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摘要集

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目　录

Required strength of geosynthetic-reinforced soil structures subjected to varying water levels using numeric-based kinematic analysis

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Abstract: This work developed a numeric-based kinematic approach for evaluating the required strength of three-dimensional (3D) geosynthetic-reinforced soil structures (GRSSs) with different water levels. Instead of directly employing the pore-water pressure coefficient r_u, this work utilizes numerical simulations to obtain the distribution of pore-water pressures. The presented method avoids to determine the value of ru, which is uncertain as the variation of water tables. A 3D horn-like failure mechanism is discretized to describe the collapse of GRSSs. On this basis, the seepage forces acting on each element of the discretized mechanism are determined by using an interpolation technique. Thanks to the principle of work rate balance, the required reinforcement of geosynthetics is determined through optimization. Sets of design charts are provided for simplicity of practical use, followed by a sensitivity analysis. Results of this paper indicate that the presence of a seepage flow increases the required strength of reinforcements, whereas the inclusion of 3D effects has an opposite effect. The variation of water levels significantly impacts the required strength and the failure pattern of GRSSs. The proposed method in this paper can provide an insight into the design of GRSSs subjected to seepage forces.

Keywords: Geosynthetics; 3D reinforced soil structures; Different water levels; Seepage forces; Numeric-based kinematic analysis

Numerical modeling of geosynthetic reinforced soil retaining walls with different toe restraint conditions

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Abstract: This paper reports numerical modeling of the prototype geosynthetic reinforced soil (GRS) walls corresponding to four centrifuge models that have different toe restraint conditions. The development of the interface stresses and displacements at wall toe during wall construction is investigated to understand how the toe carries load in the GRS walls with a practical toe structure. The numerical results show good agreement with the data from the centrifuge modeling. For the GRS walls with a leveling pad embedded in foundation soil, the shear resistance at the facing block-leveling pad interface acts as the toe resistance to counterbalance a portion of horizontal earth load, while the leveling pad-foundation soil interface play no role in wall performance because the soil passive resistance in front of the leveling pad inhibits the development of the shear stress and displacement on this interface. For the GRS walls with an exposed leveling pad, it is the leveling pad-foundation soil interface that works for carrying the earth load because the wall is more likely to slide along this weaker interface. The contribution of the toe to load capacity depends on the shear strength of the effective toe interface that contributes to the resistance against the earth load.

Keywords: Geosynthetics; Segmental retaining walls; Numerical modeling; Toe restraint; Toe load; Toe interface stress

Importance of thickness reduction and squeeze-out Std-OIT loss for HDPE geomembrane fusion seams

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Abstract: The difference in seam squeeze-out antioxidant loss (in terms of standard oxidative induction time, Std-OIT loss) and thickness reduction are evaluated for three different 1.5 mm-thick high density polyethylene (HDPE) geomembranes (GMBs) seamed using a variety of welding parameters and two different wedge welders. Partial squeeze-out antioxidant loss was detected in seams created from each of the three materials examined, with the majority off loss occurring when seam thickness reductions fell between 0.4 mm and 0.8 mm. Seams with thickness reduction exceeding 0.8 mm were found to exhibit greater squeeze-out Std-OIT loss, with near full Std-OIT depletion for one material. Wedge welder size was found to influence this relationship, some seams created with the large wedge welder exhibiting a near full Std-OIT depletion from squeeze-out at approximately 0.6 mm thickness reduction. Variation in seaming pressure and high load melt index (HLMI) were found to shift the degree of thickness reduction a seam may experience for a given welding speed and temperature, with higher seaming pressure and HLMI values generally resulting in greater thickness reduction. Although, for a given welding speed, wedge temperature, and sheet temperature combination, changes in seaming pressure had a limited effect on squeeze-out Std-OIT loss. This paper provides a rational basis into defining a practical 1.5 mm fusion seam thickness reduction criteria based on limiting antioxidant loss within a seam's squeeze-out and also provides a framework for identifying potentially higher risk fusion seams for future research

Keywords: Geosynthetics; Geomembrane; Seams; Welds; Squeeze-out; Antioxidants; Std-OIT; HDPE; Thickness reduction; Quality assurance

Influence of geosynthetic stiffness on bearing capacity of strip footings seated on thin reinforced granular layers over undrained soft clay

