BRACED EXCAVATION USING BUNK RETAINING WALL

Y.S.Geraldini N.Iwata M.Niinomi K.Noda I.Uetani
H.M.Shahin T.Nakai F.Zhang

1 INTRODUCTION

Recently, braced excavation using bunk retaining walls is often done. However, its design method is not established. In order to properly predict the settlements and wall displacements it is important to understand and clarify the mechanisms developed in the soil when one wall interfere with the other wall's behavior. In laboratory tests the experiments simulating excavation with two retaining walls were conducted on a two-dimensional model where the ground is simulated using aluminum rods.

2 DESCRIPTION OF MODEL TEST

The apparatus for the experiment simulating the braced excavation as a two-dimensional model is shown in Figure 1. It is a frame of 680mm in width, 450mm in height. The ground is simulated using a mass of aluminum rods with diameters of 1.6 mm and 3.0 mm mixed in the weight ratio of 3:2. This mass of aluminum rods behaves like a medium or dense sandy soil. Aluminum boards with 60mm width are used as walls ($EI=4{,}4x10^{-2}N.m$) and two cylindrical aluminum bars are used as struts to brace the excavation. All dimensions and stiffness are determined on field data simulating a scale 1:100. The first strut is displaced at 15mm depth when the excavation level reaches 30 mm depth. The second is introduced at 75mm depth when the excavation reaches 90mm depth. On the right hand side of the model, there is a column that consists of 13 slide blocks (30mm in height), which may move independently in the horizontal direction measuring the axial force on struts. Surface settlements are measured with a laser type displacement transducer that moves along a slide shaft over the ground model. Furthermore, the movements of the ground as a whole can be found by taking photographs of the mass of aluminum rods. The excavation process is simulated by removing the mass of aluminum rods on the right side of the wall. A total of four cases were carried out, the different profiles of ground model are described on Figure 2.

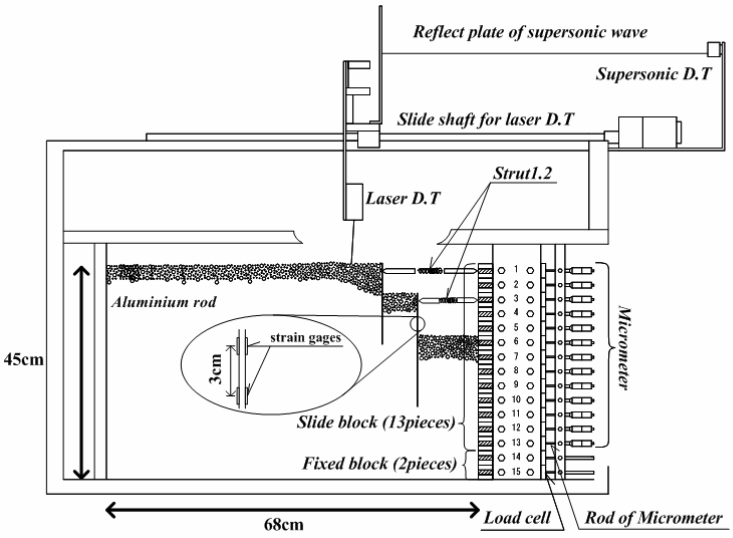

Figure1 Apparatus for 2D model tests

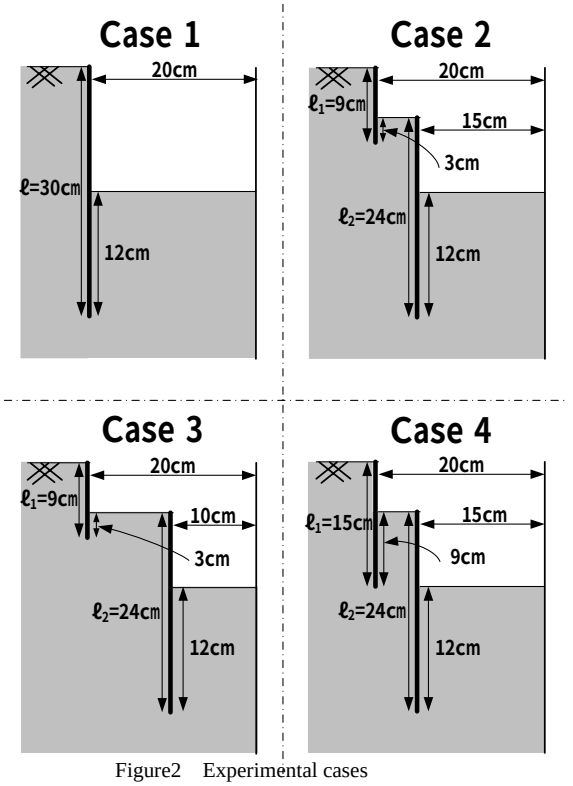

Figure2 Experimental cases

4 RESULTS AND DISCUSSION

4.1 *Wall Displacements*

Figure3 shows the wall displacements observed. Comparing case 3 and 2 can be noted that closer are the walls, larger are the wall displacement on both- inner and outer walls. Therefore, the displacements are inversely proportional to the distance between the walls. Considering the single wall behavior, it is between the case 2 and case 3. A greater distance

between the walls shows a favorable situation; however, as the walls became closer this condition changes into unfavorable condition relative to the single wall case. Further, on the experiments, case 4 showed almost the same or greater settlements them case 2 although the longer outer wall used. Therefore a longer outer wall does not imply in smaller wall displacements.

