Book Reviews

Geotechnical Instrumentation for Monitoring Field Performance. J. Dunncliff. Wiley, New York, 1993. £41.50 paperback; xx + 577 pp. ISBN 0-471-00546-0.

This book is intended for practising engineers involved with instrumentation as well as for students of geotechnical engineering; there is information for those planning and implementing instrumentation programmes as well as for owners, project managers, main contractors, suppliers and technicians. This is an ambitious brief to which the author brings his substantial experience. The title of the book is ‘monitoring’ and so specifically excludes ‘measurement’; many readers may find this omission irritating.

To achieve such a wide coverage, initial overviews lead to more detailed discussions of the various classes of instruments, ending up with checklists of actions and requirements and lists of instruments and suppliers. The readers can therefore select their depth of involvement. Those looking for an overview of instrumentation will initially be satisfied with the Foreword, Chapter 1 and Chapter 26, before delving deeper. Chapter 2 provides such a brief review of soil and rock mechanics principles as to be a contribution of doubtful value here. The author believes strongly that the greatest shortcoming in practice is the lack of adequate planning, and this is repeatedly emphasized. Chapter 4 lays out the principles of systematic planning and introduces the rest of the text. Part 2 covers specification and 4 contractual arrangements (USA). Part 3 has major and comprehensive chapters on measurement uncertainty, data acquisition, and measurement of groundwater, stress, strain and temperature. These chapters have a bias away from international methods and some dated coverage of particular aspects. Part 4 provides guidelines on the execution of programmes including calibration, installation and processing of collected data. Part 5 illustrates applications for a range of geotechnical problems with a series of simple, but often forgotten, questions and listing potentially appropriate instruments. This well thought out section provides rare insights to some realities of instrumentation. The inclusion of brief but extensive summaries of published case histories is invaluable. As with the rest of the book, these are predominantly American, but with sufficient international examples to provide a reasonable balance. The book is completed with a number of useful Appendices.

Although this edition is dated 1993, it is unfortunate that the opportunity has not been taken to update the text or references. Nevertheless, the value of the book lies in its coverage of basic principles, and its availability in paperback is welcomed.

The book is intended as a practical guide and so has to inform on planning, executing and reporting an instrumentation programme. The author presents his own robust view in an accessible style. The broad brief is met in a readable text with clear diagrams, but the photographs of field installations often lack clarity. This book fills a substantial gap on the geotechnical bookshelf in such a way as to make it invaluable, whether a clear overview or an in-depth guide is sought. Its particular value lies in the presentation, within single covers, of such a wealth of information, guidance and experience that any shortfalls or criticisms become secondary.

D. Norbury

Spreadsheet Geomechanics: An Introduction. B. Look. Balkema, Rotterdam, 1994. £35 hardback, £19 paperback; x + 268 pp. ISBN 90-5410-151-2 (hb), 90-5410-152-0 (pb).

Spreadsheets are an increasingly powerful tool which have a broad range of application in geotechnical engineering. This book presents a thorough introduction to the application of spreadsheets by way of detailed worked examples.

Spreadsheets are introduced for the benefit of the complete beginner, rapidly increasing the complexity of the applications and, by Chapter 9, macros and customized menus are introduced. The book is written around Lotus 123, but would be readily translated into other spreadsheets.

Chapter 1 highlights the principal benefits of the use of spreadsheets in geotechnical engineering; the 'what if' scenario. A spreadsheet makes it easy to determine the answer to 'what if I change that parameter?' A spreadsheet application enables the user to evaluate readily how realistic his input parameters are, and the sensitivity of the analysis to variations in those parameters. This chapter highlights the perils lying in wait for the geotechnical engineer, coerced by external pressures, in committing to a 'design number' without fully understanding the implications of the information (or lack of it) available to him.