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Abstract: Thin granular fill layers are routinely used to aid the construction of shallow footings seated over undrained soft clay foundations and to increase their load capacity. The influence of time- and strain-dependent reduction in reinforcement stiffness on the bearing capacity and load-settlement response of a footing seated on a thin reinforced granular fill layer over undrained soft clay foundations is examined in this paper using finite-difference method (FDM) numerical models. The time- and strain-dependent stiffness of the reinforcement described by a two-component hyperbolic isochronous tensile load-strain model is shown to influence the bearing capacity and load-settlement response of the reinforced granular base scenario. The additional benefit of a reinforced granular layer diminishes as the time-dependent stiffness of the geosynthetic reinforcement increases. An analytical solution for the ultimate bearing capacity of strip footings seated on thin unreinforced and reinforced granular layers over undrained clay is proposed in this study. The main practical outcome from this study are tables of bearing capacity factors to be used with the analytical solution. The bearing capacity factors were back-calculated from the numerical analyses and account for the influence of rate-dependent properties of geogrid reinforcement materials and clay foundations with soft to very soft undrained shear strength.

Keywords: Bearing capacity; Strip footing; Granular layer; Soft clay; Undrained shear strength; Geosynthetic sheet reinforcement; Geogrid; Hyperbolic isochronous tensile load-strain; mode

Calculating local geomembrane strains from gravel particle indentations with thin plate theory

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Abstract: A new general method is presented to calculate local strains in geomembranes from the deformed shape imposed by overlying coarse gravel particles under vertical pressure. Past methods assume that the geomembrane attains its deformed shape by only deforming vertically and hence neglect the effect of lateral displacements on strain. The new method treats the geomembrane as a thin plate with mid surface components of displacements in three directions (x, y and z). Lateral components of displacements (those in the x and y directions) are related to vertical displacements (z direction) by large-strain-displacement relationships and compatibility of strains. Normal and shear strains in the lateral directions are calculated using Airy's stress function and a linear elastic constitutive law. Bending and torsional strains calculated from curvature and are added to the mid surface strains to find strains on the top and bottom surfaces. The method was validated against data sets with known three-dimensional displacements and strain generated by finite element analysis. The application of the new method to calculate local strains in a geomembrane from the deformed shape obtained from a protection-layer-assessment physical test is illustrated.
Keywords: Geosynthetics; Geomembrane; Geotextile; Protection; Strain

Dynamic response of Mechanically Stabilised Earth (MSE) structures: A numerical study

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Abstract: With increasing construction feasibility, lower costs and proven performance throughout past major seismic events, MSE retention systems have become one of the more preferred retention systems. To study the dynamic performance of MSE walls, the 2D FE simulation using the OpenSees programme with the Manzari and Dafalias constitutive relationship has been utilised. A series of one-dimensional (1D) and 2D site response analyses subjected to sinusoidal inputs at various frequencies have been conducted to find the natural period of the soil medium. Then, using three earthquake time-histories recorded on engineering bedrock (Vs > 700 *m/s*), the behaviour of MSE walls with geogrid length to wall height ratios of 0.50 and 0.75 has been investigated. Multipulse Ricker wavelets have been deployed for a closer inspection of possible failure mechanisms of these MSE walls. Finally, the possibility of simulating an elastic orthotropic block instead of the reinforced soil with geogrids has been examined.

Keywords: MSE wall; Geogrid; Seismic design; Failure mechanism; Elastic orthotropic; Reinforced soil; Retaining wall; Finite element; Settlement

Change pattern of geomembrane surface roughness for geotextile/textured geomembrane interfaces

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Abstract: Applying textured geomembrane improves the frictional performance of geotextile and geomembrane interfaces. However, very limited research has been conducted to analyze the variation in textured geomembrane roughness during geotextile/geomembrane interface shear processes. In this study, a geomembrane surface roughness measurement method for measuring asperity height data with fixed intervals was presented. Normalized profile length and fractal dimension were used to quantitatively describe the geomembrane surface deformation during the geotextile/textured geomembrane interface shear process. It was found that applying normal stress led to a reduction of the roughness parameters. After the mobilization of the peak shear stress during the shear process, the chosen roughness parameters decreased with the shear displacement. And, increasing the normal stress made the shear-induced reduction of roughness parameters more obvious. The hyperbolic model can be used to describe the quantitative relationship between the geomembrane roughness parameters and the shear displacement. This study can help explain the displacement-softening post-peak behavior of the geotextile/textured geomembrane interfaces.

