Book review

Geosynthetic Encased Columns for Soft Soil Improvement.
M. Almeida, M. Riccio, I. Hosseinpour and D. Alexiew
(eds), CRC Press/Balkema, Leiden, The Netherlands,
2016, ISBN: 978-1-138-03878-3, £69.99, 138 pp.

Geosynthetic encased columns (GECs) are a relatively recent technique that is used to reduce settlements and to improve the load-bearing capacity of soft and highly compressible deposits where traditional (non-encased) stone columns are not a suitable alternative. This technique was first proposed as a concept in the 1980s and then migrated to practice in the 1990s (Alexiew and Raithel 2015). GECs have now been used in some parts of the world for almost three decades. The most common design approach was originally developed by Raithel and Kempfert (2000), but other design methods have also been proposed. There is now a large literature comprising case studies of GECs supporting embankments, and guidance on the analysis and design of these structures. Nevertheless, there is until now no single book summarising the current knowledge for this soft ground improvement technique and recommendations for their design. The book reviewed here meets the need of design engineers for a comprehensive single source for the specification, design and analysis of geosynthetic encased columns for soft soil improvement.

Chapter 1 presents the general principles and application of GECs for soft soil improvement. The load transfer mechanisms and drainage features of encased granular columns are outlined, and GEC installation methods described. Then the selection of the GEC component material properties is discussed in detail. This includes the properties of the granular soil (sand or gravel) that forms the column and the geosynthetic used to provide the encasement.

Chapter 2 presents the design and calculation methods for GECs used to support an embankment. These calculations are used to determine the hoop forces and strains in the geosynthetic encasement and to calculate the vertical stress acting on top of the GEC and on the surrounding soil (Hosseinpour *et al.* 2015). In addition, details to calculate the time-settlement behaviour of the embankment-foundation and its stability, accounting for the contribution of the geosynthetic, are covered in this chapter. Column layout is also discussed with the objective of choosing a cost-effective grid pattern.

Design examples are presented in Chapter 3 using the methodologies presented earlier. The concepts of 'SLS' (Serviceability Limit State) and 'ULS' (Ultimate Limit State) are introduced, together with partial factors of safety and reduction factors to be applied at design. A series of parametric studies are presented, and design charts are provided in annexes. The use of the design charts is demonstrated step by step, using four examples.

Chapter 4 discusses an instrumented test embankment constructed in Brazil (Almeida *et al.* 2014) and other well-documented GEC projects in Brazil and Europe. Different numerical approaches commonly used to simulate the behaviour of GEC systems in 2D and 3D analyses are presented in Chapter 5. The numerical simulations described in this chapter were performed as part of an actual field project. The applicability and limitations of each model are discussed and provide the reader with practical guidance on the use of numerical modelling for more complex scenarios.

This book contains a good review of the principles behind GEC soil improvement, comprehensive calculation examples, guidelines for numerical analyses, detailed real-world project examples, and practical tips. The book is aimed at practising civil and geotechnical engineers but is also a useful resource for researchers, graduate students and undergraduate students taking advanced geotechnical foundation engineering courses.

R. J. Bathurst

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