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摘要集

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Moisture uptake and loss of GCLs subjected to thermal cycles from silty sand subgrade

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Abstract: The effect on GCL hydration and dehydration, when subject to thermal cycles, of (1) GCL bentonite granularity (powdered vs. granular), (2) GCL geotextile type (scrim-reinforced nonwoven vs. woven), (3) subgrade macrostructure due to fines aggregation, and (4) subgrade density and fines content is examined. Results of 17 hydration tests were assessed for two virgin and deconstructed GCLs placed on a nominally silty sand subgrade at w_{fdn}= 16% during daily thermal cycles when the airspace was heated to 60°C and cooled to 30°C. It is shown that bentonite granularity and mineralogy, the type of carrier geotextile and the subgrade conditions all significantly impact the GCL on cyclic hydration and that the moisture retention of a GCL is dependent on both the type of GCL and the properties of the underlying subgrade.

Keywords: Geosynthetics, GCL, hydration, dehydration, thermal cycles

Full-scale tests on soilbag-constructed retaining walls with a panel

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Abstract: In this study, full-scale tests were conducted on soilbag-constructed retaining walls (SBWs) with panels to analyse the effects of the fixed forms of the panels on the deformation and lateral earth pressures of the wall. The results show that a panel in front of an SBW affects its performance. The SBWs with fixed panels deformed laterally in a cantilever-like manner, while the SBWs with unfixed panels deformed laterally in a rigid-wall-like manner. The earth pressures acting on the fixed panel were found to be larger than those acting on the unfixed panel. The results of the full-scale tests of the panel and non-panel SBWs were compared to analyse the effects of the panel on the behaviour of the wall, and it was found that their resulting earth pressures were different, while the performance of the SBW with the unfixed panel was similar to that of the SBW without a panel. This indicates that the inclusion of an unfixed panel can make full use of the potential for an SBW to reduce the earth pressures.

Keywords: Geosynthetics, Soilbag, Retaining wall, Panel, Full-scale test

Long-term hydraulic performance of geotextiles filtering recycled materials

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Abstract: Use of recycled materials instead of earthen materials is one way to improve the sustainability of highway infrastructure. Since geotextile filters and separators are used in such construction schemes, hydraulic compatibility of geotextile filters with recycled materials and their long-term performance is essential. A series of long-term filtration (LTF) tests were performed to evaluate the hydraulic compatibility of several woven and nonwoven geotextiles with four recycled materials commonly used in construction (recycled concrete aggregate, recycled asphalt pavement, foundry sand, and recycled asphalt shingle). Upon completion of the LTF tests, grain size analyses, permittivity tests, image analyses, and piping measurements were conducted to investigate the clogging and retention behavior of the geotextiles. The results indicated that majority of the recycled materials tested were compatible with the nonwoven and woven geotextiles. Excessive piping was not observed even under relatively high hydraulic gradients. Permittivity and percent open area were the main parameters that influenced the retention performance of the nonwoven and woven geotextiles, respectively. The success of the existing criteria in predicting the filtration performance was inconsistent, suggesting that a detailed parametric study was needed to propose new filter criteria for these materials.
Keywords: Geosynthetics, geotextile, recycled materials, permittivity, physical clogging, blinding, retention

Stress crack resistance of unaged high-density polyethylene geomembrane fusion seams

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Abstract: The stress crack resistance (SCR) of high density polyethylene (HDPE) geomembrane (GMB) fusion seams is examined for two 1.5 mm HDPE GMBs and a range of welding parameters. Results are reported for both unnotched and notched seams as well as their corresponding sheet material. Unnotched seam SCR specimens are shown to preferentially initiate craze formation at the terminating edge of the squeeze-out bead, while incorporating potentially degraded areas, such as the seams heat-affected zone (HAZ), within the slow crack growth region of the specimen. In the short term, little variation was observed between the majority of seams for the nine welding parameter combinations examined, with an average normalized seam SCR value (normalized with respect to the unnotched sheet SCR) of 0.3 ± 0.1, or about 30% of the SCR of the unnotched sheet. It is shown that squeeze-out geometry plays an important role in the SCR of fusion seams. Seams with weld track rippling, a known qualitative indication of overheating, were found to have average unnotched SCR values 45% lower than smooth weld track seams. Deleterious squeeze-out geometries are identified to provide a framework through which CQA engineers and researchers can more readily identify 'higher risk' seams with respect to stress cracking.
Keywords: Geosynthetics, seams, welds, stress cracking resistance, HDPE, geomembranes, quality assurance

