《Geosynthetics International》

（国际土工合成材料）

<双月刊>

2023年第30卷第3期

摘要集

中国土工合成材料工程协会秘书处

目　录

Performance of GCLs after long-term wet–dry cycles under a defect in GMB in a landfill

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Abstract: Two geosynthetic clay liners (GCLs) with sodium bentonite and three GCLs with polymer-amended bentonite were subjected to wet–dry cycles selected to simulate the conditions to which a GCL on an 18° slope might be subjected: for a GCL below an exposed geomembrane wrinkle with a hole. The wetting involved water flowing over the GCL for 8 h each cycle. Three drying cycles (0.67, 7, and 14 days) were examined. After 12–18 months of wet–dry cycles, the samples were X-rayed to identify representative specimens for testing. The changes in the hydraulic conductivity, *k*, of the GCLs were obtained when permeated with two synthetic municipal solid waste leachates at an applied head of 0.35 m for a range of effective stresses (3–150 kPa). The results showed an up to four orders of magnitude difference in *k* depending on applied stress and RMD of the leachate permeant. The effects of the number and the duration of the wet–dry cycles, the GCL mass per unit area, presence/absence of polymer modification, the carrier geotextile, the number and the size of the needle-punched bundles, and the bundle thermal treatment are discussed.

Keywords: Geosynthetics, Geosynthetic clay liner, Wet–dry cycle, Base, Polymer-modified bentonite, Hydraulic conductivity

Slope displacement and soil pressure of soilbag-retaining wall influenced by arrangement

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Abstract: Soilbags have a good effect on slope reinforcement. In this paper, five kinds of physical model tests were carried out on slopes strengthened by reinforced soilbag-retaining wall, namely analysis of the failure mode and failure pressure of the slope, the variation trend of horizontal displacement of the slope, the maximum horizontal displacement and the horizontal transmission and vertical distribution of earth pressure. Thus, the influence of the arrangement mode of the soilbags on the slope reinforcement effect were studied. The results show that the alternate arrangement between layers (arrangement mode 1) had the deepest slip surface, the maximum bearing capacity and the minimum horizontal displacement, thus its reinforcement effect was the best. In addition, the reinforcement effect of the slope was related to the amount of tail embedded into the slope body, the interaction of soilbags in the layer and the embedment between the upper and the lower layers of soilbags. It was found that when the embedding degree of the tails into the slope was higher, the horizontal deformation constraint of the slope was stronger, resulting in a deeper sliding surface and a higher ultimate bearing capacity of the slope. This shows that the slope reinforcement effect was better with soilbags.

Keywords: Geosynthetics, Soilbag-retaining wall, Arrangement mode, Horizontal displacement, Earth pressure

Mechanical properties of PVC geomembrane based on non-contact measurement

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Abstract: The mechanical properties of polyvinyl chloride (PVC) geomembrane (GM), particularly its elastic modulus, are of the utmost importance in engineering design and evaluation of performance. The existing test methods make it difficult to provide an accurate elastic modulus of PVC GM. This research presents the establishment of an improved method for analysing the true stress–strain by non-contact measurement technology to determine the elastic modulus. Digital image correlation (DIC) was used to measure the axial and transverse strain, and it was found to give measurements of strain with a high degree of accuracy. The variation of Poisson's ratio is discussed and the true cross sectional area is determined, allowing the true stress to be calculated theoretically. In accordance with the true stress–strain curve, the elastic modulus and linear range are established, which can provide designers with the tools to evaluate the true performance of GM and help them to select anti-seepage materials in design.

Keywords: Geosynthetics, PVC GM, DIC, Poisson's ratio, True stress–strain, Elastic modulus

Analytical solution for soil flushing using PVD system with rectangular pattern

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Abstract: Soil flushing using prefabricated vertical drains (PVDs) is an innovative subsurface remediation technology for contaminated fine-grained soils. An analytical solution is presented to investigate the performance of a PVD-enhanced system arranged in a rectangular pattern for soil remediation. The analytical solution is derived based on a simplified equivalent model in which PVDs are substituted by drain walls. The results of the analytical solution are shown to be roughly consistent with those obtained from the finite-element method. Using the proposed solution, the remediation efficiency for a rectangular layout is demonstrated to be higher than that for a parallel layout. Furthermore, the effects of distance between injection and extraction PVD, injection rate, distribution coefficient, and dispersivity are investigated. Results indicate that a square pattern is the optimal layout of PVDs compared to other rectangular patterns. Increasing the injection rate of individual PVDs is an effective way to improve the remediation efficiency. The increase of distribution coefficient of contaminant leads to a significant increase in the remediation time, and the increase of longitudinal and transverse dispersivity results in a more uniform spatial distribution of contaminant concentration during the flushing process.

