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摘要集

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目　录

1. **标题:** Effect of a two-tiered configuration on the seismic behaviour of reinforced soil walls
   作者: A. R. Jamnani, M. Yazdandoust, M. Sabermahani.....1

2. **标题:** Soil/geotextile filter compatibility: a geometrical, experimental and micro-structural approach
   作者: N. Moraci, M. C. Mandaglio, S. Bilardi.....2

3. **标题:** The use of geosynthetics in roads
   作者: J.P. Giroud, J. Han , E. Tutumluer , M.J.D. Dobie.....3

4. **标题:** Behaviour of soilbags subjected to monotonic and cyclic vertical loading
   作者: S. H. Liu, B. X. Fang, Y. Lu, S. Chen.....4

5. **标题:** Influence of geosynthetic stiffness on analytical solutions for reinforced fill over void
   作者: F.M. Naftchali, R.J. Bathurst.....5

6. **标题:** Evaluation of concrete and geomembrane lining options for a canal in Egypt
   作者: J.P. Giroud, H. Plusquellec.....6

Effect of a two-tiered configuration on the seismic behaviour of reinforced soil walls

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Abstract: Shaking table tests were performed on reduced-scale models of integrated and two-tiered mechanically stabilised earth (MSE) walls to evaluate the effect of a tiered configuration on the seismic behaviour of metal-strip and geogrid reinforced soil walls. The results showed that, although inextensible reinforcements could reduce the fundamental period, acceleration amplification and lateral deflection and improve wall stability, these benefits declined with the use of a tiered configuration and gradually faded with an increase in the offset distance. This made changing the degree of extensibility a low-impact factor in two-tiered MSE walls with a sufficiently large offset distance ($D>(0.4\text{-}0.5)H$). In order to benefit from the advantage of a tiered configuration, it was found that $0.22H$ should be considered as the minimum offset distance. The findings indicated that preventing the development of a slip surface in the lower half of the wall, improving the seismic stability by increasing the failure threshold acceleration, mitigating acceleration amplification and decreasing the reinforcement load were the main advantages of a tiered configuration. Moreover, it was concluded that the Mononobe-Okabe method could be used to find the upper bound for estimating the reinforcement forces in two-tiered MSE walls.
Keywords: Geosynthetics, Two-tiered MSE wall, Seismic performance, Failure mechanism, Reinforcement load, Particle image velocimetry (PIV)

Soil/geotextile filter compatibility: a geometrical, experimental and micro-structural approach

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Abstract: The paper focuses on the evaluation of the long-term behaviour of geotextile filters in contact with cohesionless soils. The clogging, blinding and piping levels of the filtering systems have been evaluated analysing the results of long-term filtration tests, and of geometrical and microstructural analyses. The geometrical approach was based on the comparison between geotextile pore size distribution and soil grain size distribution, also taking into consideration the critical diameter of suffusion. Scanning electron microscope images of geotextiles before and after filtration tests provided useful information about blinding and clogging phenomena and about variation of the geotextile internal structure (fibres and voids). Moreover, in order to predict the geotextile filtration opening size, an existing mathematical model was modified to take into account the variation of the geotextile final porosity due to the agglomeration of particles around geotextile fibres or within geotextile pores. The geometrical, experimental and micro-structural approach allowed the Authors to better evaluate the soil/ geotextile filter compatibility in the complex case of geotextile in contact with internally unstable soils. This procedure could be a useful tool in geotextile filter design under critical/severe conditions.

Keywords: Geosynthetics, geotextiles, filtration test, geometrical analysis, SEM analysis, pore size distribution, impregnation level, blinding, piping

The use of geosynthetics in roads

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Abstract: This paper addresses unpaved and paved roads improved with geosynthetics, such as geotextiles, geogrids and geocells. The paper examines the mechanisms associated with the use of geosynthetics to improve roads, describes the principles of the design methods used to quantify the benefits of geosynthetics used in unpaved and paved roads, presents case histories to demonstrate the use of geosynthetics to solve challenging road problems, and discusses the relevance of tests and trials to real roads. This paper is supplemented by four presentations in pdf format that contain more than 800 slides. These four presentations are updated versions of the four presentations made during a one-day short course at the 11th International Conference on Geosynthetics held in Seoul, Korea, in September 2018. The paper that follows contains a summary of each of the four presentations, with special emphasis on key issues.
Keywords: Geosynthetics, geotextiles, geogrids, geocells, roads, paved, unpaved, pavements, traffic, loads, functions, mechanisms

Behaviour of soilbags subjected to monotonic and cyclic vertical loading

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Abstract: Soilbags have been successfully used in the reinforcement of building foundations that can function as the base isolation. A series of unconfined compression tests under monotonic and cyclic loading were conducted to investigate the static bearing capacity and the dynamic deformation behaviour of stacked soilbags. The results of monotonic loading tests demonstrate that the ultimate compressive strength and the tangent compression modulus of soilbags tend to relatively stable values of around 0.7 MPa and 6.73 MPa, respectively, when the number of layers exceeds three. Under cyclic loading, the accumulated vertical strain of stacked soilbags increases nonlinearly under the application of cyclic loading, reducing with each loading cycle and even reaching a relatively stable state where the vertical strain is primarily elastic, which can be described with an empirical formula with respect to the static vertical stress, the cyclic load ratio and the number of loading cycles. The resilient moduli of stacked soilbags change slightly during cyclic loading period, and increase with the increasing static vertical stress and the decreasing cyclic load ratio. The outcomes of this study demonstrate the feasibility of soilbags as the base isolation as they have prominent bearing capacity and stable deformation behaviour under cyclic loading.

Keywords: Geosynthetics, soilbags, unconfined compression test, cyclic loading, bearing capacity, deformation, resilient modulus

Influence of geosynthetic stiffness on analytical solutions for reinforced fill over void

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Abstract: Analytical solutions for geosynthetic reinforced fills over a void have appeared in the literature starting in the 1980s. Current solutions pay little or no attention to the influence of the creep-reduced stiffness of the geosynthetic reinforcement under tensile loading. This paper addresses this gap by introducing a reinforcement stiffness limit state in the design of these systems. The choice of reinforcement stiffness is based on a simple two-parameter hyperbolic isochronous load-strain model developed by the authors and applied to a large database of uniaxial and biaxial geogrids and woven geotextiles. The paper provides a design chart procedure that can be used with four well-known analytical solutions to compute the maximum reinforcement load. In addition to the stiffness limit state, the design chart approach includes vertical deformation and reinforcement strain serviceability limit states, and a tensile strength limit state. A novel feature of the design charts is a quantitative link to the ultimate strength of the reinforcement to estimate the isochronous stiffness of the reinforcement for different elapsed loading times and strains. There are many instances in the literature where the reinforcement stiffness was taken from a constant rate-of-strain tensile test. The paper shows that this is non-conservative for design.
Keywords: Geosynthetics, Reinforced fill, Void, Isochronous load–strain behaviour, Tensile stiffness, Creep, Hyperbolic stiffness model

Evaluation of concrete and geomembrane lining options for a canal in Egypt

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Abstract: This technical note complements a published lining evaluation for a canal in Egypt. Concrete and geomembrane linings are compared regarding leakage control and cost. Published data on leakage with concrete and geomembrane linings are reviewed, and analyses show that the predicted leakage rate is significantly lower with a geomembrane lining than with a concrete lining. The findings presented herein on leakage control and cost are significantly different from the findings of the published lining evaluation.
Keywords: Geosynthetics, Geomembrane, Lining, Concrete, Canal, Leakage, Cost