Evaluation of interaction properties of uniaxial geogrids with waste foundry sand

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Abstract: The reuse of waste materials can help alleviate problems related to placing them in landfill and can also preserve fast dwindling natural granular materials. Waste foundry sand (WFS) can be a promising candidate as a backfill material in the construction of mechanically stabilised earth (MSE) walls. In the design of such MSE structures, the interaction properties between WFS and geogrid reinforcement are important input parameters. In the present study, the interaction properties of a wide range of different polyester (PET) uniaxial geogrids with WFS in two common modes – direct shear and pullout – were evaluated using large-size interface direct shear and pullout tests. In the pullout mode, the interaction of the geogrid embedded in WFS under axial and transverse pullout was studied. The direct shear interface coefficients of four PET geogrids with WFS were found to be in the range observed in conventional fill materials. Higher axial and transverse pullout resistance factors were observed for geogrids with higher tensile strength and higher opening area ratio. Empirical equations were proposed to estimate the axial and transverse pullout resistances of geogrids at two pullout displacements. Finally, sensitivity analyses were carried out to identify the parameters significantly influencing the axial and transverse pullout resistances of geogrids in WFS.
Keywords: Geosynthetics, Geogrids, Axial pullout, Interface direct shear, Transverse pullout, Modified axial pullout resistance factor

Geosynthetic-reinforced embankment in cold regions observations and numerical simulations

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Abstract: An embankment underlain by permafrost foundation was reinforced with wicking woven geotextiles at its side slopes to reduce slope displacements when the fill material that was compacted at frozen condition thaws during subsequent spring and summer seasons following winter construction. The embankment fill and permafrost foundation were instrumented with thermistor strings to monitor soil temperatures as well as ShapeAccelArrays installed at the mid-slope of the embankment to measure displacements. A numerical model was developed in a commercially-available finite element software to simulate the thermal and mechanical behaviour of this embankment and further understand the benefit of using woven geotextiles in cold regions. A sequentially-coupled approach was used where temperature-dependent mechanical properties were invoked based on a heat transfer analysis. Four years of monitored results from the reinforced embankment were used to calibrate the numerical model. An adjacent section of the embankment without the geotextiles was also modelled and results show a significant reduction in slope displacements. The monitored performance and the model results presented will improve the design guidelines for embankments in cold regions using geotextiles.
Keywords: Geosynthetics, cold regions, embankments, winter construction, slope reinforcement, numerical modelling

Seismic behavior of tiered geogrid reinforced soil (GRS) using treated backfill soil

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Abstract: As the use of geogrid reinforced soil (GRS) walls increases, appropriate solutions should be considered to improve their performance. In recent years, wall construction in the multi-tiered configuration has improved both static and post-earthquake behavior, and become an appropriate approach to building high-reinforced soil walls. In addition to the above approach, treatment of the soil used as the wall backfill is also a suitable solution to enhance the wall performance. In this study, a combination of the two above concepts has been employed for better understanding the GRS wall behavior by developing a series of reduced-scale physical models. One-meter-high models in one- and multi-tiered fashion were tested backfilled with untreated and treated (by adding a combination of cement and polypropylene fibers) silty sand mixture. A comparison of the 1g shaking table tests among wall models subjected to seismic waves indicated the influence of the treating solutions on the dynamic response of the walls. The findings suggest that use of the two proposed approaches in the GRS walls construction has a notable effect on the wall stability after construction and during an earthquake. It also improves the essential seismic parameters such as displacement and acceleration responses.

Keywords: Geogrid reinforced soil (GRS) wall, multi-tiered walls, soil treatment, reduced-scale physical models, 1g shaking table test