

Book reviews

Slope stabilization and erosion control: a bioengineering approach. (1st edition.)

R. P. C. Morgan and R. J. Rickson (eds). E & FN Spon, London, 1995. ISBN 0 419 15630 5, £47.50, 274 pp.

Geotechnical engineers interested in slope analysis and design will find this book excellent reading. The book's eight chapters cover engineering properties of vegetation, ecological principles for vegetation establishment and maintenance, application to water and wind erosion control, and slope stabilization. The authors are to be complimented for achieving a remarkable unity of treatment, despite the wide range of subjects taken from different disciplines (such as geotechnical engineering, agriculture, and environmental engineering). Geotechnical engineers will find this book particularly useful as it draws together material usually found scattered in many journals of different areas.

The chapters are well-balanced. Chapter 2, 'Engineering properties of vegetation', written by M. E. Styczen and R. P. C. Morgan, provides an elegant introduction to hydrological, hydraulic and mechanical effects of vegetation, in a way which is suitable for non-specialized readers. Chapter 4, 'Simulated vegetation and geotextiles', written by R. J. Rickson, discusses the use of both geotextiles and mulches under the same point of view. Another highlight of this book is Chapter 7, 'Slope stabilization', written by Professor T. H. Wu. This chapter makes fascinating reading, particularly the sections on root properties and soil reinforcement by roots. This book is well-presented, with clear figures. It is therefore a valuable source of reference for both analysis and design of slopes.

A. V. D. BICA and L. A. BRESSANI

Dredging: A handbook for engineers. (2nd edition.)

R. N. Bray, A. D. Bates and J. M. Land. Arnold, London, 1997. ISBN 0 340 54524 0, US\$225, 434 pp.

The first edition of this book was published in 1979 and has been extensively used by engineers involved in dredging and reclamation projects. Before 1979 there was no single general reference for those researching dredging; most of the available information was tied up in technical papers published at one or two conferences dealing with dredging or marine civil engineering. There was no first-port-of-call type textbook available, and Bray filled a large void. The reason

for the lack of available information was that dredging was (and still is) carried out by a small number of companies, and the main commercial advantage these companies have over each other or any new company is tied up in their plant and their working practices.

Since 1979, extensive dredging works have been carried out around the world, connected with the construction and maintenance of harbour development works, navigational sea channels, seabed cable-laying, and reclamations. The equipment used has been computerized and improved, and has generally been enlarged to optimize dredging capacities and working practices. Several specialist conferences have been held, bringing more case histories to light; BS 6349 *Maritime structures, code of practice for dredging and land reclamations* was published in 1991 and several PIANC (Permanent International Association of Navigational Congresses) bulletins and reports have been published in the interim. The original 1979 edition was ripe for revising, and in 1997 the second edition was published. Bray, along with Bates and Land, has revamped the original handbook adding many more figures (and including for the first time colour plates), adding to the understanding and comprehension of the text. A new chapter has been added to deal specifically with project implementation.

The book is split into 14 chapters: Chapter 1 provides a brief introduction to dredging, historical development and terminology; Chapter 2 looks at project implementation, UK legislation, site appraisal, project documentation, tendering and control, and is illustrated by a number of decision-making flow charts. Chapter 3 covers the design of dredging works in relation to type of dredger; Chapter 4 discusses the use of dredged materials, reclamations, and gives an overview of ground improvement methods; Chapter 5 covers the methods of disposal of unwanted dredged materials, the legislation and chemical testing; and Chapter 6 pre-contract meteorological, hydrographic, geological and environmental site investigations. Chapter 7, the biggest in the book, describes the dredging plant and equipment. If as a geotechnical engineer you read only one chapter, it should be this one: it provides the fundamentals of dredging and quickly immerses the reader in dredging terminology. Chapter 8 discusses the numerous factors that affect the performance of dredging plant (and is the best chapter for cross-checking with contractors' submitted method statements). Chapter 9 deals with estimating output; the most geotechnically-relevant section on bulking factors is too brief. Chapter 10 covers costs and prices. Chapters 11

*Proc. Instn
Civ. Engrs
Geotech. Engng,
1999, 137, Jan.,
55-60*

and 12 cover contract methods and supervision and control, and highlight the key dredging factors that need to be taken into account. Chapter 13 gives a good summary of environmental aspects and follow-up references but is already dated in some aspects, and Chapter 14 ('Pre-treatment of rock') is specifically for rock and hard soils dredging, and includes underwater blasting.

