

60TH RANKINE LECTURE

Wednesday 16th March 2022 at 5.30pm

Doors open at 4.45 pm

The Great Hall, Sherfield Building, Imperial College London, Exhibition Road, SW7 2AZ

(Additional seating in the Clore Lecture Theatre, Huxley Building, Imperial College – see No 13 on map overleaf)

The unusual and the unexpected in geotechnical engineering Observation – Analogy – Experiment

Professor Stephan Jefferis

Environmental Geotechnics Ltd

In this 60th Rankine lecture I shall explore a wide range of processes which have substantial consequences in geotechnical engineering and yet have received little formal attention.

I shall first examine the behaviour of support fluids used in piling, diaphragm walling, tunnelling and horizontal directional drilling – processes which have been strongly influenced by analogies with oil well drilling operations. However, the role of the support fluid in each of these applications is different and it would be a mistake to assume that the key properties are the same for all of them. For example, for decades it was assumed that an excavation support fluid must form a filter cake and should be markedly denser than the surrounding groundwater. The advent of polymer support fluids, which may have little tendency to form a filter cake and have near water densities, has shown these assumptions to be simplistic.

From support fluids, the next step is to consider slurry trench cut-off walls and then the impact of geotechnical activities on soils more generally. On careful analysis, one finds that many of the natural processes that occur in soils are mediated by micro-organisms. This adds new dimensions of complexity as there can be multiple outcomes. Construction processes that influence microbiological activity include heating/cooling, tunnelling, dewatering, flooding, sealing with liners, grouting and other introduction of chemicals. These are processes that we regularly undertake without a second thought for their potential microbiological consequences. Fortunately, these usually pass unnoticed and innocuously but occasionally, as will be shown, the effects are at the least unexpected!



Stephan Jefferis is a director of Environmental Geotechnics Ltd, a company he established in 1982 anticipating developments in this area. He is a Visiting Professor in the Department of Engineering Science at the University of Oxford. He is a former Chairman of the BGA and was a founder director of WJ Groundwater.

Stephan has worked on major projects across the World including dams, tunnels, shafts and deep foundations. He has over 45 years experience in the investigation and resolution of unusual and unexpected geotechnical problems, often associated with natural chemical and microbiological processes. He has worked on geotechnical processes including fluid supported excavation for decades and is co-author of the book Polymer Support Fluids in Civil Engineering.

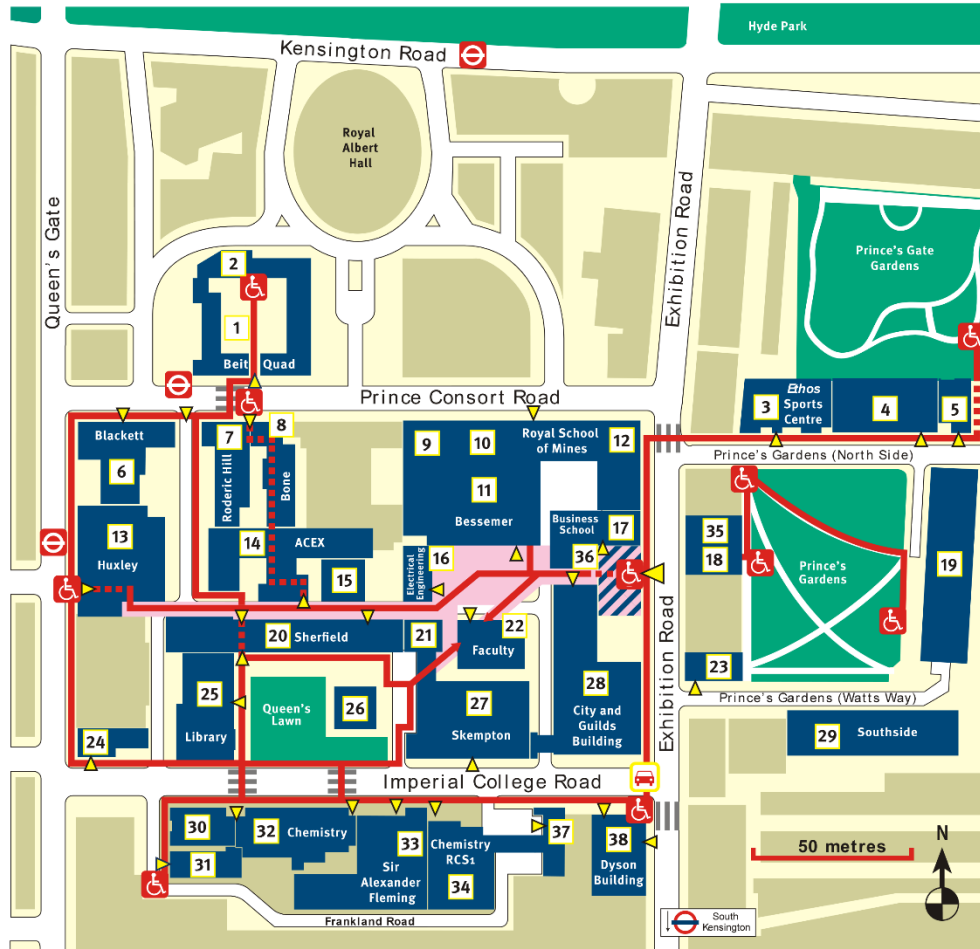
Covid 19 Precautions by personal attendees: for the safety of everyone, please:

- take a Lateral Flow Test on the day of the Lecture
- wear a mask at all times (NOTE: no refreshments will be served prior to the Lecture)
- follow the directions of the stewards through the queueing system, access to the Great Hall will be from 16:45 hrs
- provide proof of registration, either by mobile phone or printed confirmation, to gain entry to the auditorium.
- Register in advance online through the ICE website - available in early March 2022
- remain in your seat (NOTE: no readmittance if you leave the auditorium)

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Imperial College London

South Kensington Campus



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Main entrance	Bus stops	Thurloe Place
Accessible route	Building entrances	Thurloe Street
Buildings where wheelchair access is not possible at this time	Vehicle entrance	

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| 2 Imperial College Union | 13 Huxley Building | 22 Faculty Building | 31 Flowers Building |
| 3 Ethos Sports Centre | 14 ACE Extension | 23 58 Prince's Gate | 32 Chemistry Building |
| 4 Prince's Gdns, North Side | 15 William Penney Laboratory | 24 170 Queen's Gate | 33 Sir Alexander Fleming Building |
| 5 Weeks Hall | 16 Electrical Engineering | 25 Central Library | 34 Chemistry RCS1 |
| 6 Blackett Laboratory | 17 Business School | 26 Queen's Tower | 35 52 Prince's Gate |
| 7 Roderic Hill Building | 18 53 Prince's Gate | 27 Skempton Building | 36 Alumni Visitor Centre |
| 8 Bone Building | 19 Eastside | 28 City and Guilds Building | 37 Observatory Building |
| 9 Royal School of Mines | 20 Sheffield Building Student Hub Conference Office | 29 Southside | 38 Dyson Building of Design Engineering |
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| 11 Bessemer Building | | | |