

Contribution of geocell's reinforcing mechanisms in load bearing capacity

ジオセル補強における支持力の分配に関する研究

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How geocell works

The purpose of this study is to get a better understanding of the contribution of reinforcing mechanisms by the inclusion of geocell in a soil body, which can be break to 2 mechanisms: (1) **vertical stress dispersion effect ($\Delta p1$)** distributes the pressure over a wider area; and (2) **hammock effect ($\Delta p2$)** use the tension strength of the geocell material (Zhang et al., 2009).

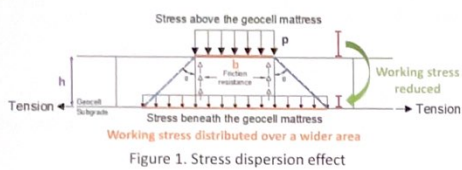


Figure 1. Stress dispersion effect

$$\Delta p1 = \frac{2htan\theta}{b + 2htan\theta} p$$

$$\Delta p2 = \frac{2Tsin\alpha}{b}$$

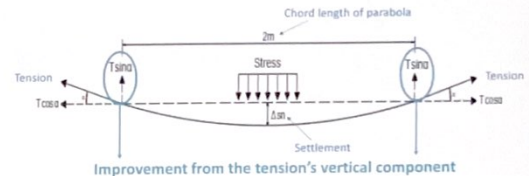


Figure 2. Hammock effect

Small scale model test

Monotonic loading model test with the inclusion of geocell was conducted to compare the bearing capacity-settlement relationship with the unreinforced soil. Aside from the use of a sensor, a controlled-capture camera was also employed to track and measure particle motion and displacement as a non-contact measurement method. The acquired images then used for Digital Image Correlation (DIC) analysis in order to calculate the bearing capacity of each aforementioned mechanism.

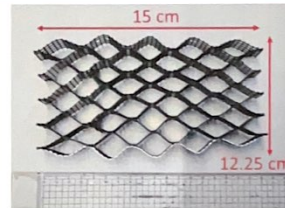


Figure 3. Geocell model

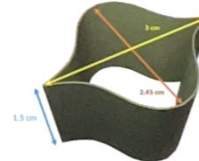


Figure 4. Cell dimension

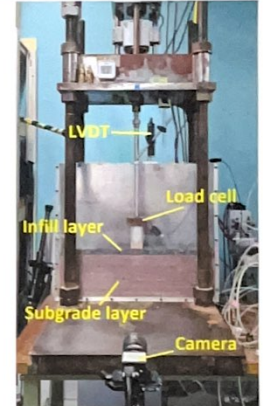


Figure 5. Test Setup

Image analysis results

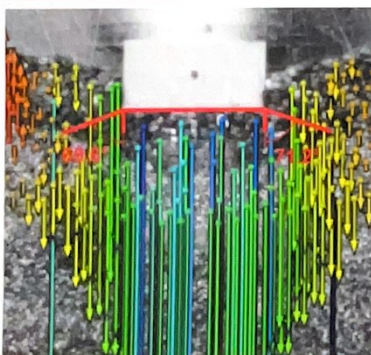


Figure 6. Stress dispersion analysis

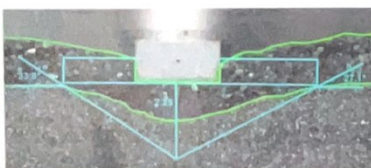


Figure 7. Hammock effect analysis

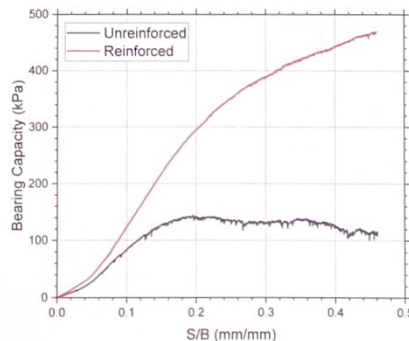


Figure 8. Bearing-settlement curve of unreinforced and geocell reinforced soil

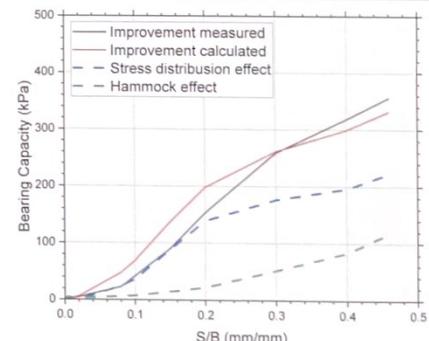


Figure 9. Bearing-settlement curve of geocell reinforcing mechanism

Inclusion of geocell improves the soil bearing capacity significantly compared to the unreinforced soil as shown in figure 8. By doing the image analysis, the contribution of each geocell's mechanisms could be calculated (see figure 9). Most of the bearing improvement were provided by stress dispersion effect. Hammock effect contributes less at the beginning because it was dependent on the magnitude of settlement.