III-181 BEHAVIOR OF THE IMPROVED GROUND BY D.M.M. UNDER EMBANKMENT LOADING

Asian Institute of Technology Mem.○Yusuke Honjo
Chung-Ho Chen, D.T. Bergado, A.S. Balasubramaniam
TAKENAKA Civil Engineering Co. Ltd. Mem. Ryosuke Okumura

1. Introduction

The objective of this study is to investigate the behavior of the improved ground by the Deep Mixing Method under horizontal loading condition induced by a structure such as an embankment. For this purpose, a full-scale test embankment on DMM improved ground with two different configurations, namely wall type and pile type, were constructed and subjected to the loading. Field observations were made during and after embankment construction in order to elucidate the behavior of the improved ground with the different configurations. This paper reports the initial stage observations obtained at this test embankment.

2. Test Embankment Construction

The test site is located inside the AIT campus 42km north of Bangkok. Fig.1 illustrates soil profile at the site which is a typical Bangkok clay profile of the central Chao Phraya Plain. Under 2m of the weathered crest, there is about 6m of soft Bangkok clay layer whose natural water content is 70 to 80% which is underlain by the stiffer layers. The strength of this soft clay is about 2t/m^2 which is slightly overconsolidated. The average shear strength of the insitu improved soil is 10 to 15 t/m^2 which is about half of that of the laboratory mixed improved soil.

The plan of the test embankment is shown in Fig.2. The improved ground configuration for the North side is the pile type, whereas that of the South side is the wall type; both of them have the same number of the improved columns to sustain the same load intensity. The hight of the embankment is 5m and the embankment toe was excavated 2 m to remove the crest and to increase the lateral deformation as well as to maintain plane strain condition as much as possible.

The instrumentation layout is presented in Fig.3. The main objective of this measurement is to trace the deformation of the improved ground; the 4 inclinometer pipes and the 14 settlement gages are installed for this purpose. 26 stand pipe type piezometers are also installed.

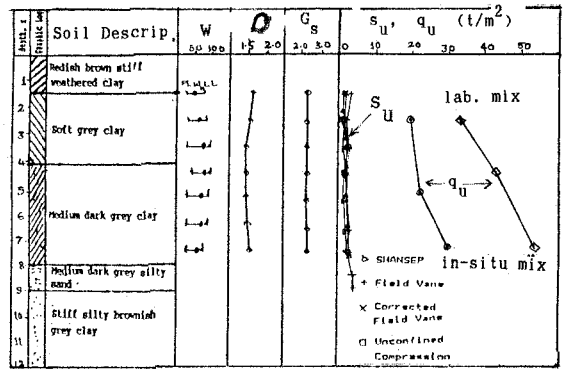

Fig. 1 Soil Profile and Strength

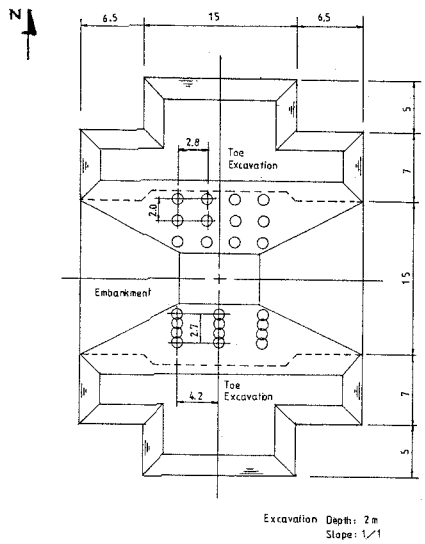

Fig. 2 Test Embankment Plane

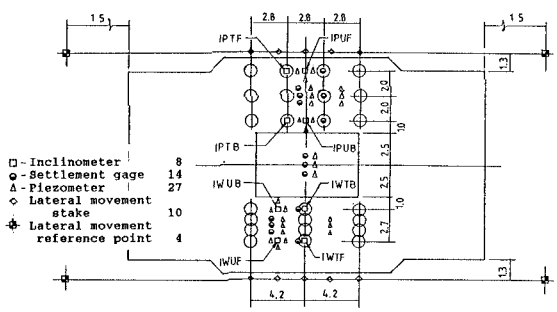

Fig. 3 Layout of the Instrumentation

3. Results of the measurements

The lateral movement of the ground detected by the 8 inclinometers are plotted in Fig.4. The loci of these inclinometers at 2m depth are also shown in Fig.5. The followings can be stated:

(1) The deformation of the pile type improved ground is larger than that of the wall type.

