forces, this increase did not affect the size of the diagonal braces. However, Bill recalled that the steel fabricator had requested the use of bolted connections instead of full-penetration welded connections for splices in the diagonal braces. When Bill discovered that increased wind forces had not been considered during shop drawing review of the revised diagonal brace connections, he decided that the brace connections should be reinforced to reduce the risk to public safety—even though the New York City building code and the three national building codes in effect at the time did not require design for simultaneous application of wind from two orthogonal directions.

Bill was also a highly regarded educator, lecturing at MIT's Department of Civil Engineering, several Structures Congresses of the American Society of Civil Engineers (ASCE), and many major engineering schools. He was appointed adjunct professor at Harvard's Graduate School of Design in 1982.

His research interests included structural optimization and column stability. He was one of the pioneers in applying virtual work optimization techniques to reduce material quantities in structures. He wrote two highly cited papers on the stability of steel frames. He was also one of the inventors of the staggered-truss system for high-rise hotel and residential buildings.

Bill was a fellow of the American Concrete Institute and ASCE, and in 1961 he was appointed to the American Institute of Steel Construction (AISC) Committee on Specifications, the body responsible for publishing the design specification for structural steel buildings in the United States.

In addition to his election to the National Academy of Engineering in 1978, he was elected an honorary member of the American Institute of Architects in 1988 and ASCE in 1989. In 2004 he was made a national honor member of Chi Epsilon.

He received the Allied Professions Medal from the American Institute of Architects in 1968; ASCE's George Winter Award in 1993, Shortridge Hardesty Award in 1995, and President's Medal in 1996; and the AISC J. Lloyd Kimbrough Award in 1999. He also received honorary doctor of engineering degrees from Rensselaer Polytechnic Institute in 1998 and the University of Massachusetts Dartmouth in 2002.

Bill is survived by his wife Dorothy (née Judd), daughters Claire and Irene, son Peter (BS mech eng from MIT, 1984), and seven grandchildren (Amy, BS neurobiology from MIT, 2010).