Keywords: Roughness parameter; Textured geomembrane; Direct shear; Shear strength; Profile change

Estimation of seismic active earth pressure on reinforced retaining wall using lower bound limit analysis and modified pseudo-dynamic method

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Abstract: Present study estimates seismic active earth pressure on the reinforced retaining wall by combining the lower bound finite element limit analysis and the modified Pseudo-dynamic method. A series of parametric analyses are performed by varying seismic acceleration coefficient, time period of seismic loading, soil friction and dilation angles, reinforcement spacing, length of reinforcement, soil-reinforcement interface, damping ratio of soil, soil-wall interface, wall inclination, and ground inclination. Maximum active earth pressure is exerted when natural time period of reinforced soil matches with the time period of an earthquake. Reinforcement is found to be effective in terms of reducing active earth pressure significantly on the wall subjected to seismic loading. Effectiveness of reinforcement depends upon two factors, namely vertical spacing and soil-reinforcement interface friction angle. For relatively smaller reinforcement spacing, soil-reinforcement behaves like a composite block, which helps to constraint stresses within a small area behind the wall. Maximum tensile resistance is developed when fully rough interface condition is assumed between soil and reinforcement layer. Failure patterns are provided to understand the behaviour of reinforced retaining wall under different time of seismic loading.

Keywords: Reinforced retaining wall; Lower bound limit analysis; Modified pseudo-dynamic method; Parametric study; Failure mechanism

Influence of uncertainty in geosynthetic stiffness on deterministic andprobabilistic analyses using analytical solutions for three reinforced soil problems

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Abstract: The paper examines the quantitative influence of uncertainty in the estimate of geosynthetic reinforcement stiffness on numerical outcomes using analytical solutions for a) the maximum outward facing deformation in mechanically stabilized earth (MSE) walls, b) maximum reinforcement tensile loads and strain in MSE walls under operational conditions, and c) the mobilized reinforcement stiffness in a geosynthetic layer used to reinforce a fill over a void. The stiffness of the reinforcement is modelled using an isochronous two-parameter hyperbolic load-strain model. A linear relationship between isochronous stiffness and the ultimate tensile strength of the reinforcement is used to estimate reinforcement stiffness when product-specific creep data are not available at time of design. Solution outcomes are presented deterministically and probabilistically. The quantitative link between nominal factor of safety used in deterministic working stress design practice and reliability index is provided. The latter is preferred in modern performance-based design to quantify margins of safety within a probabilistic framework. Finally, the paper highlights the practical benefit of using product-specific isochronous secant stiffness data when available, rather than estimates of isochronous stiffness values based on reinforcement type or pooled data.

Keywords: Geosynthetics; Reinforced fill over void; MSE wall deformations; MSE wall maximum tensile load and strain; Isochronous load-strain behaviour; Tensile stiffness; Creep; Hyperbolic stiffness model; Probability of failure; Reliability index

Land reclamation using the horizontal drainage enhanced geotextile sheet method

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Abstract: Increasingly waste materials or soft soil dredged from sea or river have to be used as fill materials for land reclamation. Although preloading using prefabricated vertical drains (PVDs) has been commonly used as the treatment method for soft soil, this method is time consuming as it can only be applied after all the fill materials have been placed. In this paper, a conceptual design for land reclamation using a horizontal drainage enhanced geotextile sheet (HDeGs) method combined with vacuum preloading is proposed. Large-scale model tests are carried out to verify the effectiveness of the HDeGs method. The proposed method is also compared with the existing prefabricated horizontal drain (PHD) method and the advantages and disadvantages of the HDeGs with vacuum preloading method are discussed. This study has demonstrated that the proposed HDeGs method is not only effective, but also more efficient compared with the PVD or PHD methods, as it can reduce substantially the construction time required for land reclamation.

Keywords: Land reclamation; PVDs; Horizontal drains; Horizontal drainage enhanced geotextile sheet; Large-scale model tests

Effect of geogrid reinforcement on the load transfer in pile-supported embankment under cyclic loading

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Abstract: This paper investigated effects of geogrid reinforcement on the load transfer in pile-supported embankment under cyclic loading using self-moving trapdoor tests. In the self-moving trapdoor test setup, the trapdoor between two stationary portions (which were equivalent to the piles) was supported by compression springs to simulate the subsoil. Quartz sand and a biaxial geogrid were used as the test fill and reinforcement material, respectively. Tests results show that soil arching above the geogrid reinforcement and load transfer to the stationary portions (caused by the soil arching and tensioned membrane effect) experienced a process of "relatively enhancing - relatively degrading" with an increase in the number of cycles and maintained similar degrees within each complete cycle of cyclic loading. Moreover, the inclusion of geogrid reinforcement reduced the mobilization of soil arching, but increased the degree of load transfer to the stationary portions. In addition, cyclic loading with a higher frequency tended to mobilize more soil arching and induce a higher degree of load transfer to stationary portions. Also observed was that a higher frequency cyclic loading tended to decelerate the degradation of load transfer to stationary portions and caused less surface settlement, which indicating increased load carrying capacity of pile-supported embankment.

