主論文：Reasonable Management Index of Fill Loading with Vacuum Consolidation Method on the Soft Ground

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In the alluvial plain on which a lot of population concentrates worldwide, a variety of social infrastructure facilities are constructed through necessity on the soft ground by according to improvement of usable land area. Therefore, during construction either after construction of the structure, subsidence of the ground and deformation of the structure to be generated by a lot of situations, and it has been investigated to motivation by necessity from a dynamic viewpoint of a short-term, long-term stability of the construction structure. Recently, a variety of soft ground improvement methods have been developed. The vacuum consolidation method is one of the advanced method that spread widely applied. This method is one of the promote consolidation compulsorily in a short term because the pore air and water in the ground are exhausted, and the water content is decreased relatively by the negative load of vacuum pressure against the soft ground. It has aimed at the establishment of a more efficient design method and a reasonable construction management index with the clarification of a basic mechanism concerning the vacuum consolidation in the present study.

On the other hand, it models by the indoor examination concerning the vacuum consolidation method based on obtained data, and the numerical analysis is carried out by using finite element method (FEM) in this analysis. The validity of an analytical model is examined by comparing these numerical analysis results and the value of field measurement, and it searches for the possibility of the forecast of the ground behavior in the vacuum consolidation method application ground by the numerical analysis. In the present study, the numerical simulation with the various vacuum pre- and post-loading pressures and fill speeds have been executed, and proposed a reasonable construction management index which can be easily obtain by the site measurements of ground deformation.

This thesis contains 6 chapters and the outlines are as follows:

Chapter 1 gives the background and objectives of the research together with a practice of major works conducted previously in the related field.

Chapter 2 briefly explains the main concepts of the N&H vacuum consolidation technique and applicable ground.

Chapter 3 describes newly developed a triaxial vacuum consolidation test device to clarify the ground deformation and the pore water pressure behavior by the vacuum consolidation, and the indoor test carried out for the assessment of the field behavior. Triaxial vacuum consolidation test apparatus that is originally developed enables to apply the axial pressure and the lateral pressure in a usual similar

to triaxial compression test apparatus, and the test sample is enable to be applied negative load of vacuum pressure that the drain material was simulated inserting at the center, the pore water pressure meter on the beside of the test sample. Moreover, the ground behavior when operating the axial load that simulates not only a general vacuum consolidation method but also the fill construction can be executed by the stage load.

Chapter 4 describes the experimental results of reproduce the behavior of applicable ground of the vacuum consolidation method by indoor model test. Therefore, vacuum pressure -69kPa of the field measurement is acting on the test specimen that simulated the stage in the loading initial ground. Triaxial vacuum consolidation test device is used with around the drain of the ground behavior by reproduced that fill loading with vacuum consolidation method of construction process has been assumed under the experimental conditions each kind of strain change with the elapsed time, dependence on the fill loading speed, maximum fill height and change of vacuum pressure spread rate with initial void ratio were clarified. The drainage water and the pore water pressure were confirmed the correspondence seen in the test result and the field measurement value, and the forecast in the field was possible. Moreover, it was paid attention to compare with degree of vacuum consolidation and elapsed time on the basic of stage load, clarified that degree of vacuum consolidation is more stable measurement fill construction in this analysis.

In Chapter 5, numerical simulation by FEM when fill loading with vacuum consolidation method (FLVCM) intended for the soft ground were shown similarities between analytical value and the field measurement value of pore water pressure, deformation at the center of the improvement region, amount of surface settlement of the surrounding soil, amount of the lateral displacement and able to reproduce the ground behavior when the vacuum consolidation method was applied. However, upheaval of the surrounding soil, lateral flow was clarified the controlling effect of behavior, and to predict the ground behavior when fill loading with vacuum consolidation was used. FLVCM was clarified that effect of generation of the excess pore water pressure during the fill construction and effect of reduce the residual settlement on the fill leaving period, rebound phenomenon was controlled. During the fill construction effect of the excess pore water pressure was controlled by the standard hydrostatic pressure and effect of reduce the residual settlement on the fill leaving period, rebound phenomenon was controlled with pre and post of vacuum pressure to obtain according to those analytical results. Moreover, when this method was applied, the pore water pressure was clarified the function of fill speed, vacuum pressure and fill height in this analysis.

In Chapter 6, the main findings of each chapter are summarized and the points that need to be solved in the future work are indicated.