Long-Term Performance of Geosynthetic Reinforcement Materials with Field Installation Condition

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1. Introduction

In the case of the geosynthetics usage to soil structure, there are some damages by compaction. And these damages by the installation compaction result in the unexpected changes of short and long term properties of the structure. So in the case of index test, there are some problems to the exact evaluation on the installation damage. Therefore, to the more definite evaluation on the installation damage of geosynthetics, the real site installation damage test is encouraged.

In this study, to evaluate the changes the geosynthetics tensile and creep property, two types of geosynthetic reinforcement material are installed in the various test sites. To evaluate the long term property of the structure, the GRI GG 4 test method was used and installation damage, creep damage and after installation creep damage reduction factors were calculated.

2. Experimental

5 kinds of geogrid (A~E) and 1 geocomposite (F) were used in this study, and 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 geocomposite. To estimate the damage of geosynthetics according to various fill thickness, total 6 step (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. The creep test about both damaged and undamaged samples were performed to evaluate the creep reduction factor. The GRI GS10 test method used in this study. The temperature steps were 26, 40, 54, 68 and 82 ℃. The loading level is 60% of the ultimate tensile strength.

3. Results and discussion

Table 1 shows the reduction factors of the geosynthetic samples (A~F) according to the fill thickness. And the decrease of the tensile strength was observed. Here, the PVC coated samples (A~E) tensile properties decrease letter 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, so the tensile properties were decrease 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 of strength, the construction quality control should be carefully managed.

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

	Reduction factors					
	20 cm	30 cm	40 cm	60 cm	80 cm	100 cm
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 shows the creep reduction factor values of the undamaged and damaged geosynthetic samples (A~F). This shows the damaged creep reduction factors are higher than the undamaged reduction factors. Also, there are no trends according to the fill thickness in the all geosynthetic samples. In the case of sample F, the change of the creep reduction factor is more higher than the other sample, and this the results of the shape of the samples.

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

SAMPLE	Reduction factors						
	Original	20 cm	30 cm	40 cm	60 cm	80 cm	100 cm
A	1.67	2.0	2.0	2.0	2.0	2.0	2.0
B	1.67	1.67	1.81	1.81	1.81	1.67	2.0
C	1.67	2.0	1.67	1.67	1.67	1.67	2.0
D	1.67	2.0	1.81	2.0	2.0	1.67	1.67
E	1.67	2.0	2.0	1.67	1.67	1.67	1.81
F	1.42	1.81	2.0	2.0	2.0	1.81	1.67

4. Conclusion

(1) The results of the tensile property test show that there are some strength decreases in each of warp and weft directions.

(2) There are decreases of the tensile properties by the installation damages, and this is not related to the soil filling thickness

(3) The decreases of the creep deformation were occurred after installation, and the decreases of the composite type (sample F) is higher than the fabric type (A~E).

(4) In the designing with the reinforcement geosynthetics applied to the reinforced structure, this decreases of properties should be carefully considered.

References

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