

## The 16<sup>th</sup> Mallet-Milne Lecture

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The biennial Mallet–Milne Lecture is organised by the UK Society of Earthquake and Civil Engineering Dynamics (SECED) in memory of Robert Mallet (1810–1881) and John Milne (1850– 1913), 19th century British pioneers of seismology. SECED was founded in 1969 to promote the study and practice of earthquake engineering and structural dynamics in the UK. It provides a bridge between academics and practitioners interested in these fields from a multitude of disciplinary backgrounds, providing a forum for discussion and knowledge exchange. The Mallet-Milne lecture series has been running for 30 years and is one of the means of celebrating UK and international scientists and engineers that have provided a significant contribution to seismology and earthquake engineering through their careers' work. The Mallet-Milne lectures serve as a reminder of how rapidly knowledge on earthquakes and their mitigation has evolved, and by drawing on the life experience and achievements of the eminent Mallet-Milne speakers, they demonstrate how much can be achieved by individuals, providing inspiration to new generations.

Past Mallet-Milne lectures have covered areas of seismology and seismic hazard assessment, ground, structure and infrastructure response to earthquakes, and the societal and economic effects and consequences of major seismic effects.

The inaugural Mallet-Milne lecture was given in 1987 by Professor Nicholas Ambraseys and was entitled 'Engineering Seismology'. This lecture described a new approach to the assessment of liquefaction potential and re-evaluation of twentieth century seismicity in Turkey. In the lecture Professor Ambraseys also emphasised the importance of field observations and measurements to provide data for proper earthquake risk management. These principles had led to the formation in 1982 of the UK Earthquake Engineering Field Investigation Team (EEFIT), which founding members included two future Mallet-Milne lecturers: Professor Robin Spence and Edmund Booth.

Areas of seismology and seismic hazard were addressed in four further Mallet-Milne lectures. The fifth Mallet–Milne lecture 'From Earthquake Acceleration to Seismic Displacement' by Professor Bruce Bolt of the University of California at Berkeley, discussed the destructive nature of near-field ground motions containing high energy pulses. The eighth Mallet–Milne lecture 'Living with Earthquakes: Know Your Faults', was presented by Professor James Jackson of Cambridge University who addressed the identification and characterisation of active geological faults. Professor Jackson illustrated the advances made in the determination of source parameters for earthquakes, in the understanding of the relationship between crustal deformations and geomorphology and in the developments of technology for measuring the deformation of the earth's surface. The thirteenth lecture in the series, saw Lloyd Cluff of the Pacific Gas and Electric Company, California, present on 'The Practice of Earthquake Geology: Career-Changing Events and Life Stories'. In his lecture Dr Cluff related a lifetime of field reconnaissance studies and of developing seismic hazard techniques and risk assessments for critical facilities around the world. Finally, in the fourteenth Mallet–Milne lecture in 2013, Dr Roger Musson of the British Geological Survey presented an overview of the contribution of British seismologists and engineers to the study of earthquakes in 'A History of British Seismology'. The presentation was the culmination of extensive research by Dr Musson on the topic, and was presented underplaying his own very significant contribution to British seismology.

To appropriately account for the effects of earthquakes on the built environment, it is important to identify local ground response, foundation behaviour and the potential for soil-structure interaction. These were the topics of two Mallet–Milne lectures. In the seventh Mallet–Milne lecture, 'The Road to Total Earthquake Safety', Professor Cinna Lomnitz of the National Autonomous University of Mexico addressed the dynamics of seismic wave propagation, the response of soft soils and the coupling of ground response with structural response. The tenth lecture in the series saw W.D Liam Finn, Anabuki Professor of Foundation Geodynamics

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at Kagawa University, Japan, present more specifically on the design of piled foundations with his lecture of title 'A Study of Piles during Earthquakes: Issues of Design and Analysis'.

