Editorial

Castorina Silva Vieira PhD

Assistant Professor, CONSTRUCT, Faculty of Engineering,
University of Porto, Portugal

Environmental Geotechnics is a well-recognized scientific journal focused on a diverse range of issues related to geoenvironmental engineering, covering multidisciplinary research and technological advances linked to the reduction of waste, waste disposal facilities, climate change, remediation of contaminated sites, geothermal energy, carbon sequestration, mine site rehabilitation, sustainable design and the like. The interdisciplinary nature of the journal is evidenced in this issue, where sustainability assessment methodologies, mitigation measures to control post-construction soil deformations, bioremediation of contaminated soil and carbon dioxide sequestration are all addressed.

Nowadays many types of earth-retaining wall solutions able to perform the same function are available to designers. As geotechnical engineers we must try to find the most sustainable solution. A sustainable design involves finding a good balance between the cost of materials, the technical requirements, construction and maintenance, the environmental impacts and the functional needs. In the first paper of this issue, Damians *et al.* (2018) presents an assessment methodology for selecting the best sustainable earth-retaining wall solution.

In an earlier study, Damians *et al.* (2017) analysed and discussed the environmental impacts associated with different earth retaining wall types (gravity, cantilever and mechanically stabilised earth – MSE) using a life-cycle assessment (LCA) approach. In this issue of *Environmental Geotechnics*, the paper by Damians *et al.* (2018) extends their earlier study, presenting a sustainable assessment methodology based on the relative importance of three requirements (pillars): environmental, economic and societal/functional. The environmental pillar is focused on environmental impacts and is analysed using an LCA approach (Damians *et al.*, 2017). The economic pillar is concentrated on project costs (manufacture and transportation of construction materials, material losses and on-site labour). The societal/functional pillar is linked to issues such as safety, aesthetics, ease of design and constructability. The sustainability assessment model used by Damians *et al.* (2018) is based on the value integrated model for sustainable evaluations (MIVES) methodology using value theory and multi-attribute assumptions. They conclude that when environmental issues are of major concern to stakeholders, the best solution, regardless of wall height, is achieved with MSE walls.

Slab-track high-speed railways are very demanding structures in terms of allowable settlements, requiring frequent maintenance and incurring significant costs. Post-construction deformations of embankments supporting slab-track railway lines due to the settlement of earthworks induced by soil-atmosphere interactions

and the impact of distinct protective measures are modelled by Pérez-Romero *et al.* (2018). The effect of the use and different locations of impermeable membranes on the performance of slab-track railway earthworks is numerically studied, analysing the influence of climatic conditions, height of the earthworks and suction value at the foundation level. Making use of real climate data, they have concluded that partial or total fill impermeabilisation is a suitable mitigation measure for the undesirable embankment settlements caused by fill-atmosphere interaction, thereby reducing the cost of slab-track systems maintenance.

Contamination of soil by petroleum hydrocarbons (PHC) is currently of major concern, particularly in areas where exploration, transportation and production of oil take place. Among the remediation methods to mitigate PHC pollution, hybrid approaches combining electrokinetics and bioremediation have recently been put forward (Mao *et al.*, 2012; Keykha *et al.*, 2014). Using these hybrid methods the natural biodegradation of the contaminants is accelerated, as a result of the distribution of nutrients by electrokinetics and through the growth and diversity of the microbial community. The microorganisms enhance the degradation of pollutants to less harmful substances and thus the bioremediation is successful. However, the effectiveness of this bioremediation process is strongly influenced by the changes in soil pH that occur during electrokinetics. In the conventional anode-cathode configuration a zone of high pH develops near the cathode while an acid zone is created at the anode. The development of this pH gradient in the soil by electrolysis reactions of water can reduce the microbial levels and diversity, which means that control of soil pH is of utmost importance for a successful bioremediation solution.

In this issue Hassan *et al.* (2018) propose a new technique to distribute nutrients and stabilise soil pH, adopting a novel anode-cathode compartment that keeps the soil pH relatively unchanged by electrokinematics. This novel configuration succeeded in delivering nutrients throughout the soil enhancing the electrokinematic bioremediation of soil contaminated with biodegradable compounds.

There is currently a widespread consensus on the need to reduce greenhouse gas emissions to combat climate change and to meet the Kyoto Protocol. This means that humanity should pursue the diversification of clean energy sources, energy efficiency and the replacement of fossil fuels by renewable sources of energy, in combination with the development of carbon dioxide capture and sequestration technologies. Carbon dioxide sequestration involves finding suitable storage locations like depleted oil and gas reservoirs, deep aquifers or unmineable coal seams within a short distance of

important sources of carbon dioxide, to reduce transportation costs and the corresponding carbon footprint. Sarhosis *et al.* (2018) presents a preliminary evaluation of the carbon dioxide storage potential of the deep-lying coal seams of the South Wales Coalfield. The storage capacity for carbon dioxide and the energy potential that can be achieved by coal bed methane recovery are estimated. Although this study was carried out at a regional level the authors conclude that carbon dioxide sequestration in coal beds with enhanced methane recovery has a reasonable deployment potential.

All the papers in this issue of *Environmental Geotechnics* represent steps towards a more sustainable geoengineering practice. Moreover, it is hoped that this issue will serve as an encouragement to all stakeholders (researchers, designers, contractors, owners) to promote and implement a circular economy in geotechnical engineering.

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