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摘要集

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目 录

Model studies of square footings on geocell-reinforced slopes

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Abstract: This study examines the behaviour of square footings located on unreinforced, single-, and double-layer geocell-reinforced sand slopes through a series of reduced-scale model tests. Contributing factors such as the distance between the footing and the edge of the slope, depth of burial of the first geocell layer, vertical span between successive layers of the geocell, length and width of the geocell mattresses, and the number of geocell layers were considered, and their effects are discussed in detail. The results indicate that geocell reinforcement plays a more effective role as the distance between the footing and the edge of the slope decreases. The optimum depth of placement of the first geocell layer for both single- and double-layer reinforced slopes was determined, and was found to be independent of the length of the geocell. In addition, the performance of the footing continued to decrease with greater vertical distance between the top and lower geocell layers. Only a marginal improvement in the behavior of the tested models was observed for a range of widths of the geocell.

Keywords: Geosynthetics, Geocell, Slope, Square footing, Bearing capacity

Influence of facing toe condition on the bearing capacity of full-height panel MSE walls

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Abstract: The paper presents a numerical modeling study on the bearing capacity of full-height panel, Mechanically Stabilized Earth (MSE) walls under strip footing using a validated finite element method that is based on upper-bound limit analysis (FE-UBLA). Parametric analyses were carried out to examine the influences that wall facing toe restraint conditions could have on predicted bearing capacity and failure mechanisms of MSE walls when subjected to strip footing load as a function of footing location, reinforcement design (i.e. tensile strength, length, and vertical spacing), wall height, and backfill shear strength. Results indicate that when the footing is placed on the reinforced zone, the bearing capacity is larger for MSE walls that are only free to rotate than those that can slide only. Also, the influence of facing toe restraint condition on bearing capacity gradually decreases with footing distance from the facing toward the retained zone. Additionally, the difference in predicted bearing capacity due to different toe restraint conditions becomes smaller for stronger and longer reinforcement layers. Finally, the foundation failure mechanism (FFM) usually corresponds to a larger bearing capacity relative to the compound failure mechanism (CFM) within the backfill.

Keywords: Geosynthetics, Bearing capacity, MSE walls, Upper-bound limit analysis, Failure mechanism, Footing load

Field monitoring of vertical stress distribution in GRS-IBS with full-height rigid facings

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Abstract: This paper presents a case study of the first geosynthetic reinforced soil-integrated bridge system (GRS-IBS) with full-height rigid facings in China. Open graded gravel and biaxial geogrid were used for the GRS-IBS. Steel frames and three-dimensional (3D) vegetation nets were used as temporary facing support during construction of the GRS abutments. Full-height rigid facings were cast in place on strip foundations. Field monitoring results of vertical stress distribution for different construction stages and loading conditions are presented and discussed. For both bridge dead load and truck loads, measured incremental vertical stresses under the beam seat increase significantly with increasing elevation, especially for higher applied vertical stress. The calculated incremental vertical soil stresses using the Boussinesq solution are in reasonable agreement with the measured values, while the 2:1 stress distribution method overestimates the incremental stresses in the lower section of the abutment. The transferred vertical stresses from bridge load application for the GRS abutment with full-height rigid facing are larger than those for the GRS abutment with modular block facing near the top of the abutment, but are smaller near the bottom.

Keywords: Geosynthetics, Geosynthetic reinforced soil, GRS abutment, GRS-IBS, Vertical stress distribution

Strength and microstructure of a lignin fiber-reinforced expansive soil in cold regions

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Abstract: An experimental program was undertaken to investigate the effects of lignin fibers and freeze-thaw (FT) actions on the shear strength behavior of an expansive soil. Soil specimens were prepared at five lignin fiber contents. Consolidated undrained triaxial tests were carried out on as-compacted specimens and specimens subjected to 10 FT cycles. Scanning electron microscopy and nuclear magnetic resonance tests were performed to reveal the microstructural characteristics. Test results indicate that the inclusion of lignin fibers leads to a significant increase in the cohesion due to the fact that lignin fibers form spatial networks that increase the bonding among soil aggregates. The cohesion-fiber content relationships are linear and their slope is constant regardless of FT actions, which indicates that the contribution of lignin fibers to the cohesion is not impaired by FT cycles. Lignin fibers alleviate the development of FT-induced cracks and the associated reduction in cohesion. Meanwhile, lignin fibers have little impact on the arrangement and contact stress and roughness among soil particles. Therefore, they have little influence on the friction angle of the soil with or without FT histories

Keywords: Geosynthetics, Lignin fibers, Expansive soil, Shear strength, Microstructure, Freeze-thaw cycles