A brief introductory chapter on spreadsheets leads on to six chapters of detailed, worked examples. Whilst the particular analytical method used may not be the reader's favourite, the examples provide a good indication of the art of the possible. There are spreadsheet applications for stress analysis, retaining walls, slope stability, piled and shallow foundations and ground improvement. Programme listings are given in an Appendix for each of the fifteen separate spreadsheets used as examples.

This is a well-produced 'how to' manual and, although the comprehensive listings would make it
possible, it is not a catalogue of recommended applications but an introduction to the use of the spreadsheet as a routine tool for the evaluation of soil engineering problems. The book provokes the reader to review his data and analytical methods critically, and should be required reading for those who have not yet discovered spreadsheets.

A. J. Fletcher

Elementary Mechanics of Soil Behaviour. J. Biarez & P. Y. Hicher (eds). Balkema, Rotterdam, 1994. £35 hardback, £24 softback; xvi + 280 pp. ISBN 90-5410-156-3 (hb), 90-5410-157-1 (sb).

In reviewing this book the reviewer has had considerable difficulty in reconciling the content with the title. The book covers a range of soil behaviour in a fairly complex way, so the book cannot be said to be simple. Therefore this meaning of the word ‘elementary’ as equivalent to ‘simple’ has to be discounted. However, there is another meaning that could be implied by the word ‘elementary’, that is, ‘treating from first principles’. It is this latter meaning that is a better, though incomplete, fit with the contents.

The terminology and notation, that the authors use, is not classic and, unfortunately, in many cases is not properly defined. The reviewer has not had the opportunity to read the many papers and research theses that are cited, and it is probable that many of the missing definitions are to be found in these. In most cases the reviewer was able to bridge these omissions by inference; but it is uncertain if the lay reader could do this easily.

The main benefit to the reader is in the presentation of a body of research, in the form of test results, that was generated in the French School. Some of these results are very close to already published and well established results, and proper acknowledgement to work outside France is sometimes missing.

The reader will either accept or reject some of the quite dogmatic statements and comments which are made as supporting arguments are not given. As an example, the meaning of ‘normally consolidated soil’ is never properly defined, but statements about ‘normally consolidated behaviour’ are made and the reader is left to infer that these statements pertain to ‘behaviour’ at current stress conditions that are larger than any previous stress conditions. The authors go on to say that it is practically impossible to obtain a dry normally consolidated sand. The reader has to interpret this statement as representing behavioural response of sand as compared with the equivalent behaviour of clay. The statement is clearly incorrect as the authors take pains to derive a power function stress–strain relationship for sand which does not stand comparison with the semi-logarithmic relationship for clays; why they try to force a ‘response fit’ is a real puzzle as it certainly does not help the reader.

A main feature is the display of information using multiple figures on the same page. So it is a pity that some are not properly labelled and in many cases the figure numbers do not have their proper part numbers. It is said that the book contains so many mistakes, especially in that a large number of these are due to poor editing.

To benefit from this book the reader has to be fully aware of the developments that have taken place in research into the mechanics of soil behaviour, in particular with the idealization of elasto-plastic soil response leading to ‘critical state soil mechanics’. One can say that this book is primarily of use to a well-read research worker who wants to know something of the research work that has been carried out in the ‘Paris School’.

A. E. Skinner

The Periglaciaiation of Britain. C. K. Ballantyne & C. Harris (eds). Cambridge University Press, 1994. £50 hardback; x + 330 pp. ISBN 0-521-32459-9.

The whole of Britain has been subjected to periglacial environments: those relating to non-glacial cold climatic conditions. Many of our landscape features, deposits and soil structures cannot be explained by the processes that are currently active. We must look to arctic, sub-arctic and cold montane regions of today to be able to appreciate the legacy of Quaternary environments in Britain. This is extremely important for engineering geologists, who need to build a conceptual model of the landscape (and its genesis) in order to interpret the results of their ground investigations and to make statements about the nature and variability of the geotechnical parameters.