Keywords: Geosynthetics, soil flushing, PVD-enhanced system, rectangular pattern, analytical solution

Dynamic behaviour of pipe protected by rubber–soil mixtures

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Abstract: As reuse materials, waste tyres mixed with soils are valuable materials to be used for many purposes in geotechnical projects that may be subjected to dynamic loads. The aim of this study is to assess the efficacy of using waste tyres in buried pipe protection. To achieve this purpose, a series of laboratory model tests were carried out to investigate the dynamic responses of pipe buried in pure soil and rubber soil mixtures with volume content of 10%, 20% and 30% rubber particles. Test results such as earth pressure and strain of buried pipe are discussed in this study. The results indicate that inclusion of 20–30% rubber particles in the mixtures leads to a change in earth pressure increment distribution, and these mixtures lead to obvious reductions in earth pressure increments. For the mixtures with 20–30% rubber particles, the pipe had lower strain under the dynamic loading. Compared with pure soil, the mixtures with 20–30% rubber particles exhibited better performance with regard to the responses of the pipe–soil system. Hence, the research undertaken in this paper provides a viable approach to protect buried pipes subjected to dynamic loading.
Keywords: Geosynthetics, Waste management & disposal, Earth pressure, Strain

Reliability analysis for internal seismic stability of geosynthetic-reinforced soil walls

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Abstract: A reliable design of geotechnical structures requires an appropriate estimation and consideration of the parameter's uncertainties. Traditional design codes account for the uncertainties by using conservative factors. This paper presents a reliability-based analysis of the seismic internal stability of geosynthetic reinforced earth retaining walls. The deterministic computation of the structure safety factor is based on the upper bound theorem of limit analysis. The discretization technique is used to generate the rotational failure mechanism so that the seismic loading can be implemented by the pseudo-dynamic approach. The considered uncertainties involve the soil shear strength parameters, seismic loading and reinforcement strength parameters. The Sparse Polynomial Chaos Expansion combined with Monte Carlo Simulation is the reliability method considered to carry out the probabilistic analysis. The influence of the correlation between the soil parameters and the random variables distribution type on the probabilistic results are investigated and discussed. A global sensitivity analysis is performed in order to specify the contribution of each random variable to the reinforced earth retaining wall safety factor.
Keywords: Geosynthetics, earth retaining wall, limit analysis, reliability, pseudo-dynamic approach, discretization, sparse polynomial chaos expansion

Geogrid-soil interaction: experimental analysis of factors influencing load transfer

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Abstract: This paper presents interaction experiments with transparent soil to investigate the load transfer at the interface of different geosynthetic reinforcements. Microscopic interaction performance was evaluated in terms of mobilised tensile loads and interfacial shear stresses resulting from the relative movement between geosynthetic and soil. The effects of geogrid aperture size, tensile stiffness, geogrid type and reinforcement configurations on the load transfer were analysed. It was found that with increasing soil deformation, the contribution of friction to the total load transfer decreased and the transverse ribs were increasingly activated. The interfacial shear stresses were reduced as the ratio of geogrid aperture to mean particle size increased, resulting in lower geogrid loads. Higher geogrid loads were mobilised with increasing tensile stiffness of the reinforcement, but lower displacements of geogrid and adjacent soil occurred. Consistent results were found for woven PET and laid PP geogrids. The most effective load transfer was obtained for the aperture configuration with two closely spaced transverse members at each rib, as the soil particles were additionally confined. When the geogrid was attached to a nonwoven geotextile, the separation function was enabled, but the reinforcement performance of the geocomposite was lower due to reduced particle-aperture interaction.

Keywords: Geosynthetics, soil-geosynthetic interaction, geogrid, interface efficiency, load transfer, physical modelling, transparent soil, digital image correlation (DIC)