The text is clearly written, with bullet points used effectively to summarize and emphasize key points throughout. It is written in a way that allows the reader to dip into the book as well as to read it from cover to cover. The book is well-illustrated and includes figures taken from BS 6349: 1991 and various PIANC documents. The text is generally well-referenced in most chapters; unfortunately for geotechnical engineers, there is very little specific cross-reference to documents dealing with site investigation, soil properties and parameters, geology or construction. One of the drawbacks is that the references to specialized technical papers are limited. There are some aspects on which a geotechnical engineer would need more information, for example clayballs in sandfill, softening of marine deposits at the dredge level due to dredging, chemical testing of disposal material, and the bulking of different types of material in relation to dredger types or amount of handling.

The book is a very good primer for those engineers entering or actively involved in dredging. It gives a good first-port-of-call for answering dredging questions, either providing the information outright or providing (in most cases) a further reference. It is a must for any university library with students following civil or maritime engineering. In addition, I recommend that all those engineers that have a copy of the first edition on their shelf should update with a copy of this new and revised edition.

C. S. COVIL

provides an extensive recent literature review which looks at developments and extensions of the original systems. Several UK case histories are given. The report goes on to draw together the conclusions of all the various papers and to make recommendations.

Each ground classification system is described in relation to its use in site investigation, in the logging of borehole results, in the preliminary design for the choice of support systems, and then on site for the modification of these support systems when necessary. Their use in comparing actual conditions with the predictions of ground reference conditions in a risk-sharing type contract is described at some length.

The two systems which receive the most attention are the Norwegian Geotechnical Institute's 'Q' rock quality system and the CSIR (Bieniawski) rock mass rating system (RMR). A history of each system is given, followed by a detailed description of how to calculate the Q value of any rock. Recent research into the relationship between the Q value and the seismic reaction of the rock is also considered and other problems currently receiving research attention, such as the application of probabilistic methods and numerical modelling to rock classification schemes, are treated at length.

The information given in the case histories varies considerably as it obviously depends on the amount of data available in the public domain.

As a summary of all the available rock classification systems and their comparative use, together with the application to modern tunneling techniques, this report provides a very useful work of reference. The extensive bibliography and list of references, including those peripheral to the subject, make it a valuable source of information for all those involved in tunnel design.

G. PAKES

Ground classification systems in tunnel construction. (1st edition.)

G. I. Crabb. Transport Research Laboratory, 1997. ISSN 0968 4107, 30 pp.

This 30-page A4 booklet is a Transport Research Laboratory Report, No. 280, available to interested parties through the normal TRL publication avenues. It was originally prepared for the Highways Agency and it reviews the development and use of empirical ground classification systems for the selection of tunnel support and other purposes.

It commences by describing the concept and nature of all the published ground classification systems, and discusses their strengths and weaknesses and areas of application. It also

Recent developments in soil and pavement mechanics. (1st edition.)

M. Almeida (ed.). A. A. Balkema, 1997. ISBN 90 5410 885 1, Hfl 165, 502 pp.

This book is a collection of papers and keynote lectures, recording the proceedings of a symposium of the same title held in Brazil in 1997. The book is, effectively, divided into two sections. The first, comprising some 40% of the volume, consists of eleven keynote lectures prepared largely by well-known geotechnical authors from all the populated continents except Africa. The distribution of topics covered is a little uneven with centrifuge testing/modelling claiming three of the eleven.

