Characterizing pullout stiffness of geogrid considering the interaction with soil

(土との相互作用を考慮したジオグリッドの引抜剛性に関する検討)

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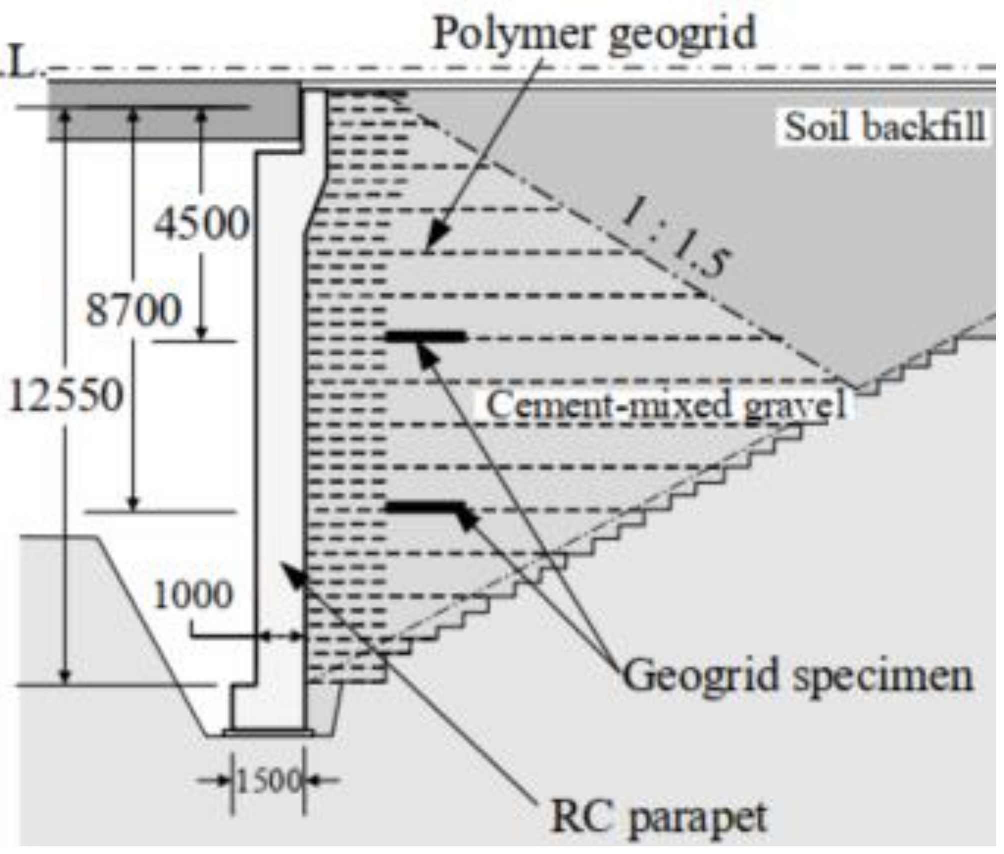
Research Introduction

In the Geosynthetic reinforced soil structures (GRS structures) design, the in-isolation stiffness (*E*) is used rather than the actual stiffness, which is pullout stiffness (*J*). considering the soil's contribution. This is due to the complexity of understanding the characteristics of pullout stiffness (*J*). compared to the in-isolation stiffness (*E*). Which causes the underestimation.

