Engineering Properties Evaluation of Geogrids by Index Tests

Han-Yong Jeon
Division of Nano-Systems Engineering, Inha University, Incheon, Korea

ABSTRACT

This study is focusing on the test method that used for evaluating the long-term design strength of 3 types of geogrids (warp knitted, woven and membrane drawn geogrid). Short-term tensile properties of the membrane drawn geogrid showed very low elongation results compared to the other types. But estimated long-term creep deformation indicate that the 30% of $T_{ul}$ loading level is the optimum value that satisfying the creep criteria in the case of membrane drawn geogrid (60% in warp knitted geogrid and 65% woven geogrid). From the durability test results, the membrane drawn geogrid has good resistance to chemical, biological and UV to be compared with the textile type geogrids. And the total reduction factor that considered creep, installation damage and durability of the warp knitted, woven and membrane geogrid are estimated as 2.0, 1.9 and 3.6 respectively.

KEY WORDS: Long-term design strength; 3 types of geogrids; creep deformation; durability test; total reduction factor

INTRODUCTION

Geosynthetic reinforced retaining soil walls have been in use for more than 25 years and in the vast majority of cases have performed very well. The field application has expanded constantly and is still in an active stage of development and research (Holtz, Christopher, 1997; Koerner, 2005).

For the time being, the mechanism of reinforcement for geosynthetics is not fully understood, and hence the development in analysis method and design theory is backward as compared with its engineering application (Cazzuffi, Ghinelli, 1997).

And the inherent margin of safety against poor performance with respect to internal stability has not been quantified in a systematic manner. This lack of quantification can be argued to contribute to the current lack of acceptance for this technology by some practitioners and government agencies in the world.

The correct understanding and thesis about the product properties, development level of product, and standardization of suitable test method and systematization of estimation method are very insufficient until current (Navarrete, 2001; Thornton, 1998; Gurung, 2003).

Therefore, it is of paramount importance to become capable of accurately predicting the exact deformation by long-term sustained and cyclic loading, develop a relevant and rational design procedure taking into account the viscous property of geosynthetic reinforcement and develop a method (or methods) that can effectively reduce the residual deformation by long-term sustained and cyclic loading and various construction conditions (Cancelli, Montanelli, 2000).

In this study, various tests are performed to evaluate the engineering properties of the various geogrids that used for reinforcement and to assess the contribution the factor of safety. Used geogrids have same product strength but different raw materials and manufacturing methods. To estimate the RF values, short-term tensile test, long-term tensile test, installation damage test and durability test were performed and the test result compared to each samples.

EXPERIMENTAL

Sample Preparation

Three types of geogrids were employed in this study. The textile type of geogrid is divided into woven geogrid(8TW, 10TW) and warp knitted geogrid(8TK, 10TK) of polyester high tenacity yarn coated with PVC resin. And the membrane drawn type geogrid(8TM, 10TM) of melted high density polyethylene with uniaxial conformation were used for better comparison of the above two types of geogrids.

Table 1 and Fig. 1 show the specification and photographs of these geogrids. The tests were performed to only longitudinal directions because in the case of membrane drawn type geogrid the longitudinal direction is the main direction that performed its primary function.

Engineering Properties Evaluation

Wide-width tensile test was done with ISO 10319 and unconfined tension creep behavior of geogrid specimens at constant temperature was specified in ASTM D5262. And this test result was used for calculating the reduced long-term tensile properties and this value was...