Furthermore, the scope of the keynote lectures differs markedly. Two examples will serve to illustrate this. A lengthy, detailed and informative overview of the critical state soil mechanics framework and its applicability is provided by S. Leroueil (Université Laval, Canada), including about 160 references. D. Velloso (Federal University of Rio de Janeiro, Brazil), on the other hand, takes an entirely different approach, giving a relatively brief statement of foundation engineering practice in Brazil. His paper is supplemented with much reference material listing design equations, parameter values, available pile sizes, etc. To some extent it is inevitable that there should be such variation in a book of this nature, but this makes it difficult to recommend the book as a comprehensive overview of 'Recent developments ...'.

A further criticism of the title must relate to the 'pavement mechanics' element. Only one of the shorter keynote papers (14 pages by J. de Medina, Federal University of Rio de Janeiro, Brazil) touches pavement engineering and it is on the rather specialized pavement engineering topic of the influence of tropical soils and climates on stiffness and (for soil-cement) fatigue properties of laboratory specimens. For material more fitting to this aspect of the title, readers must turn to the five submitted papers of the 40 which make up the second 60% of the book.

These contributed papers are, in addition to 'Pavement mechanics', grouped under the headings 'Engineering properties and investigation' (17 papers), 'Numerical, physical and probabilistic methods' (two papers), 'Earthworks' (five papers), 'Environmental geotechnics' (six papers) and 'Foundation engineering' (five papers). Most geotechnical areas are addressed with the exception of tunnelling, deep excavation, retaining wall, *in situ* instrumentation and dam engineering topics.

This reviewer was pleasantly surprised by the quality of these 40 papers. Despite—or perhaps because of—their being almost entirely of Brazilian authorship and from academic institutions, these papers are usually well-written and presented and describe novel, useful and well-formed research. The authors frequently present the results of careful laboratory and, less often, field studies. It is evident that the authors are aware of, and draw upon a wide reading of, literature published elsewhere in the world. This book will put into the hands of readers outside Brazil a useful compendium of activity inside its borders. It is to be hoped that they will consult it in order to inform their own work of the valuable work in progress in that country.

Because of the wide coverage, it is unlikely that many outside Brazil will wish to purchase copies for their own use. The exception will be those non-residents having regular contact with Brazilian geotechnical engineers. They will need to refer to it as a summary of current research

and thinking. Other readers should ensure that they locate a library which will purchase the book, mostly for the papers on Brazilian work but also for the specialist keynote papers in which they will, in some areas, find useful summaries.

A. DAWSON

Soil mechanics—concepts and applications.
(1st edition.)

W. Powrie. E & FN Spon, 1997. ISBN 0 419 19720 6, £24.99 (paperback), 420 pp.

This is William Powrie's entry into the closely-fought market for the undergraduate soils textbook. It faces stiff competition from the old favourites such as Craig and Smith, offering advantages derived from long print runs of many editions—a traditional approach, a familiar layout. Against these advantages, Powrie offers a fresh look at the subject: new ideas and learning approaches are incorporated into the text at a fundamental level, rather than in a piecemeal fashion.

As the title implies, another important difference between Powrie's book and those already mentioned is the integration of soil mechanics theory with design and construction practice. This accords with common sense and current thinking on learning techniques, which says that many people learn more thoroughly if a theoretical concept is illustrated with a practical application.

The book is laid out in the now-familiar mid-size format, with two columns of text per page. The text is clear, the author's style engaging and very readable. Each chapter starts with a list of objectives, and ends with a series of key points that the reader is expected to have mastered: Powrie's stated aim is to convey concepts rather than hundreds of equations. Students liked the many case studies, and plenty of worked examples, questions and detailed references complete each chapter. Rather than in-depth discussion of particular design codes, Powrie opts for a thorough treatment of the underlying principles, which should ensure a longer shelf-life.

While the content cannot be faulted, in places the production seems rather economical: the book is monochrome throughout, few photographs appear, and some of the figures are on the small side. These are minor quibbles, however, for a book in its first edition and at a competitive price.

