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摘要集

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目　录

Quantitative assessment of the shoreline protection performance of geotextile sandbags at an *in-situ* coastal experimental station

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Abstract: The coast of China is periodically impacted by tropical cyclones and storm surges, and has experienced significant coastal erosion problems. Traditional "hard engineering" coastal protection measures used to protect Chinese sandy coasts from storm erosion are found to be expensive and less environmental and even make sandy beach disappearing. In this study, geotextile system as a more flexible material was developed and qualitatively compared with the traditional coastal protection measures. An *in-situ* permanent revetment was applied with durable geotextile sandbags on the coast of Chudao in China from October 2018 to October 2020, and it was designed for three different testing segments to optimize the stability and construction cost of geotextile sandbags. The field surveys were carried out to collect the *in-situ* data on beach profiles, wave dynamics, material durability, and sandbag revetment stability. In analyzing the two-year field data collected, it is found that the testing segment-2 wrapped with sheet of plastic geogrids is the most effective of the three testing segments in terms of their coat, structural stability and material durability, and that both the slope of the seabed and the design thickness of geotextile sandbag are the dominate factors responsible for the failure of sandbag structures.

Keywords: Coastal erosion, Geotextile sandbags, Field experiments

Assessing the importance of drainage layers over geomembrane liners within engineered cover systems: Seven years of field monitoring at three mine waste rock piles

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Abstract: Geomembrane liners are commonly subject to defects that can allow water leakage through these openings and significantly undermine their performance. While defects are difficult to prevent and characterize, minimization of potential leakage can still be attained with appropriate lateral drainage over the liner. The objective of this study is to assess the performance of different drainage layer materials within HDPE-lined cover systems at three mine waste rock piles (WRPs) in the Sydney Coalfield, Nova Scotia, Canada. Natural soil, clean gravel and a geocomposite net were employed at the Summit, Victoria Junction and Franklin WRPs, respectively. Extensive field monitoring of precipitation (PPT), moisture content within the cover materials, and head of water above the liner, was performed. The head of water and moisture was consistently high at Summit throughout the year, while consistently low at Victoria Junction and Franklin, with the geocomposite net being just as effective as the gravel layer. Using typical assumptions of defect size/number, leakage rates at Victoria Junction and Franklin remained very low due to limited water head and flow gradient. Therefore, while the prevention of defects is highly challenging at HDPE-lined cover systems, potential defect leakage can be proactively controlled during cover system design with the implementation of adequate drainage layers above the liner.

Keywords: High density polyethylene, Geotextiles, Waste rock piles, Defect leakage, Atmospheric ingress

DIC assessment of foundation soil response for different reinforcement between base and soft subgrade layer – Physical modeling

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Abstract: This paper presents insights from small-scale model tests on statically loaded strip footing on dense base sand supported by a single reinforcement layer. The selected reinforcement includes various lengths of wire mesh and a non-woven geotextile placed on soft subgrade sand. The influence of these inclusions on base and subgrade response (deformations and failure mechanism) is evaluated from the displacement pattern obtained by the digital image correlation (DIC) technique. The benefits of the reinforcement and geotextile were assessed by comparing the results obtained for the improved and unreinforced soil model. Additionally, the confining effect of the reinforcement was experimentally analyzed by comparing the sand displacements around the wire mesh reinforcement with different aperture geometry and geotextile without apertures. These systematically selected reinforcement geometries enabled the investigation of the aperture size influence on base and subgrade behavior during surcharge loading. Results confirm the contribution of reinforcement inclusions to the improved behavior of base and subgrade layers compared to the unreinforced soil. The test results with different reinforcement confirm the influence of the aperture geometry on the model response during the surcharge load application. Compared to large apertures, enhanced confining and membrane actions were obtained for reinforcement with relatively small apertures.