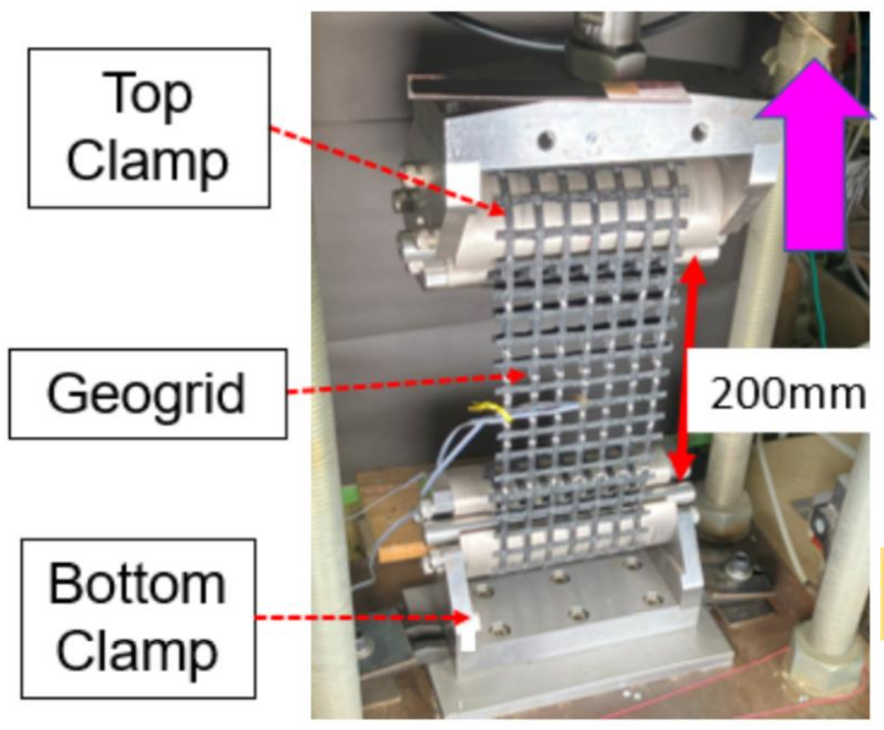
GRS Integral Bridge at Genshu for Kyushu Shinkansen, 2018