Powrie obviously expects a great deal from his own students: they are introduced to critical state in their first year. Although the book is obviously aimed primarily at undergraduates, many sections would be useful to MSc students

and practitioners looking for particularly clear explanations of such topics as dewatering, triaxial testing, and plasticity applied to retaining wall design. I would recommend this book's fresh approach to any of our readers.

A. H. HARWOOD

Geotechnical engineering. (2nd edition.)

R. Lancellotta. A. A. Balkema, Amsterdam, 1995. ISBN 90 5410 179 2, £46.00 (paperbound) and 90 5410 178 4, £76 (hardbound), 440 pp.

This is a general textbook, which covers a broad range of soil mechanics and geotechnical engineering topics. It is scholarly and well-researched, and strikes a suitable balance between traditional analytical techniques and a modern understanding of soil behaviour. Its distinguishing features include mathematical rigour and the extensive use of laboratory and field data to illustrate various aspects of soil behaviour. There is a useful chapter on the fundamentals of continuum mechanics, which sets out the basic assumptions on which the more common models of soil behaviour are based; and a detailed and comprehensive chapter on *in situ* investigations, which covers almost everything from the analysis of well-pumping tests to geophysical methods.

According to the back cover, the book is aimed primarily at undergraduate students. In many areas, however, the book goes into rather more detail at an early stage than would usually be the case in a first degree course in civil engineering—at least in the UK. For example, in the chapter on consolidation, the effects of increasing layer thickness, self-weight and varying consolidation parameters are all addressed. Overall, the book covers much in only 440 pages, and this breadth is inevitably achieved by a general brevity of explanation, an almost total absence of worked examples and exercises for students, and the omission of some derivations and proofs. In my view, it would be a difficult introductory text; but advanced course students and practising geotechnical engineers wishing to refresh or extend their knowledge of modern soil mechanics and geotechnical engineering theory should find it both informative and useful.

W. POWRIE

Fundamentals of earthquake prediction. (1st edition.)

C. Lomnitz. John Wiley & Sons, New York, 1994. ISBN 0 471 57419 8, £75, 326 pp.

For most geotechnical engineers, not professionally involved with the business of earthquake

prediction but nevertheless deeply interested in the prevention of large-scale human disasters, this book will be a fascinating read. Those who do have significant knowledge of this field may well, one suspects, find the text rather irritating.

The book deals with the practice and developing science of earthquake prediction but does not, as might be inferred from its title, attempt to give the reader a clearly structured introductory guide to the subject. The author is clearly well-informed, but the text is distinctly quirky in places. The tone is well set at the start when the author notes that 'earthquake prediction (in the sense of forecasting the date, location and magnitude of an earthquake) is not feasible today. A practical method or system for predicting earthquakes is possibly five to 25 years in the future.'

Chapters with titles such as 'Trial by water', 'A blundering oracle', and 'Science in ashes: a theory of coincidence' do little to help the reader from place to place in the text, but they do give a clear indication of the style of the book. This is an essay which considers science, engineering, social issues and politics at once. It takes equal account of the role of the seismologist observing seismic waves and the zoo-keeper observing unusual animal behaviour, as providers of warnings of impending quakes. It must be read from start to finish, much as one would read a novel.

At the end the author sums up his views as follows: 'This brief enumeration may give but a small idea of the large number of scientific challenges that await those willing to engage in earthquake prediction. I stop here because I don't wish to give the idea that there is a rigid agenda to be followed. Science should be fun, as the physicist-seismologist Merle Tuve used to say. Fun but not a joke.'

C. R. I. CLAYTON

Tunnel engineering handbook. (2nd edition.)

J. O. Bickel, T. R. Kuesel and E. H. King (eds). Chapman and Hall, 1996. ISBN 0412 99291 4, £85, 544 pp.

Tunnel engineering is here treated in 28 chapters covering both the design of a range of underground facilities and the tunnel construction. The chapters vary in their depth of scrutiny—much detail in some, more guidance in others. Each provides a good number of references, many from the UK (TBMs and 'Ventilation' for example) including monthly publications and conferences. Messrs Parsons, Brinckerhoff Quade and Doyle Inc. provide the authors for about half the chapters but are well supported by other companies providing expertise.

