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論　文　内　容　の　要　旨
Abstract of Dissertation

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The dissertation describes the effects of anisotropy on behavior of both saturated and unsaturated soils. Triaxial apparatus incorporated local small strain measurement technique and bender element test was used to investigate anisotropy on shear strength and shear modulus. Mechanical anisotropy of soils was considered in terms of particle orientation and principal stress ratio.

Inherent anisotropy is referred to the initial fabric resulting from sedimentation process. Under different deposition process, soils with different particle shape can create various fabrics. An inclined container with changeable its walls was used to prepare sand specimen at different deposition angles of 0º, 22.5º, 45º, 67.5º and 90º. Two specimen preparation methods namely air pluviation and dry vibration method were used to simulate different deposition processes in nature. Toyoura sand with different mica content of 0%, 1%, 2.5%, 5% and 10% was used as the testing materials to examine the effects of particle shape. Toyoura sand has the sub-angular shape while mica has the angular shape. Mica 5% and 10% were conducted at different void ratio to investigate effects of void ratio on anisotropy of shear strength and shear modulus. A two dimensional optical microscope was used to evaluate the fabric structure of sands.

The obtained results suggest that the particle shape has the significant effects on the anisotropy behavior of soil. The shear strength of sand without mica content decreases when deposition angle changes from horizontal (0º) to vertical (90º) directions. However, the initial shear modulus increases with increase of deposition angle. The shear strength and the initial shear modulus become small with increase of mica content because of high compressibility of mica. The sand mixed mica shows the different behaviors from those of pure sand on the shear properties. The anisotropy on shear strength vanishes because of particle breakage of mica. However, the degree of anisotropy on the initial shear modulus increases concomitantly the increase of mica content. These results suggested that the increase of angularity increase the degree of anisotropy on initial shear modulus. The test results of 5% mica and 10% mica at different void ratio demonstrate that the initial shear modulus decrease with increase of void ratio. However, the degree of anisotropy is independent from the changing of void ratio. On the comparison between saturated and unsaturated sands, unsaturated sand produces a slightly higher degree of anisotropy on the initial shear modulus than saturated sand because of the application of matric suction. Two equations were suggested based on the measurement of particle orientation to assess the degree of inherent anisotropy on initial shear modulus.

Induced anisotropy is related to the soil structure created from an applied anisotropic stress state during ground formation. The influence of stress anisotropy on shear modulus of cohesive

soils was investigated using bender element test and monotonic compression test. Triaxial tests were performed using Yoneyama silt, which is lateritic soil. Stress ratio $K=\sigma_h/\sigma_v$ defined as the ratio between horizontal stress σ_h and vertical stress σ_v was used to define different stress stated applied during consolidation. The values K of 0.35, 0.43, 0.6, 0.8 (Compressional stress state), 1.0 (isotropic stress state) and 1.5, 2.0, 3.0, 3.5 (extensional stress state) under the same mean stress were selected to investigate the effects of stress ration on anisotropy of shear modulus.

The results show that the initial shear modulus of saturated soil clearly exhibits anisotropy as stress ratio K changes: shear moduli in extensional stress state ($K>1$) is smaller than those in compressional stress state ($K<1$). However, anisotropy of this kind is indistinct in the case of unsaturated soil.