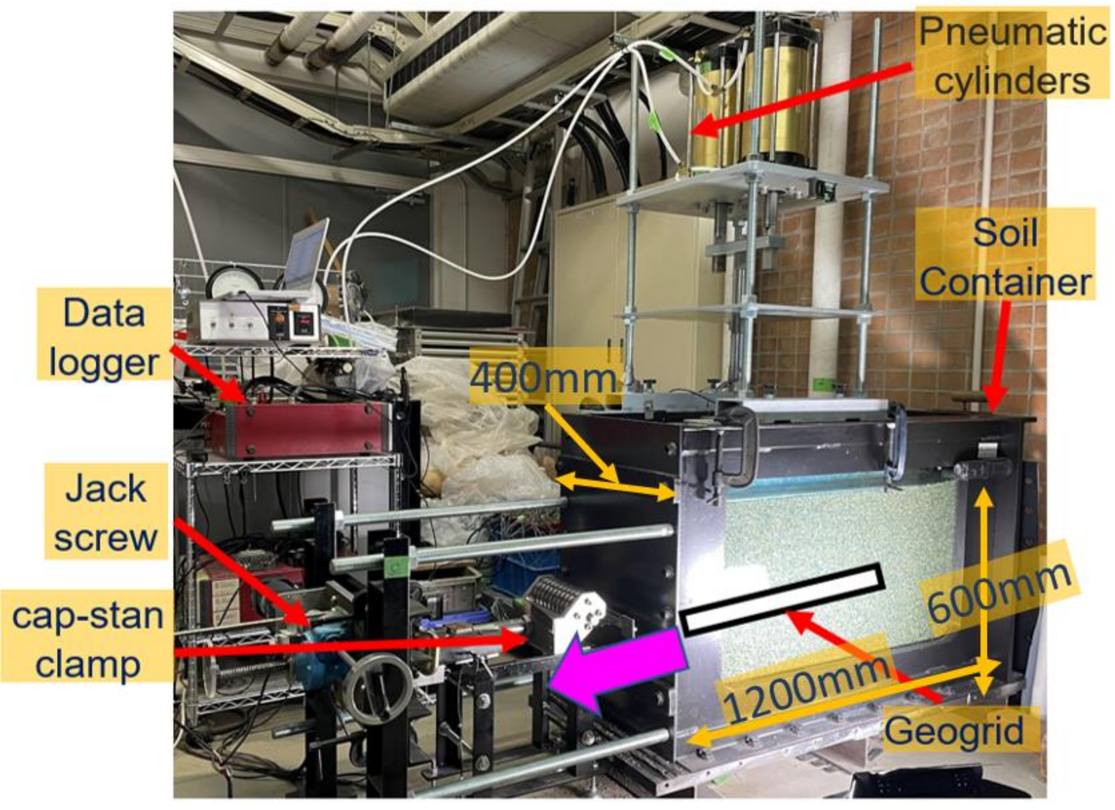


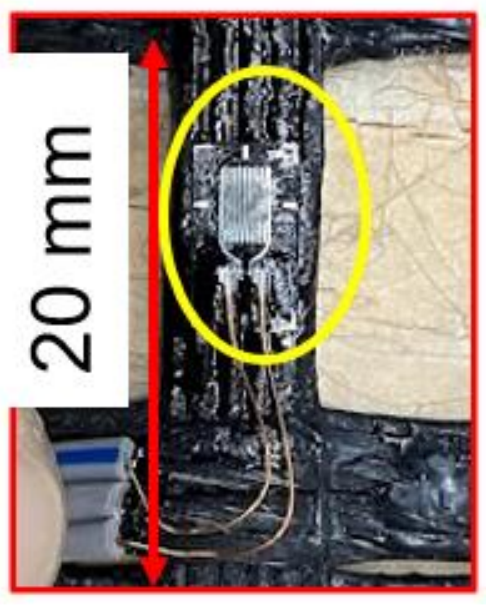
GRS bridge abutment

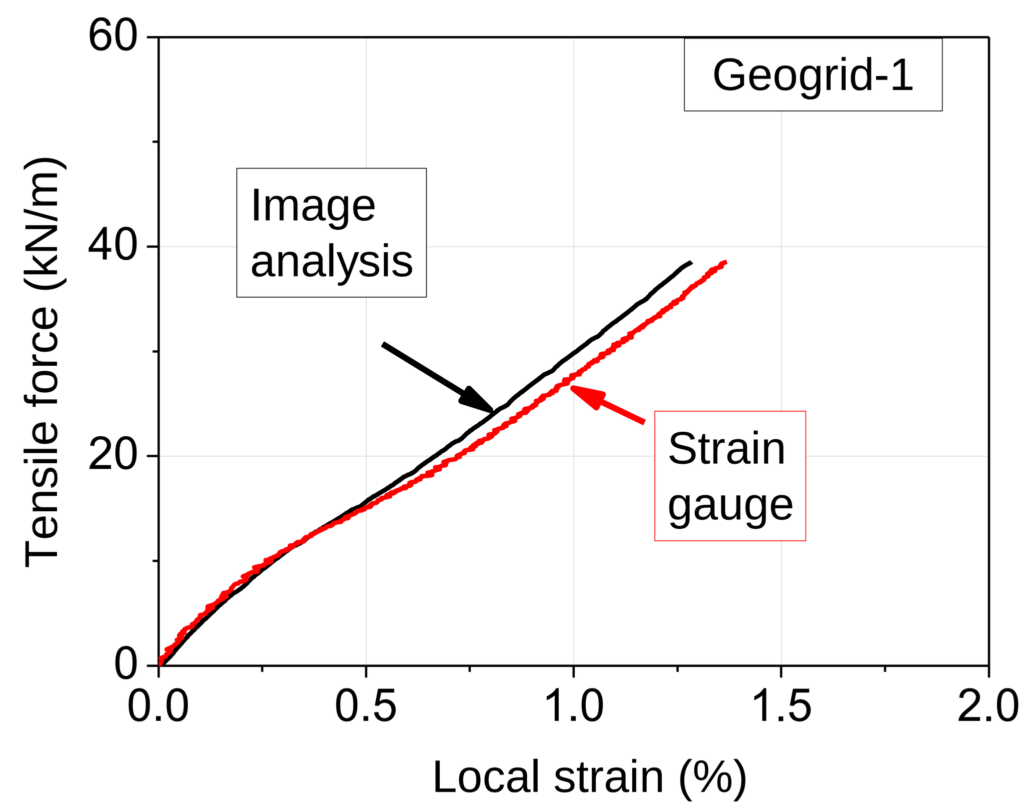
Testing apparatus and methodology

To understand the characteristics of the pullout stiffness, the in-isolation experiments and pullout experiments were performed at a similar displacement rate and similar loading path. The technique with the strain gauge was developed to understand the interface in detail.