Keywords: Load transfer; Soil arching; Tensioned membrane effect; Cyclic loading; Pile-supported embankment; Self-moving trapdoor tests

Evaluation of Atactic Polypropylene (APP) geomembranes used as liners for salt ponds

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Abstract: This study focused on evaluating the longevity of Atactic Polypropylene (APP) used as a geomembrane (GM) to line ponds that collect runoff water from salt handling facilities. Samples of APP were exhumed from the ponds that have been in service for 6-, 25-, and 44-years and evaluated in the laboratory. Tests were conducted to analyze the surface cracks and textures, tensile properties, puncture resistance, and ability to hold water (permeability). Control tests were conducted with virgin APP GM. Results were compared based on the difference in the age of the APP, location of where the APP samples were obtained within the side slope of the pond (i.e., submerged, and above water level), and orientation of the side slope in relation to the sun (e.g., east, west, north, or south). Based on the field observations and laboratory evaluations, it was determined that exposure to sunlight accelerates the degradation more so than the chemical degradation that occurs due to the salt content within the pond water. The samples exhumed from the north slope (south-facing) had more severe degradation due to high solar radiation energy deposition.
Keywords: Salt pond; APP; Geomembrane; Degradation

Artificial intelligence algorithms for predicting peak shear strength of clayey soil-geomembrane interfaces and experimental validation

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Abstract: The peak shear strength of clayey soil-geomembrane interfaces is a vital parameter for the design of relevant engineering infrastructure. However, due to the large number of influence factors and the complex action mechanism, accurate prediction of the peak shear strength for clayey soil-geomembrane interfaces is always a challenge. In this paper, a machine learning model was established by combining Mind Evolutionary Algorithm (MEA) and the ensemble algorithm of Adaptive Boosting Algorithm (ADA)-Back Propagation Artificial Neural Network (BPANN) to predict the peak shear strength of clayey soil-geomembrane interfaces based on the results of 623 laboratory interface direct shear experiments. By comparing with the conventional machine learning algorithms, including Particle Swarm Optimisation Algorithm (PSO) and Genetic Algorithm (GA) tuned ADABPANN, MEA tuned Support Vector Machine (SVM) and Random Forest (RF), the superior performance of MEA tuned ADA-BPANN has been validated, with higher predicting precision, shorter training time, and the avoidance of local optimum and overfitting. By adopting the proposed novel model, sensitivity analysis was carried out, which indicates that normal pressure has the largest influence on the peak shear strength, followed by geomembrane roughness. Furthermore, an analytical equation was proposed to assess the peak shear strength that allows the usage of machine learning skills for the practitioners with limited machine learning knowledge. The present research highlights the potential of the MEA tuned ADA-BPANN model as a useful tool to assist in preciously estimating the peak shear strength of clayey soil-geomembrane interfaces, which can provide benefits for the design of relevant engineering applications.

Keywords: Clayey soil; Geomembrane; Interfaces; Peak shear strength

Effect of chemical additives on the consolidation behaviours of mini-PVD unit cells –from macro to micro

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Abstract: The mechanism of adding NaCl, $CaCl_2$ and small amounts of cement/lime (1–4% by dry weight) into clay slurry for mitigating the effect of apparent clogging around PVDs during vacuum consolidation was investigated by mini-PVD unit cell consolidation tests as well as microstructure observations via scanning electron microscopy (SEM) imaging. The consolidation test results indicated that for the specimens with $CaCl_2$, cement and lime additives the rate of consolidation increased considerably, while the effect of the NaCl additive was limited. The SEM images show that for the specimen without additive, there were obvious localized deformation-induced microstructure anisotropies. For specimens with $CaCl_2$ and cement/lime additives, the microstructures of the soils tended to be isotropic. The additives tested reduced the thickness of the diffusive double layer around the clay particles and promoted the formation of a more stable flocculated microstructure, therefore mitigating the effect of apparent clogging.

