수평배수재의 단기 압축거동 해석

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Short-Term Compressive Behavior of Planar Drainage Materials

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1. Introduction

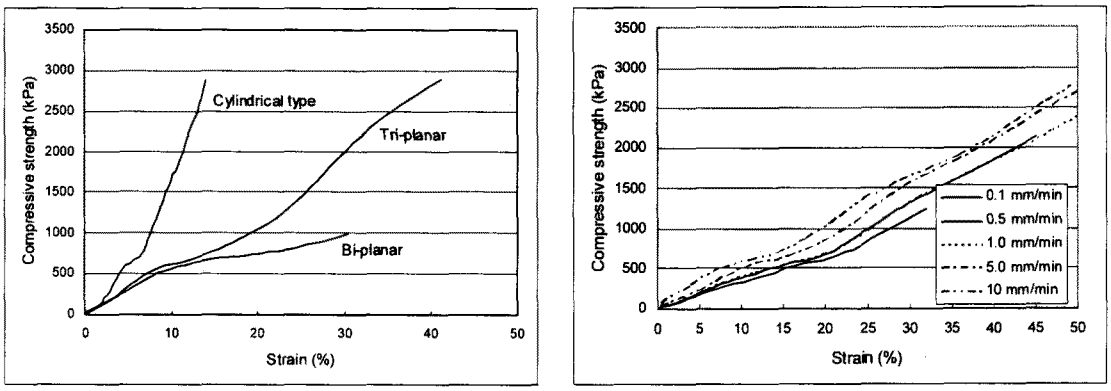
Geonet used as a drainage component on top of the geomembrane, this severe site-specific condition may influence to geonet's short and long-term engineering properties. The high value of environmental temperature can make the movement of geonet's molecular chain very actively; this could result in weakening the geonet's compressive resistance. In this study, the manufacturing parameters of geonets and the factors on the short-term compressive properties were investigated.

2. Experimental

Three samples of geonets were used. The first is a 5.6 mm thick HDPE traditional bi-planar geonet. The second and third are also HDPE made and have 8.6mm tri-planar, 8.2mm cylindrical type bi-planar structure, respectively. All these material are used for landfill cover and lining system for drainage. Short-term compressive deformation test was performed by ASTM D6364. Compressive strength is measured at several values of strain. In short-term compressive test to determine the factor on the short-term compressive strength was performed with various manufacturing parameters; Thickness, Mass per unit area, crystallinity, strand strength, junction strength of strands, in-plane strand angle and inclination, Figure 2 shows these various parameters. Also to consider the landfill's severe site-specific conditions, modified test conditions were applied to test; test temperature 23, 35 and 50℃, compressive deformation rate 0.1, 0.5, 1.0, 5.0 and 10 mm/min.

3. Results and Discussion

Figure 1 (a) shows the relation between compressive strength-strain curves of geonet samples. The cylindrical type exhibits a very stiff behavior even after the end of the roll-over and has very short roll-over range compare to the bi-planar which has very long roll-over region. By defining the factor that affecting the short-term compressive behavior of the bi-planar geonet, it was determined that before the determining point of compressive strength (= start point of the roll-over) all of the manufacturing parameters can affect in a very complex pattern and after that point strand inclination and strand cross-sectional shape will affect the roll-over phenomenon mainly. Therefore it is concluded that if the cross-sectional shape of the strand is close to the circle, the roll-over region could be shortened dramatically. And this advantage will advance the long-term flow capacity of the geonet.



(a) (b)

Figure 1. (a) compressive strength-strain curves of geonets
(b) Compressive behavior curves according to various deformation rates at 50℃ for tri-planar geonet

Figure 1 (b) shows the results of compressive strength-strain measurements at different temperatures (23, 35 and 50℃) at different deformation rate (0.1, 0.5, 1.0, 5.0 and 10 mm/min). The compressive strength is reduced and the strain at yield increase substantially with the temperature, as would be expected. Simultaneously, the initial slope of these curves decrease strongly with increasing temperature. It seems that the changes in the modulus with temperature are higher than with the deformation rate in the range of variation studied. Considering the landfill's severe temperature conditions, this decrease may affect the long-term flow capacity of the geonet drainage.

4. Conclusion

The compressive behavior of the bi-planar geonet is divided into two regions which are before compressive strength and after that. In before compressive strength all of manufacturing parameters can affect the resulting value in a complex pattern and after compressive strength the strand inclination and strand cross sectional shape will affect the roll-over behavior mainly. Since geonets are visco-elastic materials, compressive behavior was affected by the temperature changes. The compressive decreases were up to 40% and tri-planar geonet in very critical temperature condition (50℃). Considering the actual landfill condition these decrease in compressive strength should be considered in designing process.

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