News of the Profession

The Fifth Mallet–Milne Lecture Professor Bruce A. Bolt
From Earthquake Acceleration to Seismic Displacement

The Fifth Mallet-Milne Lecture will be presented Wednesday May 24, 1995 at 5:00 pm at the Institute of Civil Engineers, 1-7 Great George Street, London. This year's honored presenter is Professor Bruce A. Bolt. Professor Bolt gained his BSc, MSc and PhD at the University of Sydney, Australia. He has been Professor of Seismology at the Department of Geology and Geophysics since 1963 (Professor Emeritus from 1993), and at the Department of Civil Engineering, University of California at Berkeley from 1988 to 1992. He was Commissioner on the Seismic Safety Commission, California, from 1978 to 1993 (Chairman 1984-86). He is currently in the Advisory Committee on the International Decade for Natural Hazards Reduction, National Research Council, as well as being Chair, Academic Senate, University of Berkeley.

Abstract

A primary goal of both Mallet and Milne was to explain the great variation in damage to structures in the same earthquake. Their primary approach was that, through the close examination of the observed intensity, the damage pattern could be understood and, hence, resistant designs developed. Real progress began with the deployment of strong motion seismographs in the 1930s. An impressive edifice of engineering codes grew from the correlation of damage and measured ground motions in modern earthquakes, with the 1940 El Centro accelerograms adopted as the free field touchstone. Unfortunately, a dichotomy between seismological and engineering studies developed and has persisted. As the measured horizontal accelerations of the seismic ground motions have been found to range up to and even exceed gravity, the crucial question arose, and has not been answered, as to why many structures resist structural damage when building codes are based on a lower intensity of shaking.

The present design analysis concentrates on scaling input motions to peak ground acceleration; both amplitude response spectra and accelerograms ("time histories") are used for response estimation of important structures. This approach is now being re-examined and significantly modified. Assessment of non-linear structural deformation requires also computation of the complementary phase response spectra for input seismic motions. Attenuation relations, largely limited in the past to peak ground acceleration, have become frequency dependent and work has started on estimation of seismologically defined duration and ground displacements. The stimulation is the engineering demand for design of base isolation systems and multi-supported structures in which the incoherency of wave motion and the time variation of strain at long periods is important.

The 1989 Loma Prieta and 1994 Northridge, California and other recent earthquakes, have provided not only free field accelerograms but records of building response. The resulting spatiotemporal correlations allow for joint application of seismology and engineering in the spirit of Mallet and Milne. The structural motions, predicted from code procedures, can now be compared with the actual behaviour. Further, the history of cracking and other non-linear degradations can be followed in the structural records - by those with a combined skill in structural engineering and seismology.

This promising situation makes mandatory a close integration of strong motion seismology and structural and geotechnical engineering in university education if the full value of structural response recordings in future earthquakes is to be gained and transferred into codes and dynamic analysis procedures. The content of courses in earthquake engineering must be rethought.

Learning From Earthquakes

Colombia Hit by M 6.5 Quake

A magnitude 6.5 earthquake struck near the town of Turamena, Colombia on January 19, 1995. As of the date of publication of the newsletter (Jan. 23) there have been no reports of damage in the area, which is scarcely populated. In Bogota, a man was killed by a section of facade falling from the seventh story of a building under construction. No other deaths or injuries have been reported. Bogota is about 150 miles northwest of Turamena. EERI members William E. Gates and Luis E. Garcia will be inspecting industrial facilities in the area of Turamena next week and write a report on the earthquake for the EERI newsletter.