Although the general discussion is universal,

there are references to standards and detailed tables which are of value only to US practices. For some topics the reader is recommended to specialist works, for example for tunnel lining design and compressed air work. This allows for the enlargement of this second edition to include important new chapters such as 'Fire life safety' (15 pp.).

Perhaps the most valuable contribution is Terrence McCusker's chapter on 'Tunnelling in difficult ground' (24 pp.) and it is the most relevant to the geotechnical engineer. Geotechnical investigation in Chapter 4 is a very useful survey although, except for N. Barton *et al.* and a couple of others, the references are all American. The chapter does include a very important section on the Geotechnical Design Summary Report and Geotechnical Baseline Report and these are enlarged upon in the last few pages on tunnel construction contracting where the differing site conditions clause and the Disputes Review Board are strongly advocated.

There are problems with poor reproduction of photographs and some of the figures and tables have been reduced too much for easy reading. Although there is no index, the contents list averages an item every two pages. The main topics, in addition to those already mentioned, cover soft and rock tunnels and shafts, cut-and-cover and immersed tube tunnels, surveys, shotcrete, electrics, use of shotcrete and a chapter on rehabilitation.

There is an amusing misprint in the chapter by Spiritzbeton and some strange physics (Std. Temp = 20°C = 70°F; Std Pressure = 29.29 in of mercury); even Parsons perhaps appropriately became Persons. There appears to be no reference to recent developments in Japan, for example multi-face TBMs, shaft excavation by robots, though such omissions illustrate the problems of producing a handbook. It is not possible to say all there is in 500-odd pages but this volume certainly covers a great deal.

The book is dedicated to the memory of John O. Bickel who conceived the initial enterprise and who sadly died in 1991 before this second edition was complete.

J. BUCHANAN

Tunnel boring machines—trends in design and construction of mechanized tunnelling. (1st edition.)

H. Wagner and A. Schultze (eds). A. A. Balkema, Rotterdam, 1996. ISBN 90 5410 8118, Hfl 120, 260 pp.

These proceedings present 25 papers from a conference at Linz, December 1995. Dipl. Eng. H. Wagner gave the keynote and closing lectures and introduced the subject of geomechanics

which is the coordination of mechanics, electronics and robotics in the field of geotechnology.

The papers are mostly general discussions of the use of tunnel boring machines (TBMs) in many different ground conditions, with some interesting case histories including the latest in Japanese multi-face TBMs. Much of the computer technology is related to the design of tunnelling segments and the last few papers refer to their fabrication and jointing systems. Robotics are discussed in relation to lining erection and computer programs are applied to path planning and to cost analyses of alternative construction methods according to different geological conditions.

The most important paper for the geotechnical engineer is by G. Swoboda and M. Mamsour—'Three-dimensional numerical modelling of slurry shield tunnelling'—where the modelling is used to study soil, ground, slurry and grouting pressures and simulate the construction process under different ground conditions. The relationship of rock pressure and consequent deformation of the exposed surfaces to the design of TBMs is shown in the following paper by K. H. Gehring.

There are some misspellings and errors—Hoek and Brown have been misquoted on p. 64 and there is confusion between 'max' and 'ave' on p. 73. Nevertheless, the editors are to be congratulated on bringing out the proceedings so quickly. They constitute an interesting and valuable up-to-date review of various aspects of TBM tunnelling.

J. BUCHANAN

Deep excavations—a practical manual. (1st edition.)

M. Puller. Thomas Telford, London, 1996. ISBN 0 7277 1987 4, £80, 435 pp.

It is surprising that so few books have been written which tackle the overall design of deep excavations. This is perhaps because there are so few potential authors who can straddle the different disciplines necessary to produce an authoritative textbook/reference manual. Fortunately, Malcolm Puller has used his extensive experience to summarize the key issues which must be addressed for the successful construction of deep basements.

