

61ST RANKINE LECTURE

Wednesday 15th March 2023 at 5.30pm

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)

Constitutive Modelling in Computational Geomechanics

Professor John P. Carter

Emeritus Professor
University of Newcastle, Australia

Constitutive models are an essential part of computational modelling in geotechnics; they are at the heart of almost all theoretical predictions of geotechnical structures. How the stress-strain (and perhaps time) response of soil (and rock) is represented in these mathematical models is usually the key to successful prediction of the behaviour of geotechnical structures. However, the important details of these models, particularly the idealisations that are made, may be poorly or incompletely understood, or ignored, sometimes at significant cost to the unwary analyst. Indeed, the capabilities and the shortcomings of these models, especially the more advanced models, are not always easy to ascertain. In some cases, determination of the values of the input parameters is not straightforward. Consequently, it may be difficult to determine which model to select for a particular task. This lecture will explore some of the more important developments in the constitutive modelling of soils and will attempt to address some of these issues of potential concern. The need for such models and the various attributes and capabilities that the commonly used models possess will be reviewed. Also discussed is the issue of matching a particular model to the geotechnical problem at hand, which model attributes are required and why. The intention is to place emphasis in this lecture on the physical basis of these models, rather than explore their mathematical complexity in detail. Some of the constitutive models encoded in the software packages used routinely in geotechnical practice are reviewed, and discussion is also provided on their specific limitations. Examples of practical applications, involving the solution of boundary and initial value problems, are described to illustrate both the advantages and some of the limitations of both commonly used and highly advanced constitutive models.



John Carter is a civil engineering graduate of the University of Sydney, Australia. He is an Emeritus Professor and former Pro Vice-Chancellor and Dean of Engineering at the University of Newcastle, in New South Wales. He is also a former director of the geotechnical consultancy, Advanced Geomechanics (now Fugro AG), registered in Perth, Western Australia.

John is a geotechnical engineer with more than 40 years of experience in teaching, research, and consulting in civil and geotechnical engineering. His wide research interests include analytical and numerical modelling, soil-structure interaction, rock mechanics, the behaviour of carbonate soils, soft soil engineering, tunnelling, and offshore foundations.

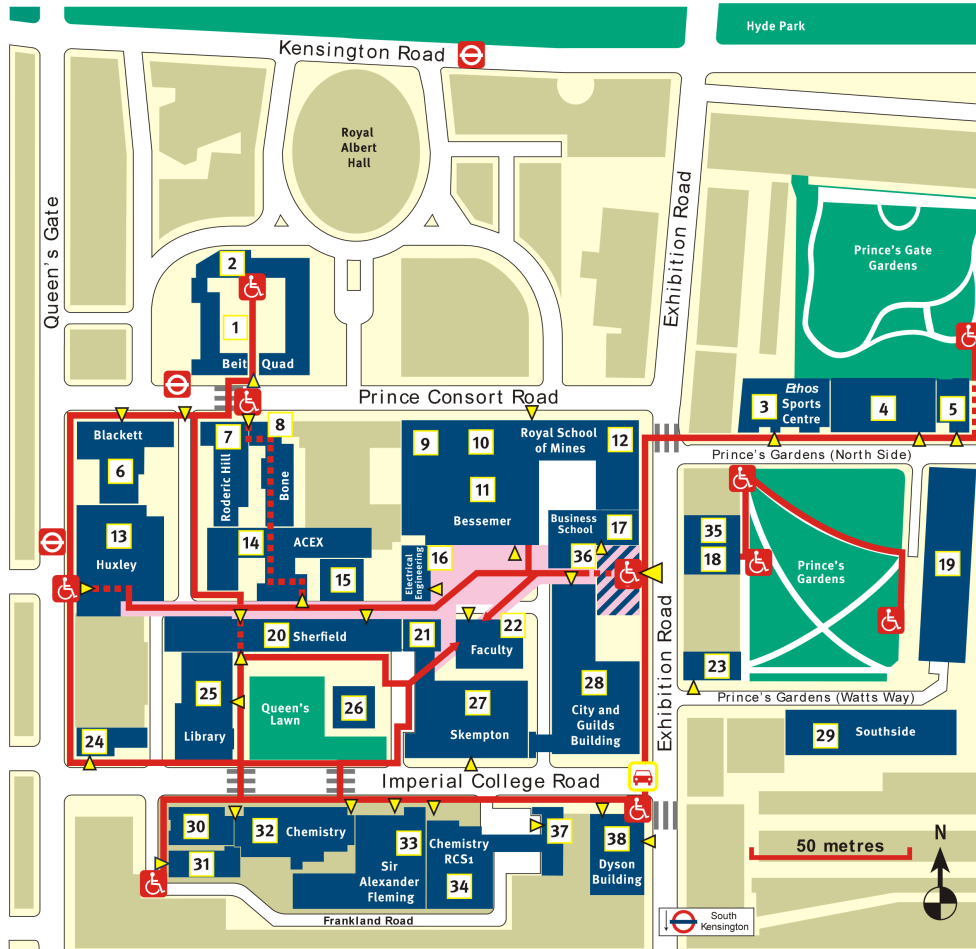
He is a Fellow of the Australian Academy of Science, the Australian Academy of Technology and Engineering, the Royal Society of NSW, Engineers Australia, and the Australian Institute of Building. In January 2006 he was appointed as a Member of the Order of Australia (AM) for his “contributions to civil engineering through research into soil and rock mechanics and as an adviser to industry”.

Disclaimer: Any views or opinions expressed on any matters by the presenters or participants during or in connection with any presentation are solely the views of the authors of the respective comments and/or opinions and must not be taken to be the views of ICE or the British Geotechnical Association or any other organisation. ICE and the BGA make no representations, warranties or assurances concerning any information provided in these presentations and accept no responsibility for the content and/or accuracy

This event will be broadcast online, details for which will be published prior to the event

**Imperial College
 London**

South Kensington Campus



- Main walkway
- Main entrance
- Accessible route
- Buildings where wheelchair access is not possible at this time
- South Kensington Underground
- Bus stops
- Building entrances
- Vehicle entrance

- | | | | |
|-----------------------------|---|--|--|
| 1 Beit Quadrangle | 12 Goldsmiths Building | 21 Grantham Institute – Climate Change and the Environment | 30 Sir Ernst Chain Building – Wolfson Laboratories |
| 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 Sherfield Building Student Hub Conference Office | 29 Southside | 38 Dyson Building of Design Engineering |
| 10 Aston Webb | | | |
| 11 Bessemer Building | | | |