Keywords: Geosynthetics, Digital imaging, Soil reinforcement, Physical modeling, Failure mechanism

Pullout behaviour of polymeric strips embedded in mixed recycled aggregate (MRA) from construction &demolition (C&D) waste – Effect of type of fill and compaction

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Abstract: Recycling and reusing construction and demolition (C&D) waste is the pressing priority, and the use of such non – conventional structural fill in reinforced soil structures (RSS) is gaining momentum. However, the utilisation of mixed recycled aggregate (MRA) from processed C&D waste as structural fill with polymeric strips (PS) and the effect of poorly compacted structural fill on the pullout interaction is not reported. This research presents the viability of using MRA as a structural fill for reinforced soil structures, appraising the physical, mechanical and electrochemical properties of MRA and the pullout behaviour of polymeric strips embedded in MRA at different relative densities in a large-scale pullout box. The results for MRA were compared with those obtained using locally available coarse and fine sands. The test results showed that MRA was alkaline (pH < 9) and had good mechanical properties and shear strength suitable for reinforced soil structures. Pullout testing results exhibited high values of the interface apparent coefficient of friction ($\mu_{S/GSY}$) under dense conditions and a 70–80% reduction in loose conditions. The present study reinforces the viability of using MRA as an alternative structural fill with PS and highlights the effect of construction variability on $\mu_{S/GSY}$.

Keywords: Polymeric strip, Constrained dilatancy, Reinforced soil structures, Soil density, Soil-Geosynthetic interaction

A quasi-2D exploration of optimum design settings for geotextile-reinforced sand in assistance with PIV analysis of failure mechanism

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Abstract: Many earlier studies were focused on testing different types of geosynthetics to investigate effect of reinforcement on bearing capacity, but the effect of tensile strength on the failure mechanism has not been examined sufficiently. Within this scope, a test setup was prepared to apply strip loads on densely compacted reinforced sand under the plane strain condition. The tank containing the reinforced sand was a rectangular prism with perfect transparency, and its interior dimensions were 960 × 200 × 650 mm^3. Firstly, optimum values of design variables (depth of first sheet, length and number of sheets, space between sheets, tensile strength of sheets) for the woven geotextile reinforced sand were determined experimentally. Then, the failure mechanisms of the soil, which were reinforced with geotextiles of different tensile strengths, were observed and analyzed with particle image velocimetry (PIV) technique. Consequently, the failure mechanism of the sand with a single geotextile reinforcement was similar to general shear failure of unreinforced soil. Contrarily, the failure surfaces were deeper and longer. Additionally, the deep-footing mechanism reached out large depth in the case of four reinforcement layers. The failure mechanism converted into a punching type due to a hypothetic increase in the bearing depth of reinforcement.

Keywords: Bearing capacity ratio, Settlement reduction factor, Particle image velocimetry technique, Failure mechanism, Reinforced soil, Tensile strength of geotextile

Multi-scale understanding of sand-geosynthetic interface shear response through Micro-CT and shear band analysis

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Abstract: To understand the process of mobilisation of shear strength in sand-geosynthetic interfaces at a fundamental level, it is essential to precisely characterize the size and shape of the grains and the shear-induced surface changes in geosynthetics. In the current study, shear behaviour of dilative and non-dilative geosynthetics interfacing with sands of different morphological characteristics was analysed through interface shear tests and a gamut of digital imaging techniques. 3D shape parameters of sands such as sphericity, convexity, roundness, aspect ratio, and roughness were quantified at different scales using X-ray micro computed tomography (μCT) and optical profilometry. Interface shear tests revealed higher peak and residual friction angles for particles with greater irregularity, angularity, and surface texture. The surface texture of geotextile surfaces resulted in higher interface friction and higher vertical displacement compared to geomembrane surfaces, which showed completely non-dilative behaviour. Surface changes in geomembranes were quantified using laser profilometry. High resolution images obtained at different stages of shearing were analysed for quantifying the shear zone thickness using digital image correlation (DIC). Thickness of the shear bands, microscopic shearing mechanisms and shear strength are correlated to the multi-scale shape parameters of sands and surface changes in geosynthetic surfaces.
Keywords: Geosynthetics, Micro computed tomography, Interface shear, Shear band, Digital image correlation, Laser profilometry