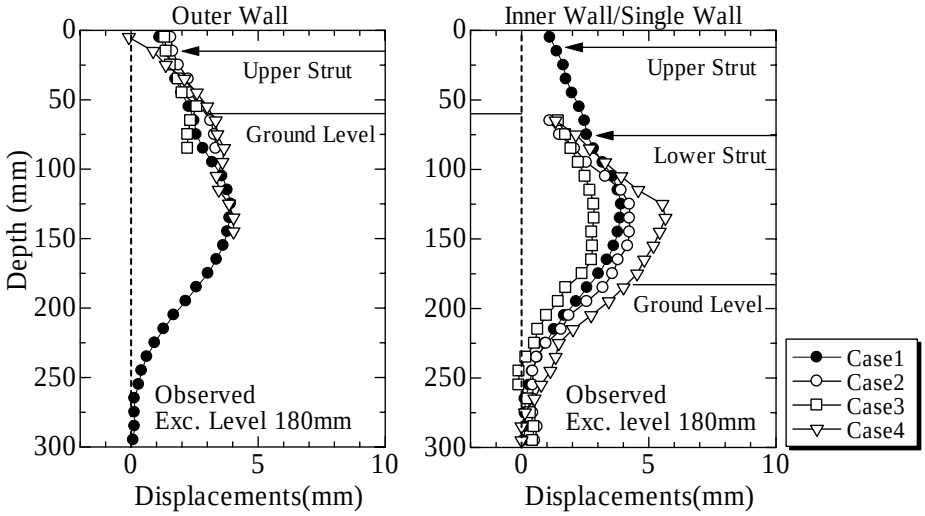

Figure3 Observed wall displacements

4.2 *Surface Settlements*

The settlements observed on experiments are shown on Figure 4. The abscissa represents distance in x-direction and ordinate represents the surface settlements. Case 3 has a smaller settlement than case 2, showing that closer are the walls greater are the settlements. Case 3 presents the smaller region where the settlements occur. Further, the settlements follow the same tendency of the wall displacements.

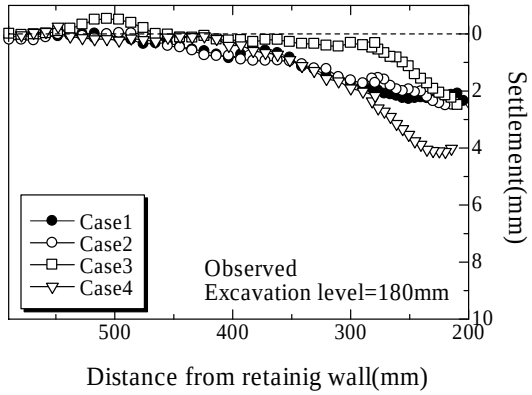

Figure4 Observed settlements

4.3 *Axial Force on Struts*

Figure 5 shows the struts loads observed in experiments. The abscissa represents the excavation level and ordinate represents the axial loads. In one level excavation, case 1, as the excavation goes on, the upper strut is relieved, when the axial load on the lower strut increases. However, on the two levels excavation, both struts load increases continuously. Further, on the two walls excavation, the lower strut load does not increase as fast as on single wall case.

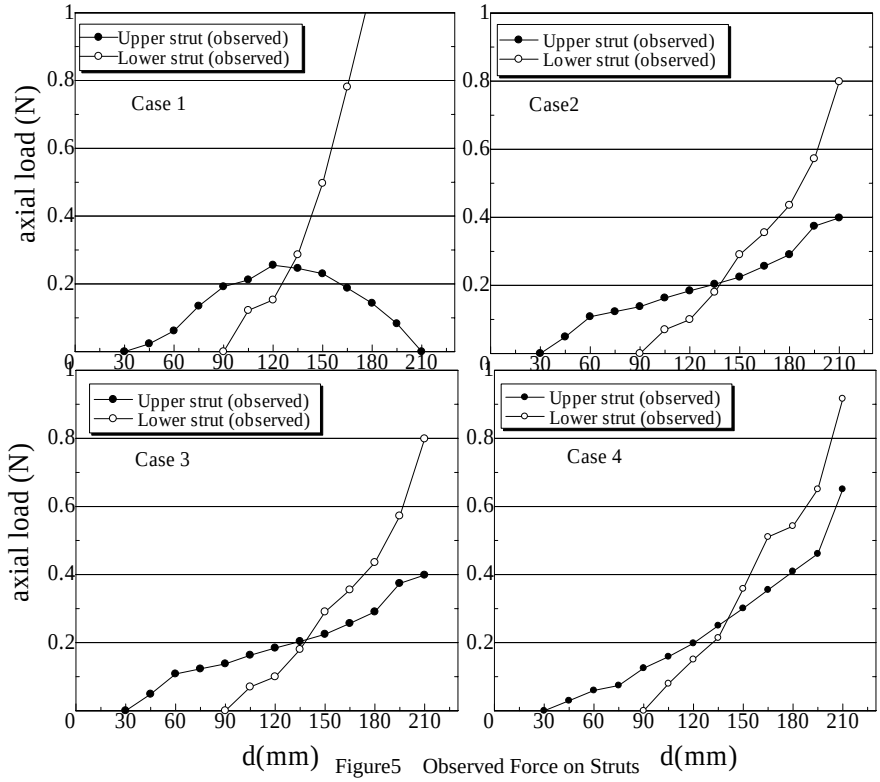

Figure5 Observed Force on Struts

5 CONCLUSIONS

The walls displacements described an inversely proportional relation to the distance between the walls. A longer outer wall did not imply in smaller wall displacements. The settlements follow the same tendency of the wall displacements, and the settlement region is smaller in case 3 where two walls where displaced with a larger distance between them. In one level excavation (single wall), as the excavation goes on, the first strut is relieved from axial force, when the axial load increases in the other strut. On the other hand, on the two levels excavation both struts have the axial load increased continuously being more efficient.