This book does not consider geotechnical parameters. It is a state-of-the-art review of periglacial geomorphology. The bulk of the text comprises a systematic survey of periglacial features, their formation and their environmental significance. The authors have drawn on extensive theoretical, laboratory and field studies of features in present-day environments and used this to understand features in Great Britain and to reconstruct the conditions of the Quaternary. The book is divided into four parts.

Part 1 introduces the concepts, with three chapters covering the nature of periglacial, the history of research, the chronology of the Quaternary and the characteristics of modern periglacial environments. Part 2 reviews the features of lowland Britain, an area of dominantly sedimentary rocks with thick superficial cover, generally below the 400m contour. The char-
acteristics of the landforms, deposits and structures are split into five chapters around the following themes: ice wedge casts and tundra polygons; pingos and ground ice phenomena; active layer cryoturbation and patterned ground caused by near-surface freeze-thaw; mass wasting and slope evolution by shallow (solifluction) and deep-seated mechanisms; and subsequent modifications by fluvial and aeolian processes. The final chapter, for example, contains some clear illustrations of the complex interrelationship between terrace gravels and colluvium that is so common in southern Britain yet frequently catches engineering geologists unawares.

Part 3 concerns the upland areas of Britain, where there are more resistant rocks, intense glacial erosion, steep slopes and thin superficial deposits, mostly derived from frost-shattered rock. The five systematic chapters of this part deal with frost weathering and detritus; patterned ground; solifluction landforms; the development and modification of talus slopes; and the modifications by nival, fluvial, aeolian and coastal processes operating in periglacial environments.

The final part of the book brings together many of the features already discussed and outlines three contrasting periglacial environments. These are the Dimlington Stadial, a prolonged period of very severe cold climate when two thirds of Britain was covered by glacial ice; the Loch Lomond Stadial, a briefer, less severe phase when glacial ice was restricted to upland areas; and present-day mountain areas of Britain where periglacial conditions still prevail, albeit extremely marginally.

This book achieves what it sets out to do and does so in a very clear and concise manner. It is well presented and very well illustrated. There are nearly 280 figures, comprising photographs, maps, sketches, tables, sections, graphs and block-diagrams. In many cases each figure consists of a number of sub-figures and there are diagrams to explain photographs. The information is derived from a great number of sources in addition to the authors' life-long research interests, and there are 25 pages of references. This book is a 'must' for anyone who wants to understand what has been going on during the past few hundred thousand years. The paperback edition will be more reasonably priced.

K. D. Privett

**Improvement techniques of soft ground in subsiding and lowland environment.** D. T. Bergado, J. C. Chai, M. C. Alfaro & A. S. Balasubramaniam. Balkema, Rotterdam, 1994. £35 paperback, £61 hardback; viii + 222 pp. ISBN 90-5410-153-9 (pb), 90-5410-144-X (hb).

The book is aimed at practising engineers and deals with soil improvement methods in soft soils. In spite of the rather ponderous title, and a number of shortcomings discussed below, I liked this book and it will certainly find a place on my bookshelf. It is generally well-presented and readable; provides sufficient detail for practical use; achieves a good balance between theory, design and construction; and a good range of references are included for further study.

Although apparently aimed at a worldwide audience, the practical experience described is mainly derived from South East Asia, and Thailand in particular. Experience from some other soft clay areas is taken in, especially in regard to theory and analysis, but I would have liked to have seen more extensive coverage from such locations as Japan, Scandinavia and North America.

The scope of the book is also somewhat limited in regard to the techniques covered. For example jet grouting gets very limited coverage, and only then as a wet mixing technique, and an excellent opportunity to review the interesting jet grouting work done in Singapore in recent years was lost. Indeed the chapter on deep-mixing was deficient in not providing more details of the auger injection construction methods and in failing to report on the very extensive field data on their performance available from Japan. Similarly I would have preferred more discussion of surcharge and preloading techniques which are rarely given the coverage in print that their use in practice would merit. Geotextiles are included in respect of embankment reinforcement but their more general use in soft ground problems was poorly addressed and the potential for such fringe systems as thermal methods, settlement control piles, and electro-osmosis was not addressed. Finally I would have liked to have seen the introductory chapter extended to cover the engineering geology, investigation methods and key geotechnical characteristics of soft 'lowland environments'.