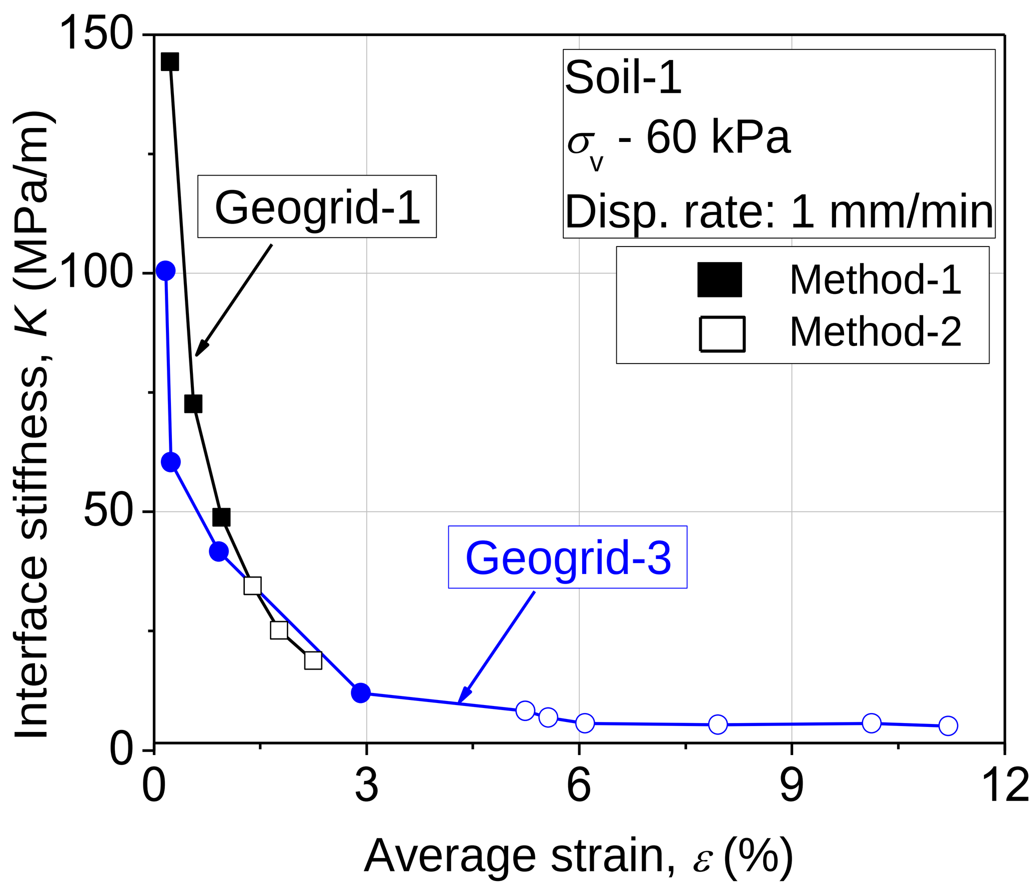




Characteristics of interface stiffness (*K*)

- The ***K*** was successfully evaluated in a novel way using tensile force distribution data and Tatusoka's model.