Keywords: Geosynthetics; Vacuum consolidation; PVD; Apparent clogging; Chemical additive; SEM image

Effect of pressurization frequency and duration on the consolidation of a dredged soil using air booster vacuum preloading combined with prefabricated horizontal drains

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Abstract: The prefabricated horizontal drain (PHD) clogging problem often results in poor drainage and consolidation effects. To solve this problem, this paper adopts air booster vacuum preloading combined with PHDs to treat dredged soil. Laboratory model tests and microscopic tests are used to investigate the improvement effect of this method on dredged soil consolidation at different pressurization frequency and duration. The test results indicate that pressurization can effectively relieve clogging and improve the consolidation efficiency. The frequent pressurization is conducive to the consolidation at the same air-boost ratio, and the longer pressurization duration has an obvious promoting effect in the later stage of consolidation at the same pressurization frequency. Furthermore, pressurization can significantly alleviate the PHDs clogging problem has also been demonstrated from the micro perspective. These findings could provide an important reference for the treatment of dredged soil by air booster vacuum preloading combined with PHDs.

Keywords: Prefabricated horizontal drain; Clogging; Air booster vacuum preloading; Pressurization frequency; Pressurization duration

Effect of elevated temperatures on the degradation behaviour of elastomeric bituminous geomembranes

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Abstract: The effect of elevated temperatures on the degradation of an elastomeric bituminous geomembrane (BGM) when exposed to air and deionized (DI) water at temperatures between 22 and 85 ◦C is investigated using immersion tests. The changes in the mechanical, chemical and rheological properties of the BGM are examined over approximately two years under different ageing conditions. It is shown that the BGM exhibited different degradation rates in its different components when exposed to elevated temperatures that are dependent on the incubation media. In air, the BGM exhibited thermo-oxidative degradation in the elastomeric bituminous coat that changed the bitumen glass transition temperature and increased its rigidity. Further degradation led to the brittleness of the bitumen coat before any degradation in the tensile and puncture strengths of the BGM. In contrast, exposure to DI water resulted in faster degradation of the mechanical properties of the BGM, while the bitumen coat exhibited substantially less degradation than in air. Arrhenius modelling is used to estimate the degradation times of the BGM at a range of field temperatures for both media.

Keywords: Geosynthetics; Bituminous geomembrane; Ageing; Thermo-oxidative degradation; Barrier systems

Experimental investigation on the accumulated strain of coarse-grained soil reinforced by geogrid under high-cycle cyclic loading

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Abstract: In this study, a series of cyclic triaxial tests were conducted to study the accumulated strain of coarse-grained soil reinforced with geogrids, and the effect of the number of geogrid layers, confining pressure and cyclic stress amplitude was investigated in detail. The test results show that the final accumulated axial strain of the soils reinforced with geogrids is less than that without reinforcement, and less accumulated axial strain is generated for the specimens with more geogrid layers under identical cyclic loading. The results also show that a higher confining pressure or a lower cyclic stress amplitude yields less accumulated axial strain for the reinforced soils. Furthermore, the plastic shakedown limits are determined by the criterion proposed by Chen et al. It indicates that the plastic shakedown limit increases significantly when one layer of geogrid is incorporated into the specimen and then tends to level off with a continuous increase in the number of geogrid layers. Moreover, a higher confining pressure yields a higher plastic shakedown limit for the soils reinforced with geogrid. The results demonstrated that the use of geogrid can be an effective method to reduce the accumulated deformation of subgrade filling materials under high-cycle traffic loading.

Keywords: Coarse-grained soil; Geogrid; Cyclic triaxial test; Accumulated axial strain; Shakedown limit

Use of polyethylene terephthalate fibres for mitigating the liquefaction-induced failures

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Abstract: The presence of non-biodegradable plastic waste is a serious concern for the health of endangered species. The present study is based on the sustainable utilisation of polyethylene terephthalate (PET) fibres obtained from waste plastic bottles to enhance the liquefaction resistance of fine sand. After performing a series of stresscontrolled cyclic triaxial tests, the cyclic behaviour of PET-fibre reinforced sand has been investigated. The application of PET fibres was found to be more satisfactory in medium dense sand than that in loose sand as observed by residual excess pore water curves. In medium dense sand with 0.6% PET-fibres, the number of cycles to reach liquefaction was about 4 times that of the unreinforced sand. Using the dynamic shear modulus (G), the degradation index was calculated for both reinforced and unreinforced soils to assess stiffness characteristics. After nearly 50 loading cycles, the value of G/G_{max} increased 2.55 times with the addition of 0.4% PET fibres in unreinforced sand. Based on the results obtained, a regression model has been developed for the calculation of number of liquefaction failure cycles ($N_{cyc,L}$) in correlation with several parameters, namely, relative density (Dr), fibre content (FC) and σ_d/σ_c' (σ_d = deviator stress, σ_c'= effective confining stress).