The chapter on vertical drains is a useful summary of current understanding and is made more valuable by the inclusion of some parametric studies, filter criteria and field data from several test embankments on both sand drains and prefabricated drains. Likewise granular piles are well covered with the major constructional techniques described followed by a review of the design methods appropriate for examining settlement rates and magnitudes, bearing capacity and shearing resistance in slope situations. Field experience is again provided.

Lime/cement deep mixing is perhaps least well covered for the reasons given above, but valuable descriptions of calculation methods and case histories are usefully included, as is the discussion on effects of water content, salt, and organic content on the strength improvement.

The final chapter, and by far the longest, is entitled 'Mechanically stabilized earth embankments/walls'. The treatment is somewhat biased towards analysis rather than actual behaviour of reinforced soil structures resting on soft soils, although it must be said that
several case histories are included. Nevertheless, the chapter represents an extensive and well presented review of current knowledge on the subject.

My copy was the cheaper paperback version and I can recommend this—the production quality was excellent.

A. L. Bell

Rock Mechanics. P. P. Nelson & S. E. Laubach (eds). Balkema, Rotterdam, 1994. £55 hardback; xiii + 1155 pp. ISBN 90-5410-380-8.

This strongly bound book contains 133 papers presented at the first North American Rock Mechanics Symposium (NARM), held at the University of Texas at Austin in June 1994. My initial apprehension on finding that I had agreed to review such a large volume diminished after reading the keynote lectures and contents pages.

Although I risk being accused of padding my review, I shall repeat the book's section headings to show the comprehensive range of topics covered by the papers: Hydraulic and mechanical properties of discontinuities; Borehole stability and hydraulic fracture; Rock engineering for underground excavations; New developments in blasting; Rock cutting and TBM performance simulation; In-situ stress; Mechanical properties of intact rock—laboratory testing; Static and dynamic properties of intact rock; Uncertainty and reliability in rock engineering; Numerical modelling—continuum analysis; Numerical modelling—discontinuum analysis; Mechanics of weak rock—creep/rheology; Intact rock testing—fluence of pores and fluid transport on properties; Natural fracture systems; Mechanics of poorly consolidated weak rock; Deep mine design in South Africa and Canada; Deep mine design/bursting/ pillar design; Coal and surface mine design; Rock mechanics in dam and hydro-project construction; Rock mechanics in the design of rock slopes.

Most of these sections contain more than five papers, selected to maintain a healthy balance between theory and practice. It was a pleasure to see oilfield and other deep-drilling rock mechanics topics sitting alongside the more traditional civils and mining applications although they sit there fairly uncomfortably, sharing the common ground of in situ stress and fracture-flow.

When I started to review this book I picked out and read several papers that were of particular interest to me, mainly case histories and descriptions of tests and techniques. I was encouraged to find that none of them covered old ground and all contained recent references. I also selected and read about twenty other papers at random. Most were interesting; one or two I didn’t understand—but I have never claimed to be a mathematician.

Having read the book, or more accurately, at least enough of the 1155 pages to enable me to review it, I remain baffled by its full title. The cover and title page has three lines—Rock Mechanics/Models and Measurements/Challenges from Industry. Isn’t that what all rock mechanics is about? Possibly the title applies more to the conference than the book. The preface is also a puzzle. Despite the fact that 27 of the 133 papers originate from outside the three organizing countries (US, Canada and Mexico), and contributors come from another 15 countries, the preface states that 'These papers are ... succinct samples of the best work in North American rock mechanics.' It is unfortunate that the contributions from elsewhere were not acknowledged.

This is a book for those who need to be kept up to date and informed of developments in rock mechanics. It is excellent value for money.