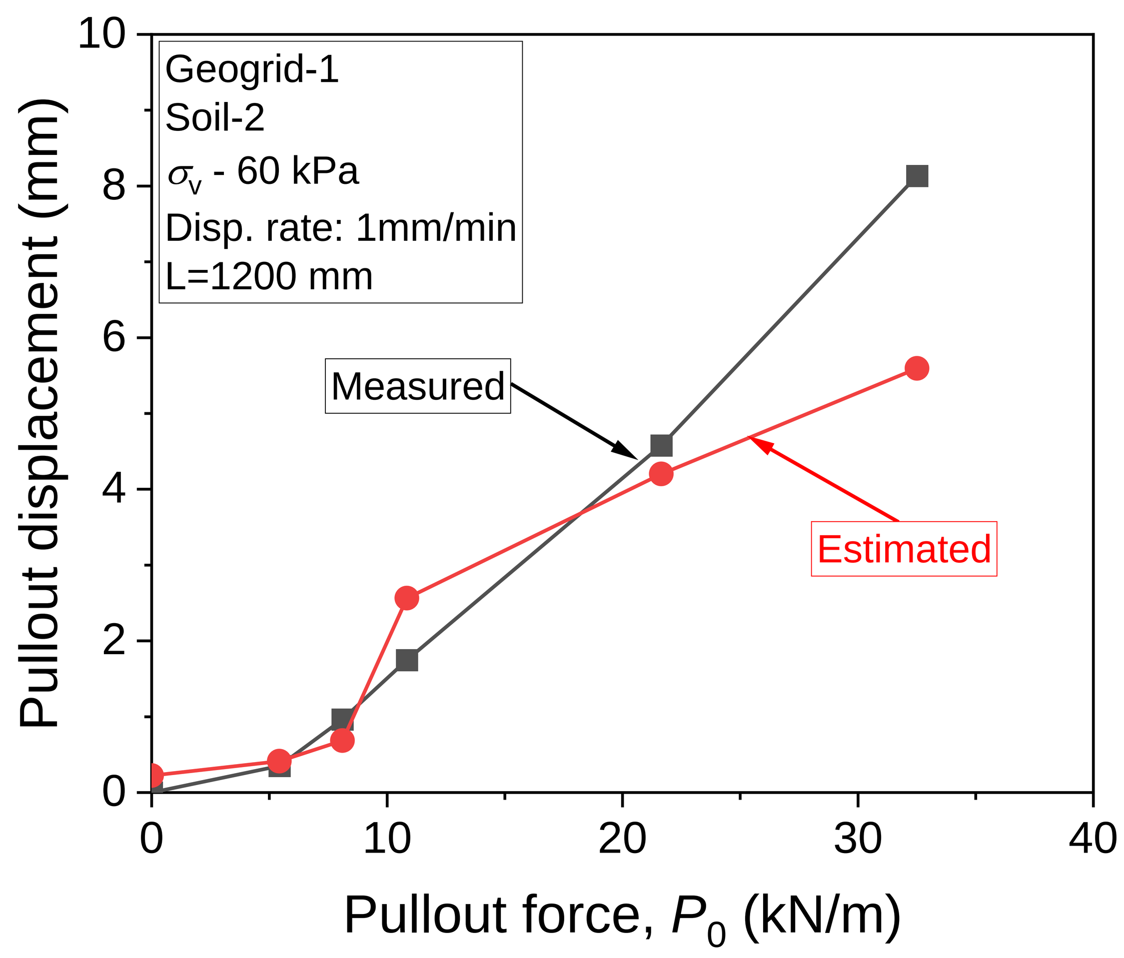
$$J = \frac{P_0}{s_0} = \sqrt{K \cdot E} \cdot \frac{[\exp(2L/\alpha) - 1]}{[\exp(2L/\alpha) + 1]}$$



- ✓ The soil confinement positively influenced pullout stiffness. This is due to the surrounding soil, which generates interface shear stiffness.
- ✓ The evaluated ***K*** exhibited a decreasing trend with strain. ***K*** rapidly decreases at small strains and becomes an almost unique line.

