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# Collapse Potential and its Mechanism in Unsaturated Granular Soils

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## 1. Introduction

The mechanical behavior of a compa- cted granular soil is experimentally investigated. The behaviors of volume changes are explored using a modified triaxial permeameter system where the stress state variables are independently controlled. Wetting stress paths are utilized to reflect field conditions associated with the rise in groundwater level in collapsible soil stratum under a certain constant isotropic loading. Measurements of total volume change and water content change are made. The experimental data are analyzed to investigate the collapse potential and its mechanism of occurrence.

## 2. The test program and procedure

A modified triaxial apparatus was employed in the program (see Fig.1). A specimen, at its initial condition of matric

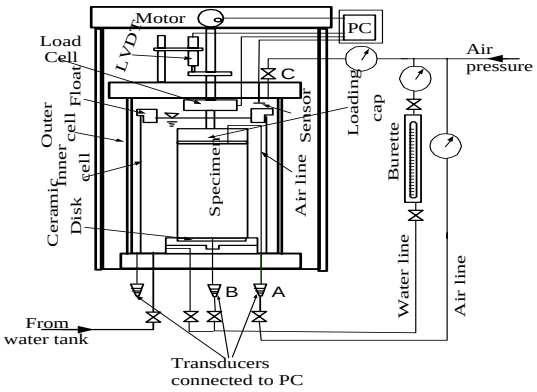


Fig. The modified triaxial cell

suction (80kPa)was isotropically loaded under a net confining pressure, ( $\sigma_3$-$u_a$), of 200kPa. The specimens were allowed to consolidate at various steps of decreasing matric suction until saturation was reached. The applied net confining pressure was maintained constant throughout the test. The changes in total volume of the specimens were monitored during each step of the tests. The net inflow of water to the specimen was moni- tored to determine the change in degree of saturation.

## 3. Results and discussion

Figs.1a) & b) show the total volume change and void ratio changes and Table 1 shows the summary of the result. Generally, the following conclusions are drawn from the investigation conducted on specimens subjected to wetting stress path.

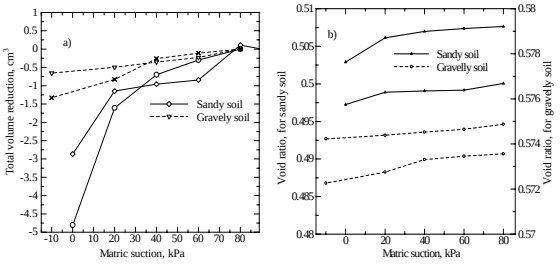


Fig.2 a) total volume reduction b) change in void ratio during wetting stress path.

Table 1. Summary of the experimental results

| Soil type | Before wetting | | | After wetting | | Collapse potential |
|---|---|---|---|---|---|---|
| | w | $\rho_d$(g/cm$^3$) | e | w | e | $\Delta e/(1+e_0)$ |
| Sandy | 0.076 | 1.75 | 0.508 | 0.078 | 0.503 | 0.332% |
| soil | 0.066 | 1.75 | 0.500 | 0.068 | 0.497 | 0.200% |
| Gravely | 0.039 | 1.69 | 0.575 | 0.043 | 0.574 | 0.063% |
| soil | 0.040 | 1.69 | 0.574 | 0.043 | 0.572 | 0.127% |

a) Three distinct phases, (similar result can be found in Jose *et al.* 2000) can be seen in collapse mechanism such as: (i) pre-collapse where small deformation obtained for large decrease in suction, (ii) the collapse where large deformation occurs for small change in suction and (ii) post-collapse phase where no deformation during further suction reduction.

b) The dry density, percent fine, and initial water content are shown to be the important factors of soil properties when we investigate the collapse behavior of a soil.

c) A soil to undergo collapse only three factors are needed such as: an unsaturated state, a high enough net confining stress, and the addition of water.

d) Collapse of a soil is associated with localized shear failure rather than an overall shear failure of the soil mass, and collapse, in the framework of the present laboratory testing technique, can be defined as a consolidation of soil mass due to gradual increase in pore-water pressure (from bottom to up), through time. It is different from the real consolidation process in that, during consolidation volume changes occur due to dissipation of pore-water pressure.