(2) The behavior of the wall type improved soil seems to be a parallel sliding, whereas that of the pile type improved soil is tilting and seems to involve a chance of bending moment development.

(3) In the pile type improved ground, the deformation of the unimproved part is the same as that of the improved part and is lateral flow type deformation. On the other hand, the deformation of unimproved part of the wall type seems to be restricted by the improved part.

(4) From Fig.5, it is possible to conclude the deformation direction is well controlled by the embankment shape and the toe excavation. A plane strain condition could be assumed in further analyses.

Fig.6 indicates the vertical movement of the ground at 1m depth. The improved part for the wall type exhibits equal deformation at the front and the back, whereas the pile type larger deformation at the back. These differences are considered to be caused by the deformation pattern differences indicated previously. The vertical deformation of the unimproved soil part is larger for the pile type and smaller for the wall type. Therefore, it is possible to state the wall type give more constrained to the unimproved soil part than the pile type when subjected to horizontal loading conditions.

The excess pore pressure measurements indicated that there is not much dissipation of pore pressure by this time (i.e. 51 days after the completion of the embankment construction). The excess pore pressure is higher for the shallower piezometers.

4. Final remarks

The measurements are continuing and analyses of the results are underway.

This is a part of the results of a research at AIT sponsored by TAKENAKA Civil Eng. Co. Ltd. The authors are grateful to support provided by Tenox Corporation in construction of the D.M.M. improved ground.

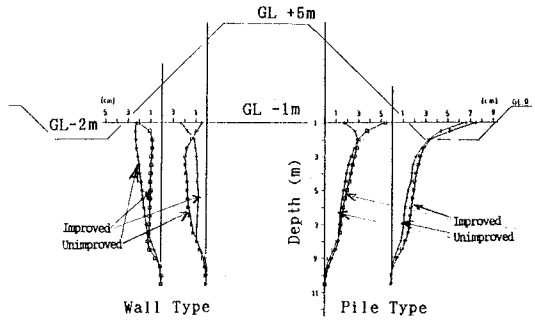

Fig. 4 Lateral Movement of the Ground

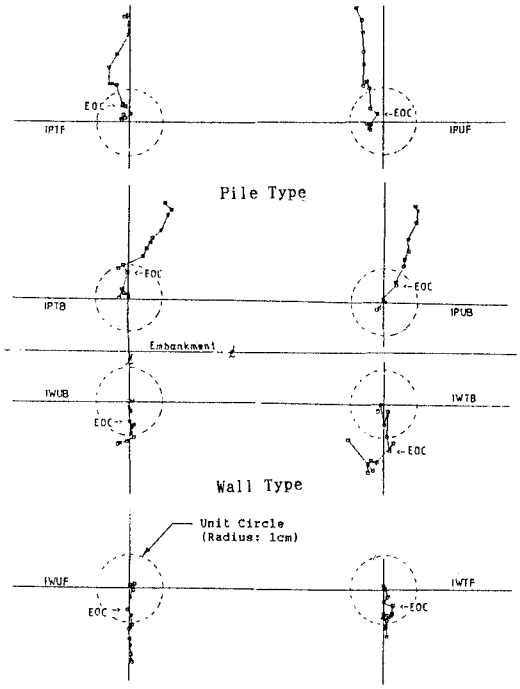

Fig. 5 Loci of Lateral Movement at 2m

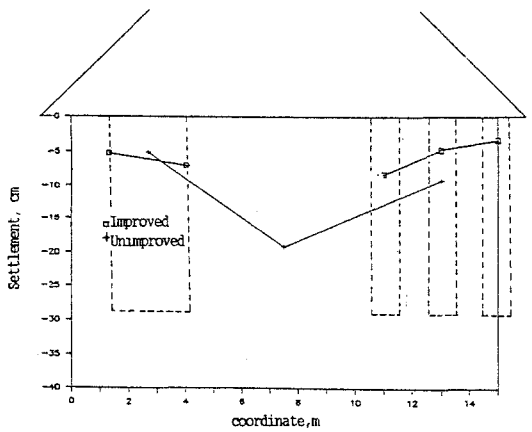

Fig. 6 Vertical Movement of the Ground