Analysis of Reduction Factors to Creep Deformation of Reinforced Geosynthetics

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Abstract

Geosynthetic Reinforcements - membrane drawn type, warp/knitted type, junction bonded type and composite type geogrids, strip type reinforcement - were used to compare the long-term perfor-mance by total factor of safety with reduction factors during service periods. To evaluate the reduction factors, wide-width tensile property, installation damage, creep deformation, chemical and biological degradation tests were performed. Long-term design strengths of geosynthetic reinforcements were calculated by using GRI standard Test Method GG4.

Introduction

The long-term performance of geosynthetic reinforcements should be dependent on the total factors of safety which are calculated from the partial reduction factors by some cases e.g., installation damage, creep deformation, chemical and biological resistances etc. Among these reduction factors, those of creep deformation and installation damage are very important to determine the long-term performance of geosynthetic reinforcements. In this study, five kinds of geogrids having the design strength 8ton/m -membrane drawn type, warp/knit type, junction bonded type and composite type geogrids- were used to compare the long-term performance.

Experimental

Geosynthetic reinforcements which have 8 ton/m design strength were prepared to examine the long-term performance such as membrane drawn type, warp/knitted type, junction bonded type, composite type and strip type geogrids. Composite type geogrid was specially designed and manufactured to to develop the junction and creep properties and to compensate for the disadvantages of typical geogrids. ISO/TR 10722-1:1998(E) was used to test the installation damage for geosynthetic reinforcements and the degree of installation damage was estimated by the strength retention before and after installation.

Creep tests were performed according to ASTM D5262. Resistance by chemical degradation of geosynthetic reinforcements was taken for 180 days under pH 3.5, 7.3, 12.4 at 25, 35, 70°C just for reference of EPA 9090 Test Method and ASTM D 5322. Test for resistance by biological degradation were done under soil burial condition for 12 months. Degree of chemical and biological resistances were analyzed by the strength retention at every 30 days.

Results

Total factors of safety of geosynthetic reinforcements were shown in Table 12. It was seen that the larger total factor of safety means the less long-term performance of geosynthetic reinforcements. Strip type reinforcement showed the most low total factor of safety among geosynthetic reinforcements to be used in this study.

Table 1. Total factor of safety of geosynthetic reinforcements

Geosynthetic Reinforcement	Membrane Drawn Type	Warp/knit Type	Junction Bonded Type	Composite Type	Strip Type
Total Factor of Safety	2.27	3.78	3.62	2.23	2.13

Table 2 shows the long-term design strength of geosynthetic reinforcements which have 8 ton/m design strength. Composite type geogrid has the excellent long-term design strength and this means the most excellent long-term performance.

This result gives the useful advantages to the construction design because the total cost to be necessary for geosynthetic reinforcements used construction is less expensive than other reinforcement materials.

Table 2. Long-term design strength of geosynthetic reinforcements

Geosynthetic Reinforcement	Membrane Drawn Type	Warp/knit Type	Junction Bonded Type	Composite Type	Strip Type
Long-Term Design Strength (ton/m)	3.52	2.12	2.21	3.59	3.75

References

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