Keywords: Liquefaction; PET fibres; Cyclic triaxial; Sustainability; Regression models

Analytical method for quantifying performance of wicking geosynthetic stabilized roadway

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Abstract: The moisture content of roadway subgrade may increase substantially due to upwards water migration and/or downwards invasion of rainfall, resulting in the softening of the subgrade and the deterioration of the roadway, characterized by the occurrence of rutting and/or cracking. Wicking geosynthetic with wicking fibers can remove the moisture in subgrade actively to improve the serviceable performance significantly. However, there is no analytical solution to quantify the benefit of the wicking geosynthetic in improving roadway performance. In this study, the solution of a multi-layered elastic geosynthetic-stabilized soil system was derived to quantify the elastic responses. Thus, a mechanistic-empirical method was developed for analyzing the roadway performance (i.e., rutting). In the analysis, layers adjacent to the wicking geosynthetic with a reduced moisture content was considered as layers with improved material properties. The results show that the analytical method developed in this study is capable of quantifying the benefit of wicking geosynthetic in stabilizing roadways, with the influence depth and the moisture reduction as known inputs. The benefits attributing to the reinforcing effect and wicking effect can be quantified separately according to this analytical method. The base-subgrade interface is a better location for the wicking geosynthetic since both the resilient moduli of the base course and subgrade were improved due to the wicking effect and the reinforcing effect is also considerable. For the paved roadway structure analyzed in this study, the wicking effect contributed 18–30%, while the reinforcing effect contributed 8–11% when placing the geosynthetic at the interfaces.

Keywords: Wicking geosynthetic; Layered elasticity theory; Elastic solution; Mechanistic-empirical; Permanent deformation; Resilience

A preliminary study of the application of the strain-self-sensing smart geogrid rib in expansive soils

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Abstract: Flexible conductive materials are widely used in structural health monitoring; it is also known in geotechnical engineering. In this preliminary study, a strain-self-sensing smart geogrid rib was proposed to monitor the induced strain by wetting-drying cycles of the expansive soil. After the calibration, a physical modeling test was conducted with the smart geogrid rib reinforced in expansive soils under three wetting-drying cycles. Results demonstrated: that the smart geogrid rib was capable of self-sensing its strain; the strain self-sensed by the smart geogrid rib was in good agreement with that measured by FBG strain sensors before cracks were generated; it could capture the crack propagation of expansive soils during wetting-drying cycles by the discrepancy compared to FBG sensors. Further study will be continued for the mechanism of the geogrid instead of the geogrid rib and the application to real-time monitoring of the performance of the geosynthetic expansive soil slopes.

Keywords: Smart geogrid rib; Strain-self-sensing; Flexible conductive film; Expansive soil; Wetting-drying

Forecasting the moisture dynamics of a landfill capping system comprising different geosynthetics: A NARX neural network approach

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Abstract: Engineered landfill capping systems consist of geosynthetics and soil layers, which often experience inconsistent and extreme weather events throughout their service life. Complex moisture dynamics in the capping layers can be created by these weather events in combination with other field conditions and can be detrimental to the system's integrity. The limited data on the hydraulic performance of landfill capping systems is a major challenge that hinders the development, validation, and calibration of models that can be used for realistic forecasting of these dynamics. Using the field-level data collected at the Bletchley landfill site, UK, this study develops a data-driven forecasting approach employing a non-linear autoregressive neural network with exogenous inputs (NARX). The data includes precipitation and volumetric water content (VWC) of the capping soil overlaying different geosynthetic layers recorded from Nov 2011 to July 2012. The NARX network was trained using the VWC data as inputs and precipitation data as the exogenous input. Also, the accuracy of NARX predictions was compared against that of a statespace statistical model. NARX-predicted VWC values for a period of 21-days ahead are distributed with a mean error of 0.05 and a standard deviation of 0.2. In the majority of prediction windows, NARX approach outperforms the state-space model. For all NARX prediction periods, RMSEr has been less than 10% for the cuspated core geocomposite. Comparatively, RMSEr values increased to approximately 15% and 19% for the non-woven needle-punched geotextile and the non-woven needle-punched geotextile with band drains, respectively.