Structural aspects of earthquake engineering have been addressed by four Mallet-Milne lectures. Professor Geoffrey Warburton of Nottingham University presented on 'Reduction of Vibrations' in the third Mallet-Milne lecture. Professor Warburton illustrated how seismic actions on structures can be mitigated by engineering intervention through the application of dampers, base isolation and active control. The fourth Mallet-Milne lecture entitled 'Simplicity and Confidence in Seismic Design' was delivered by Professor Tom Paulay of the University of Canterbury, New Zealand. He used his extensive design experience to address the concepts that can be employed to ensure the predictable seismic response of reinforced concrete buildings. The issue of predicted versus actual behaviour of buildings was revisited by Professor Roy Severn of the University of Bristol, in the sixth Mallet-Milne lecture entitled 'Structural Response Prediction Using Experimental Data'. This series of discussions was concluded in the sixth Mallet-Milne lecture by Professor Nigel Priestley of the University of California at San Diego. His lecture on 'Revisiting Myths and Fallacies in Earthquake Engineering' re-examined the fundamental principles of seismic design of structures, and introduced concepts of displacement-based design as a means of better achieving the desired seismic performance of buildings.

Earthquake engineering should meet the needs of society and be implemented for the reduction of seismic risk. Four Mallet-Milne lecturers have presented a holistic view of the earthquake effects on society and the economy, presenting their experiences in contributing to the effort of disaster risk reduction. Professor George Housner of the California Institute of Technology, and second Mallet-Milne lecturer presented on the challenges and perspectives of the International Decade for Natural Disaster Reduction in his lecture 'Coping With Natural Disasters'. Professor Housner highlighted the need for improved communication of risks including information exchange, warning systems and education programmes. These recommendations were echoed in the eleventh Mallet-Milne lecture, 'Saving Lives in Earthquakes: Successes and Failures in Seismic Protection from 1960', by Professor Robin Spence of Cambridge University. Professor Spence presented an overview of how earthquake casualties, disruption and costs have changed in the 50 years prior to the lecture, highlighting how implementation of seismic codes and other mitigation actions have helped reduce seismic risk in some societies but much still has to be done. The importance of seismic risk reduction was strongly emphasised in the Mallet-Milne lecture 'The Seismic Future of Cities' by Professor Roger Bilham of the University of Colorado, Boulder. Professor Bilham showed that earthquakes with large return periods that had little impact on villages and towns in the past would in future be shaking urban agglomerations housing upward of 12 million people, due to increasing trends in urbanisation. The fifteenth Mallet-Milne lecture "Earthquake Safety in India: Achievements, Challenges and Opportunities", Professor Sudhir K. Jain, Director of the Indian Institute of Technology Gandhinagar, built upon this theme. Professor Jain, drew on his experience of enabling disaster risk reduction and highlighted the important need for engineers and scientists to step up and play a leading role in the implementation of seismic mitigation policy.

The 16<sup>th</sup> Mallet-Milne lecture follows almost seamlessly from those of Professors Housner, Spence, Bilham and Jain. "Dealing with earthquakes: The practice of seismic engineering 'as if people mattered' " was delivered by Edmund Booth in May 2017 at the Institution of Civil Engineers in London. The lecture, received with great acclaim, offers new perspectives on the role of the earthquake engineer, calling us to duty and urging us to broaden our perspectives to become more effective in ensuring that our knowledge is actually used for the good of society.

Edmund Booth has had a distinguished career in earthquake engineering, working on many international projects as a consultant for the seismic design and analysis of buildings, bridges, industrial structures, offshore structures and projects for the nuclear power and petrochemical industry. He has applied his expertise to the seismic assessment of historical and non-engineered buildings and to seismic risk assessment studies world-wide. Significantly, Edmund has promoted the earthquake engineering discipline throughout his career, lecturing at several universities, being one of the founders of the UK Earthquake Engineering Field Investigation Team (EEFIT), a past Chair of SECED, and representing the UK on many expert committees,

including his current role as Chair of the British Standards Institution's committee dealing with the seismic Eurocode, EC8. It is in recognition of his great contribution to British earthquake engineering that Edmund Booth was elected to deliver the 16<sup>th</sup> Mallet–Milne Lecture.

Edmund Booth's career would have presented ample material for the lecture. Instead, driven by his passion for earthquake engineering he decided to embark on a new challenge to explore how, to quote Edmund, we engineers "could become more effective – and influential – in driving the agenda of protecting society against earthquake threat". In researching his lecture, Edmund undertook a study tour of four contrasting locations with high seismicity, where he spoke to a wide variety of professionals, both engineers and those from other disciplines. The result, is a truly inspiring lecture and manuscript that invites earthquake engineers to make better use of their technical strengths and ability to "get things done" by widening our perspectives, engaging with communities and stakeholders, communicating better, being authentic, and why not, having a pinch of humility!

Professor Tiziana Rossetto

SECED Chairman 2016-18