R. Whittle

Fundamentals of Earthquake Prediction. C. Lomnitz. Wiley, New York, 1994. £66 hardback; xiv + 326 pp. ISBN 0-471-57419-8.

There are books you take to bed expecting them to induce early slumber, others which can be expected to capture you until dawn. Cinna Lomnitz has produced an exciting, indeed provoking book which, if not taking me quite to Aurora, at least gave me a jaded later morning.

This is not a textbook; some would judge it to be in parts somewhat perverse. Lomnitz, a name for engineering seismologists to conjure with, comes down on the profession rather like a detachment of guerillas. He has his strategy to unify the whole, but the tactics consist of a collection of ten penetrating essays, some of which strike home more than others, but all stir the mind. The titles of the two parts: 'The Spiral of Practice' and the 'Spiral of Theory' bear witness to this. There is something in the book for all sons of earth scientists; I pick out only a few items and issues as examples.

His first provocation is to take 'Richter's Law' that 'All major earthquakes occur within three months of an equinox' and with some Bayesian sleight of hand (but following the rules) he shows that the use of an equinox as a precursor of earthquakes can be justified and that they are better than the long and medium term precursors reported for the Chinese earthquake predictions of the Hiacang, Longling or Tangshan earthquakes. His essay on Chinese prediction efforts reveals an awareness of Maoist epistemology and dialectic which makes for an acute, critical yet empathetic product.

The impact of the Haicheng evacuation and its 'role in buttressing bids for government support to earthquake prediction programs in other parts of the world' had some parallels in the response of the United States to the Soviet Sputnik of 1957 (a challenge which it can be argued led along the Vela Uniform trail to plate-
tectonics and back to earthquake prediction). It encouraged the hope that with sufficient resources all problems could be solved and led the National Earthquake Prediction Evaluation Council (NEPC) and the Parkfield Prediction. This humiliating experience in quasi-determinism is dissected by Lomnitz using his vast statistical and probabilistic understanding. Why such expert evaluation of the original hypothesis was apparently not undertaken before the expenditure of five years of study and the loss of credibility for earthquake prediction programs has yet to be answered. Lomnitz heeded the precept that empirical justification should be sought for probabilistic statements by asking some gambler friends if they would in effect reject the Poisson hypothesis at the 4.5% level (the Parkfield hypothesis) in a single trial by asking them to consider the likelihood of rolling two aces twice in a row with a pair of new dice. None would concede that this would lead them to reject the dice as unfair. Yet the probability of this happening with honest dice is 57 times less than the 4.5% which was taken to indicate a non-random underlying process at Parkfield.

In Part II he most rewardingly brings us into contact with 'A Small Paper by Kolmogorov' who in 1941 recognized the universality of the fragmentation process and introduced a scale factor and a fractal dimension in the power law form of the log normal distribution of grain sizes. It is characteristic of Lomnitz that a fundamental statement leads on to an interesting and often controversial follow-up deriving the constitutive relationship for soils in shear from first principles using the power law formulation of Kolmogorov.

In his essay on the theory of strong ground motion, (Chapter 9) he strongly espouses the cause of gravity waves, using the findings of Van Doon in 1968 that ring like structures seen on the moon around impact craters can be explained as 'lunar tsunami' and the often reported sightings of ground waves, some by Lomnitz himself. Although his espousing of a theoretical analysis of gravity waves by Freeman-Gilbert in 1967 has come under attack recently the whole tenor of Chapter 9 makes it obligatory reading for geotechnologists involved in earthquake problems. In particular his concept of 'phase transition' and his scepticism of very high reported material damping in homogeneous shear straining of soils deserve careful consideration. The reviewer has been prompted to revisit accounts of visible waves at Wivenhoe in 1884.

The book includes a comprehensive list of references and adequate index in clear text with good figures, making it a pleasant read. It is a book which should be on the shelf of every serious earth scientist as well as specialists in engineering seismology.

B. O. Skipp

T. S. Smith