

OBITUARY

ROBERT V. WHITMAN 1928-2012

ROBERT V. WHITMAN, Professor Emeritus of Civil and Environmental Engineering at the Massachusetts Institute of Technology (MIT), died of Parkinson's disease on February 25, 2012, at his home in Lexington, Massachusetts at age 84. He was world-renowned for his expertise and leadership in soil dynamics and geotechnical earthquake engineering, as an engineering educator, and for his dedication to public service.

Bob Whitman was born of academic parents on February 2, 1928, and raised in a small town near Pittsburgh, PA. After earning a BS degree (1948) in civil engineering from Swarthmore College, Bob attended MIT for his graduate studies in civil engineering, first in hydraulics and structural engineering (SM 1949), completing his doctorate (ScD) in structural dynamics in 1951. He joined Professor Donald Taylor's geotechnical group as a Research Associate/Engineer and was appointed as an Assistant Professor of Civil Engineering in 1953. Apart from two years serving as an officer in the US Navy Civil Engineer Corps (1954-1956), Bob remained on the MIT faculty for the next 40 years, retiring as Professor Emeritus in 1993.



Whitman's initial work with Taylor dealt with the effects of nuclear blasts on underground structures and marked the beginning of an illustrious career in the new discipline of soil dynamics. This included service on Air Force advisory panels for the design of hardened missile complexes and stable foundations for long-range radar stations. His research then expanded to the general problem of designing foundations with vibrating loads. Two ASCE papers co-authored with the late F.E. (Bill) Richart, Jr. in 1967, which treated the problem as a dynamically-loaded rigid disk resting upon an elastic half-space, represented a fundamental breakthrough in the understanding of foundation dynamics. Bob became one of the pioneers and leading experts in the area and generations of MIT students benefited from extensive drafts of his book on soil dynamics.

The devastating 1964 earthquakes in Alaska and Niigata, Japan, stimulated research on the effects of ground shaking on soil liquefaction and the associated damage to buildings and related infrastructure. Bob's initial technical contributions to this new discipline of geotechnical earthquake engineering included developing the analytical method that was adopted for the well known and still widely used Newmark "sliding-block analysis" to estimate the movement of earth slopes during earthquakes. He then went on to: independently develop a method similar to the "Seed-Idriss Simplified Procedure" to predict the potential for soil liquefaction based on using in situ tests for assessing the sand's resistance to shaking; draw the first national earthquake hazard maps utilizing probabilistic predictions developed by the U.S. Geological Survey (USGS); and draft the 1985 National Research Council (NRC) report *Liquefaction of Soils During Earthquakes* that still serves as a general guide for earthquake liquefaction analyses. Bob also served for five years as chair of ASCE's Technical Council on Lifeline Earthquake Engineering and received its C. Martin Duke Award (1992).

During Whitman's transition period between soil dynamics and earthquake engineering, he co-authored with MIT colleague Professor T. William (Bill) Lambe the classic textbook *Soil Mechanics* (1969). It had a unique organization developed by Bob with three principal parts treating: dry soil, wet soil with steady state flow, and wet soil with transient flow (e.g., consolidation). Of Bob's many accomplishments, he was "probably proudest of that book", which many believe provides even today the best reference for teaching and learning the fundamental principles of soil mechanics.

Bob pioneered the application of probability-based risk analyses to earthquake engineering by considering the uncertainties in both the occurrence and magnitude of earthquakes and in the resulting damage as a function of building type and local soil conditions. This approach was initiated in cooperation with Bob's MIT colleague, the late C. Allin Cornell, who had unique expertise in using stochastic models to represent earthquake loadings on and damage to buildings. Together, they developed "damage probability matrices" that ingeniously integrated the likelihood of occurrence of seismic events and the resulting levels of damage to different types of buildings. This new seismic-design decision-analysis framework enabled rational risk assessments to mitigate the damage. This approach formed the basis for new seismic provisions in building codes, the first outside California being the 1975 Massachusetts code headed by Bob,

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and eventually led to the current probability-based design practice. Awards recognizing this work include Bob's election to the National Academy of Engineering in 1975. Bob was one of the brightest stars in the Earthquake Engineering Research Institute (EERI), which was established in 1948 by the late George W. Housner and several others to promote earthquake engineering and now has some 3000 members. He was the only person, other than Housner, to have been EERI's President (1985-87), Distinguished Lecturer (1994), Honorary Member (1997) and Housner Medal recipient (2010). Bob used his term as President to further promote a *nationally applicable*, standardized methodology for estimating losses from earthquakes because prior work had been largely confined to California. He chaired the NRC panel that prepared the 1989 report *Estimating Losses from Future Earthquakes*, which laid the groundwork for the new loss methodology structure. Bob then led the committee that oversaw the development of the computer-based software program called HAZUS Earthquake. This program, funded by U.S. Federal Emergency Management Agency (FEMA), was intended to guide governmental agencies in both earthquake mitigation (i.e., seismic provisions in building codes) and in disaster response planning, but was soon also adopted in engineering practice. The program calculates the seismic hazard, evaluates the likely damage to buildings and other infrastructure facilities, and estimates both direct and indirect losses resulting from this damage. Bob's technical and policy contributions played a key role in developing HAZUS, which has now been expanded by FEMA to also include floods and hurricanes.

Bob Whitman made numerous other significant contributions to geotechnical engineering including development of one of the first computer programs for slope stability analyses; pioneering the application of probabilistic concepts for risk analysis in geotechnical engineering (Karl Terzaghi Lecture, 1981); and leadership in establishing centrifuge testing facilities in the U.S. for geotechnical research. His other honors included: the ASCE Karl Terzaghi Award (1987) for contributions to geotechnical engineering, the ASCE Croes Medal (1994) recognizing an outstanding paper from all civil engineering disciplines, and the ASCE Seed Medal (2007) for contributions to geotechnical earthquake engineering; and an Honorary Doctorate from his alma mater, Swarthmore College (1990).

Bob Whitman was widely admired for his leadership and commitment to public service. His brilliant analytical and insightful mind enabled him to identify key issues, express them clearly and then present viable solutions to problems ranging from the highly technical to largely political. Bob's leadership at the national level included over 40 years of near-continuous service on committees, advisory boards and panels-workshops for numerous high level governmental, research and defense agencies, in addition to the EERI and ASCE roles cited above. At MIT, he served as head of the geotechnical and structural groups and was well known for his role as parliamentarian at Institute faculty meetings, especially during the Vietnam War-era student uprisings. And for his hometown of Lexington, MA, Bob spent countless evenings over four decades as an elected member of the annual Town Meetings and as Chairman of either the Zoning Board of Appeals or the Permanent Building Committee. When once asked why he engaged in so many activities, Bob replied: "they were interesting challenges and I couldn't stay away from them".

Bob was also a very modest and private individual. Few knew the full extent of his activities and contributions. However, the faculty and alumni fondly remember Bob and Betsy Whitman's gracious hospitality and warmth in hosting annual parties for the geotechnical group and their generosity in welcoming new students to share holiday meals.

In addition to his wife of 57 years, Elizabeth (Betsy) née Cushman, Bob is survived by two daughters, Jill and Gwen, and four grandchildren.

This obituary was edited for ISSMGE from an original prepared by Charles C. Ladd for the U.S. National Academy of Engineering.

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Cambridge, Mass.
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