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Editorial

Geotechnical Engineering

Editorial: Advancing geotechnical practice through investigation and modelling

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This issue brings together nine contributions that, taken as a whole, illustrate the breadth of contemporary geotechnical practice and research – from the characterisation of problematic soils and rock masses in specific geological settings, to combined experimental and numerical investigations, a theoretical parametric study and a practical application to slope stability assessment. Read together, they show how progress in geotechnical engineering depends on the combined use of materials characterisation, field observations and numerical modelling.

The issue opens with three contributions concerned with the geotechnical characterisation of soil and rock masses in specific geographical and geological settings, through statistical analysis of laboratory data and field-based investigation techniques and, in one case, to detect early signs of structural distress. The first article (Doan and Nyambayo, 2026) reviews the geotechnical properties of common peats found across the British Isles, including their high porosity, compressibility and permeability dependence, all of which contribute to the settlement, failure and creep behaviour frequently observed in peat-based ground conditions. The paper proposes new correlation equations for British Isles peats, based on a re-analysis of published data and comparison with international datasets.

The second contribution (Sopaci and Akgün, 2026) examines the geotechnical parameters of the Antalya tufa rock mass (ATRM) in southern Turkey. Through normality testing, principal component analysis and multiple linear regression applied to ten parameters, the article shows that the ATRM could be better characterised by strength parameters (uniaxial compressive and tensile strength) and index parameters (unit weight and porosity).

Closing this group of papers, a section of the Gongyu expressway on the Qinghai–Tibet plateau was analysed by Bian *et al*. (2026). In this region, accelerating permafrost degradation is causing widespread distress in block-stone cooling embankments. Combining field investigation, drilling and ground-penetrating radar (GPR) surveys, the authors propose a GPR-based porosity inversion method capable of detecting structural anomalies before they compromise the embankments' cooling performance.

Characterising materials and ground conditions, however, is only part of the picture: understanding how structures actually behave over time is equally essential to sound geotechnical design. One article addresses, illustrating how in situ data can be used to assess settlement and load-transfer mechanisms in real structures over an extended period of time.

In particular, (Lopes *et al*., 2026) presents a combined field and laboratory methodology for evaluating the consolidation stage and predicting future settlement of fill placed over soft clay, applied to a case study on the campus of the Federal University of Rio de Janeiro, subsequently developed as a Technological Park under a 50-year lease.

Complementing this field-based evidence, a third group of articles turns to calibrated numerical modelling, combining experimental testing with back-analysis to capture complex soil–structure interaction mechanisms. The first (Lin *et al*., 2026) presents back-analyses of three bi-directional pile load tests on drilled shafts socketed into weak sandstone for a cable-stayed bridge, used to calibrate hardening soil model parameters and interface properties that could not be derived directly from rock quality designation and uniaxial compressive strength data alone. The second article (Li *et al*., 2026) develops and validates a three-dimensional coupled hydro-mechanical finite-element model to analyse geogrid-encased steel slag columns in saturated soft clay, comparing three modelling approaches.

Beyond calibrated back-analysis, one contribution (Qi *et al*., 2026) takes a more theoretical approach, re-examining – from first principles – a key parameter used in seismic response analysis. Using El Centro and Kobe earthquake records and artificial ground motions across 70 site types, the authors show that the influence of the equivalent shear-strain reduction factor depends strongly on the site period, and revised site-period-dependent values for use in practice are proposed.

This issue closes by returning to practice, with an application-oriented study on slope stability along National Highway NH-3 in the Beas Valley, Himachal Pradesh (Sharma *et al*., 2026), where rainfall-induced failures are a recurring hazard during the monsoon. Integrating kinematic analysis, geological strength index characterisation, limit equilibrium and finite-difference methods across four critical failure zones, wedge failure was identified as the primary mechanism, with the factor of safety decreasing by 21–32% between unsaturated and saturated conditions and instability peaking during the initial period of rainfall infiltration.

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