The chapters are: introduction; the control of groundwater; open excavation—side slopes and soil retention; vertical soil support—wall construction; design of vertical soil support; cofferdam construction; cofferdam design; basement construction and design; cut-and-cover construction; shafts and caissons—construction and design; and soil movement due to deep excavations. Each chapter contains references and a

comprehensive bibliography to assist further research into particular topics.

Mr Puller has managed to combine theory and experience in a very readable form. The book is well-illustrated and collects guidance from a wide range of sources, including the author's experience. The chapter titles do not give a full flavour of the depth of coverage of the book. For instance, the chapter on open excavation includes a comprehensive discourse on reinforced soil and soil nailing.

As ever, one can make some minor criticisms.

- (a) Groundwater control concentrates on temporary works with nothing on permanent works measures such as drainage layers beneath slabs and drained cavities.
- (b) There is concentration on civil engineering structures and some references relevant to building basements are not mentioned, for example BS 8102 and CIRIA Report 139 on water-resisting basements.
- (c) The observational method is only briefly mentioned.

However, the book provides very useful guidance on the design and construction of deep excavations. It also gives the results of the author's extensive experience and quotes widely from the published literature. The book refreshingly offers cost comparisons between different techniques. The book is recommended to all those involved in the planning and design of deep excavations.

T. J. P. CHAPMAN

Barriers, liners and cover systems for containment and control of land contamination.
(1st edition.)

K. D. Privett, S. C. Matthews and R. A. Hodges. Construction Industry Research and Information Association, Special Publication 124, 1996.

ISBN 0 86017 437 9, £77.00 (£34.00 to CIRIA members), 278 pp.

This book deals with design criteria, theory and practice of in-ground barriers, liners and cover systems used to contain both liquid and gaseous contamination. It forms part of CIRIA's contaminated land programme: the twelve volumes of Special Publication 106 gave the overview of the subject area and this report is a more detailed study of current (and probable future) good practice.

The book is divided into two parts. Part A, 'General concepts' (55 pages), provides an excellent review of the technical and legal issues behind containment of contamination. The principles behind most barrier (including slurry walls, jet grouting, secant piles, mix in-place and injection grouting), liner and cover techniques are discussed in a section which contains some

material abstracted from Volume 6 (Containment and hydraulic measures) of CIRIA Special Publication 106. Part B is more substantial (170 pages) and deals with detailed aspects of design, specification, construction and quality control for in-ground barriers, liner and cover systems in turn. Installation methods are discussed and compared, as are material properties (e.g. slurries and geomembranes) from both theoretical and practical aspects.

The book is well-presented and illustrated in the familiar CIRIA style and is written without too much jargon; it provides a lot of useful information in a fairly slim volume. Unfortunately it was written before the NRA and HMIP became the Environment Agency in April 1996, and this dates the discussion of legal issues in Part A. This apart, it is an excellent book which is likely to be equally useful as an overview for general geotechnical engineers and as a detailed reference for contaminated land specialists. The sections on barrier methods such as jet grouting and slurry walls may also be useful for engineers working on uncontaminated sites where those methods are used as temporary works to control groundwater.

M. PREENE

Earth reinforcement and soil structures.
(3rd edition.)

C. J. F. P. Jones. Thomas Telford and ASCE Press, 1996. ISBN 0 7277 2525 4, £45, 379 pp.

This book is a third edition of Professor Jones' book, first published in 1985 by Butterworth & Co and reissued as a revised reprint in 1988. This edition has been fully updated and takes into account the new British Standard Code of Practice for strengthened/reinforced soils and other fills, BS 8006: 1995.

The book summarizes the history of reinforced soil and the various areas of application—from bridgeworks to foundations to industrial applications. It explains the underlying theory, the materials and how reinforced soil structures should be analysed and designed. Finally, it gives an overview of the costs and economics before discussing the vexed subject of the durability of reinforced soil elements. As in previous editions, it concludes with a number of worked examples.

This is a major update of an important textbook. The introduction of BS 8006 has invalidated all previous UK reinforced soil design guides. Designers attempting to come to terms with its requirements will find a lot of useful information and helpful advice in this authoritative book.

T. J. P. CHAPMAN