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OBITUARY

Roy Butterfield

Roy Butterfield (1929–2023): (left) addressing the '68 Club of University of Southampton civil engineering graduates at their 40th anniversary dinner (photograph by Ian Johnston); (right) in the countryside near Faenza, Italy, 2003 (photograph by Guido Gottardi)

Roy Butterfield, Emeritus Professor of Soil Mechanics at the University of Southampton, died peacefully on 13 June 2023 after a brief illness. He was 94 years old.

Roy graduated in 1949, aged 20, with a first-class honours degree (BSc) in engineering from the University of London, UK, followed by a Diploma in Concrete Technology from Imperial College, London, UK. He then worked outside academia for a period of 11 years, mainly with civil engineering contractors, including George Wimpey & Co., Messrs Shepherds (York) and Airey (Leeds). He carried out 2 years of national service with the Royal Engineers in Nairobi from 1952 to 1954, during which time Roy and his lifetime companion Jeanne were married in Nairobi Cathedral. Before venturing into engineering, Roy spun a mean leg break in the Yorkshire cricket leagues and had a promising football career, being an apprentice at first division Huddersfield Town. This was brought to an abrupt end by a knee injury, and sport's loss was engineering's gain.

After a year teaching at Bradford College of Advanced Technology (now Bradford University), Roy joined the University of Southampton, UK, in 1962 as a lecturer in civil engineering. Although initially appointed to teach construction management, his natural scientific curiosity and practical aptitude prevailed, and he soon took responsibility for the then relatively new discipline of soil mechanics. With colleagues including Richard Harkness, and later Max Barton and Mike Cooper, Roy developed research in this area, laying solid foundations for soil mechanics and geotechnical engineering at Southampton to grow into the areas of strength that they are today. Roy and his colleagues were a meaningful and powerful presence at key international conferences through the 1960s and 1970s, as the discipline of soil mechanics developed and matured. Roy's personal contribution was immense and was recognised by the University of Southampton through the award of a DSc in 1974.

In 1973, Roy spent a sabbatical year at the National Research Centre (CNR) in Venice, Italy, investigating the ongoing subsidence that threatened the city and its lagoon. During this period, he developed the first quantitative relationship between subsidence, subsoil properties and groundwater abstraction. This helped to establish Roy's profound and enduring personal bond with Venice, and provided him with the basis for the development of an innovative and rational framework for the assessment and quantification of soil compressibility.

Roy also pioneered a novel and elegant approach to understanding the response of shallow foundations to general loading conditions, based on interaction diagrams able to accommodate every possible combination of loading. Roy later extended and generalised the method to cover the complete load–displacement behaviour of soil–footing systems. Together with meticulous and innovative experimental work on physical models with Guido Gottardi, this formed

the basis for the development of macro-element models that have revolutionised offshore foundation design all over the world.

A further area of note was the invention and development of the boundary element method of analysis, with his PhD student Prasanta Kumar Banerjee. This grew from Roy's pioneering work on the elastic analysis, using computers, of pile groups. Roy's interests in consolidation of soft clays and piling engineering combined in his research with Ian Johnston on the application of electro-osmosis to pile load capacity enhancement. Ian, who retired as Professor of Geotechnical Engineering at the University of Melbourne in 2015, describes the 'Butterfield effect':

> Roy had an incredible influence on my career and, indeed, my life. As an undergraduate at Southampton, he was about the best there was. He was a great teacher and with his boundless enthusiasm, soil mechanics became almost fun. The final year project I did under his supervision was probably the first time I was able to immerse myself in a topic over a reasonable period of time and really get my hands dirty (pun intended).
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> After I finished, I joined an old-fashioned consulting company in London but wasn't allowed anywhere near soil, which was a bit of a shame. Then some time in 1969, I was in Southampton visiting friends and had just finished a game of squash. Roy appeared dripping with sweat from the adjacent court and, after a brief chat, asked if I was interested in coming back as a research student. My immediate response was 'Where do I sign?'. And so began a fantastic 3 years. Roy, as always, was a great supervisor. Never pushy, always helpful, certainly knew how to encourage and challenge. He had a knack of how to get the best out of me and the cohort of research students I worked alongside: Bannerjee, Andrawes, Ghosh, and a couple of others. It was great food for the mind.

Roy was a formidable presence at the University of Southampton from his appointment in 1962 through to his retirement in 1994. He was successively lecturer, senior lecturer and reader in civil engineering, and in 1979 became the university's first Professor of Soil Mechanics. He served as Head of the Department of Civil Engineering from 1980 to 1990, which was a difficult and turbulent time for universities in the UK. As Emeritus Professor, Roy retained links with the Department and School of Civil Engineering and the Environment, and most recently the Department of Civil, Maritime and Environmental Engineering – including attendance at the annual Christmas lunch – up to the time of his death.

Roy's first paper was published in 1966 and his most recent in 2017 – a record spanning more than half a century. A good proportion of his papers were published in *Géotechnique*, the first and to many still the best and most rigorous journal in soil mechanics and geotechnical engineering. He served as Editor of *Géotechnique* from 1994 to 1996. His 1999 *Géotechnique* paper with Guido Gottardi and Guy Houlsby was selected as the basis for the 5th British Geotechnical Association *Géotechnique* lecture, which Roy delivered with Guy Houlsby in 2001 on 'Foundations on sand: towards a more secure basis for design'. Roy's 2017 paper on the compressibility of natural and reconstituted marine clays with Michela Marchi was awarded the Telford Premium by the Institution of Civil Engineers in 2018.

Roy cared enormously about people and about the environment. He was a founding sponsor of the organisation Architects and Engineers for Social Responsibility (AESR), representing 'UK architects and engineers who believe in social responsibility and a humane professional ethic in the use of technology'. AESR's 1990s monographs on sustainability in waste, housing, energy and transport were way ahead of their time as well as being succinct, tightly argued and evidence-based. In 2005, AESR joined with the larger Scientists for Global Responsibility, of which Roy became a patron.

Roy was always generous with his time and ideas, and many of the areas he started to develop were taken forward by others with Roy's enthusiastic support and often the handing on of ingenious apparatus or equipment. Examples include an instrumented test pile to Imperial College, and a large calibration chamber (originally from the Norwegian Geotechnical Institute) to Brazil.

Roy supervised more than 20 PhD students to completion, many of whom went on to become successful professors around the world, and inspired thousands of undergraduate students. He could be a demanding mentor and teacher – it is rumoured that he once set the analysis of a toy woodpecker attached by a spring to a collar, vibrating its way down a pole, as a first-year mechanics examination question. An always curious and immensely practical Yorkshireman, Roy will be fondly remembered and much missed by friends, colleagues and students alike for his youthful enthusiasm, eclectic manner, analytical insight and acerbic wit.

Roy is survived by his wife and muse Jeanne, and by his three children Sarah, Andy and Sam for whom he was an unparalleled father – honest, indomitable and furiously creative; as well as by many paintings and drawings, and the scribblings of his curious and unstoppable mind, which found the world mostly amusing.

William Powrie, University of Southampton, Southampton, UK

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