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Interpretation of Damage Effects on Geogrids under Installation Conditions

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Abstract: two types of geosynthetic reinforcement material were installed in the various test sites. Geosynthetics reinforcement materials are tested about the tensile and creep properties. To evaluate the long term property of the reinforcing geosynthetics, the GRI GG–4 test method was used. The reduction factors due to installation damage, creep damage and after installation creep damage were calculated. Tensile test show some strength decreases in each of warp and weft directions. The decreases of the creep deformation were occurred after installation, and the decreases of the composite type (sample F) are higher than the fabric type (A~E).

Keywords: geosynthetic reinforcement material, GRI-GG4 test method, reduction factor, installation damage, creep damage

1 Introduction

Construction structures, which geosynthetics are used in, are semi-permanent system exceed 100 years usually. Therefore, take into account long-term properties of the structure is very important, and in the designing of structure, the reduction factor should be applied. There are four major reduction factors, used in the designing of reinforced structure. They are chemical damage, biological damage, creep damage and installation damaged factor [1-3]. In this study, in order to evaluate the changes the geosynthetics tensile and creep property, two types of geosynthetic reinforcement material were installed in the various test sites. Then the geosynthetics are tested about the tensile and creep properties. To evaluate the long term property of the reinforcing geosynthetics, the GRI GG–4 test method was used. The reduction factors due to installation damage, creep damage and after installation creep damage were calculated.

2 Experimental

There were five kinds of geogrid (A~E) and 1 geocomposite (F) used in this study. The installation damage (field) and creep test were performed. Sample A is woven type geogrid and sample B~E are knitted type geogrid. In the case of geocomposite, the PET high strength yarn knitting method was used to make sure the shape of

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geocomposite. To estimate the damage of geosynthetics according to various fill thickness, total 6 step increments (20~100cm) of fill thickness were applied. Wide width tensile tests are generally performed both in the machine and cross machine direction of the geosynthetics, using the standard test method ASTM D 4595. The tensile test was used to evaluate the effects of damage, e.g. after installation trials for 6 kinds of geosynthetic samples. And then the installation damage reduction factors were calculated. Creep test were performed on both damaged and undamaged samples to evaluate the creep reduction factor and GRI GS10 test method used for this.

3 Results and Discussion

Fig. 1 shows the creep response of the each of the geosynthetic samples according to the fill thickness. The creep behaviors of the damaged were decrease compared with the undamaged samples. The strain changes occurred in the same loading levels were about 0.5~1%. The creep reduction factor follows this equation.

$$RF_{CR} = \frac{T_{ST}}{T_{LT}} \quad (1)$$

where, RFCR = Creep reduction factor, TLT = 10 year design life strength of the geogrid in sustained ASTM D 4595 or sustained GRI GG-1, or ASTM D 5262 testing at which curve becomes asymptotic to a constant strain line, of 10 percent or less, TST = Short term strength of the geogrid in ASTM D 4594, GRI GG-1 or GG-2 testing whichever is comparable to the long term creep test, i.e., wide width, single rib or through the junction test.

Table 1 shows the reduction factors determined for each of the geosynthetic samples (A~F) according to the fill thickness. Here, the PVC coated sample's (A~E) tensile properties decrease less than the uncoated sample (F). In the case of uncoated sample, the environmental factors (soil, compaction equipment, worker, etc) directly affected to the geosynthetic sample, such that the tensile properties decreased more than the coated geosynthetics. Also, there are no trends according to the fill thickness in the each coated (A~E) and uncoated (F) geosynthetic samples. Therefore, during the installation of the geosynthetics, to reduce decrease in strength, the construction quality control should be carefully managed.