Pullout displacement prediction

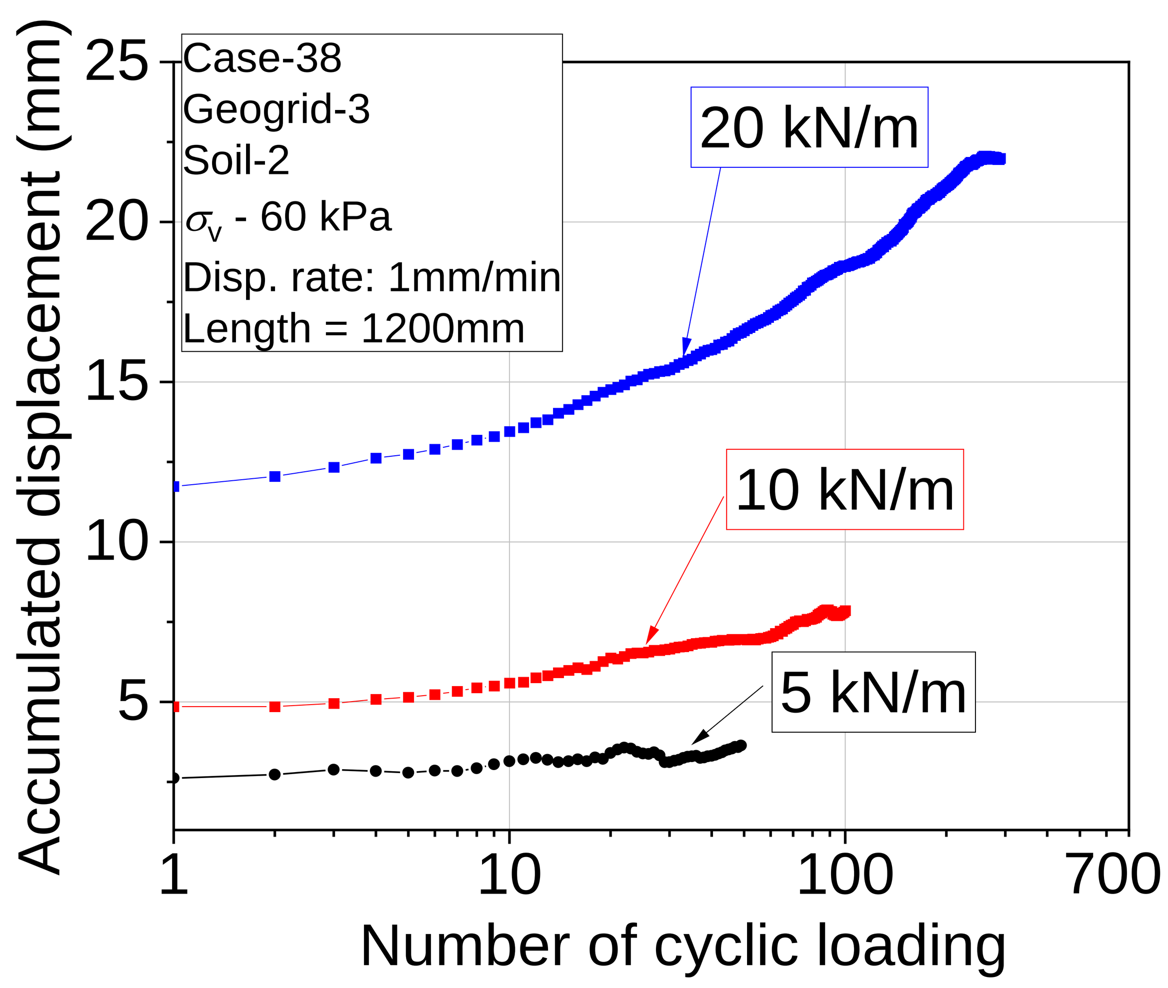
- The pullout displacement prediction model was developed based on the theoretical model and the experimental results.



- ✓ The ***J*** is significantly high at the small strains since ***E*** and ***K*** are both high at the small strains. However, at large strains, ***J*** shows the residual behaviour as ***K*** decreases to the residual stage, and only ***E*** may influence ***J***

Influence of cyclic loading

- To address the response of the Japanese GRS integral bridge for the seasonal temperature variations, the pullout tests were conducted under cyclic loading.



- ✓ Under the influence of cyclic loading, the geogrid in the air doesn't show the displacement accumulation as it shows while inserted in the soil.
- ✓ The accumulated displacements are high in the softer geogrid; therefore, a stiffer geogrid with suitable soils is recommended for GRS structures.