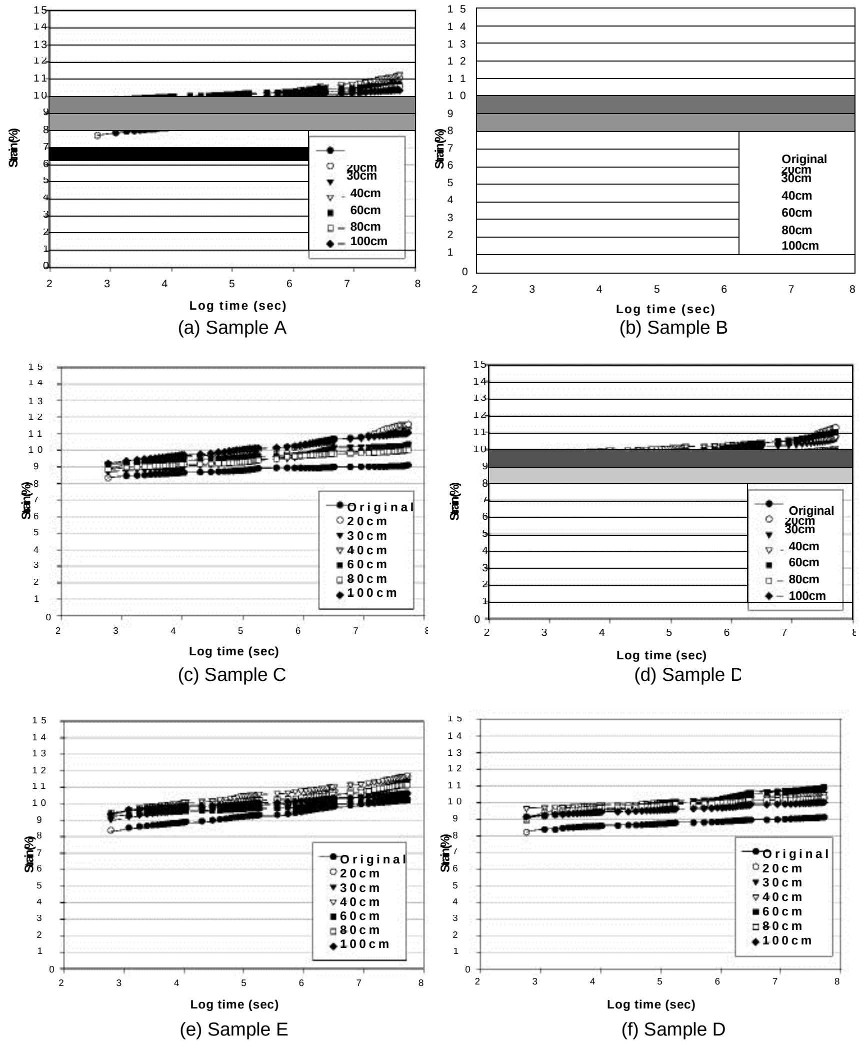

Fig. 1. Creep response curves according to the fill thickness at 60% load.

Table 1. Installation damage reduction factors of the each geosynthetic samples

	Reduction factors					
	20cm	30cm	40cm	60cm	80cm	100cm
A	1.14	1.12	1.18	1.19	1.21	1.14
B	1.09	1.05	1.10	1.09	1.05	1.05
C	1.06	1.08	1.04	1.04	1.04	1.07
D	1.03	1.01	1.03	1.06	1.11	1.03
E	1.02	1.04	1.03	1.09	1.19	1.07
F	1.34	1.63	1.49	1.51	1.42	1.49

Table 2. Creep reduction factors of the each undamaged and damaged geosynthetic samples

	Reduction factors					
	20cm	30cm	40cm	60cm	80cm	100cm
A	2.0	2.0	2.0	2.0	2.0	2.0
B	1.67	1.81	1.81	1.81	1.67	2.0
C	2.0	1.67	1.67	1.67	1.67	2.0
D	2.0	1.81	2.0	2.0	1.67	1.67
E	2.0	2.0	1.67	1.67	1.67	1.81
F	1.81	2.0	2.0	2.0	1.81	1.67

4 Conclusion

The results of the tensile test show some strength decreases in each of warp and weft directions. There are decreases of the tensile properties due to installation damage. The decreases of the creep deformation were occurred after installation, and the decreases of the composite type (sample F) are higher than the fabric type (A~E). In the designing with the reinforcement geosynthetics applied to the reinforced structure, decreases of properties should be carefully considered.

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