

Test method of damage mechanism of the half-section concrete expanded-plates pile with undisturbed soil model

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Abstract: Owing to many limitations of the traditional soil-pile model test scheme and large pile-soil solid test plan, the failure mechanism research of concrete expanded-plates pile is limited, so this paper will introduce a new test scheme. The test scheme can be a true simulation of the work together with pile and soil, observe the soil failure form, and relatively convenient, safety, and the cost is low, it has universal application significance.

Introduction

At present, there are two ways to study the failure mechanism of concrete expanding piles, the laboratory small model test[1] and the large pile soil solid test in construction site. The equipment of the laboratory model test is simple, the covered area and investment is less, but the soil used in the test in the laboratory is artificially disturbed, so soil moisture content, internal friction angle, cohesion and structure surface form are different[2] from the undisturbed soil, and And soil properties have a great influence on the test results, so laboratory model test can not truly reflect the interaction between pile and soil, and the obtained test data is also different from the actual construction. On the other hand, although the large field soil pile body test is able to get accurate data, which can be used to the actual construction[3][4], the large pile-soil test covers larger space, which equipment is complex, and takes up much time-consuming and laborious, what is more, it is difficult to observe the failure pattern of the soil, and is not good at studying the failure pattern studied of soil. Therefore, taking into the disadvantages of the above two kinds test schemes, this paper introduces a method of the undisturbed soil test, which has universal application significance.

Test scheme design

The design of the main test scheme as shown in Fig.1, the main equipment is the loading station and geotome. In this project, a small scale and half section model pile is used to carry out the

test with the undisturbed soil. Among them, the model pile (steel pile) used in the experiment is made according to a certain proportion of the actual pile body, And will buried the model pile in the undisturbed soil. Finally, put the geotome with the model pile on the loading station loading test and record test data.

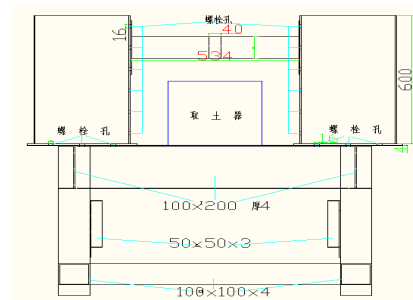


Fig.1 Test device front view

Test preparation

The loading table is one of the main components and one of the key factors to success in the test program, so we designed the test loading platform that meet the needs by ourselves. Its anti - force beam can be adjusted up and down, to meet the different heights of the geotome in the compress or tensile tests which made by the Changchun Nintaus machinery manufacturing plant for processing. The physical diagram of the loading device is shown in Fig.2.

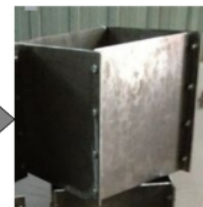
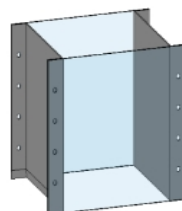


Fig.2 the Loading table entity diagram

Fig.3 the Uplift pile model

Fig.4 the Geotome map

The Small scale and half section model pile is made according to the ratio of the actual project, Because the test simulates the interaction between the pile and the soil, the pile can not be damaged, so the steel pile is used instead of the concrete pile. In Uplift model test, it need to bore a hole from the top of the pile in a certain position in order to facilitate the test. An anti pulling pile of the solid figure is given in Fig.3.

The geotome is the main equipment in extracting the undisturbed soil test, it is necessary to have a certain rigidity in order to ensure that the geotome not only does not occur deformation during extracting the undisturbed soil , but also has function of removing. The geotome size is decided by the size of the model pile, which not only meet the requirements of the pile length and the thickness of the soil , but also meet the requirements of the damage scope of the soil above the bearing plate. However, in view of the soil bulk density, the size of the geotome should not be too large. The Fig.4 presents a geotome design three-dimensional map and the physical map.

In addition to the main equipment described in front of the paper, the test also needs some

attachments (the different nature test should be equipped with the corresponding accessories), loading equipment and measurement equipment, the range of loading equipment and the precision measurement equipment should match the test, not be too big or too small.

The selection of undisturbed soil

The place of selecting the undisturbed soil is located in the Changchun City Economic and Technological Development Zone, Wuhan road south, free Tung Road East, Changchun City Economic and Technological Development Zone South movements Residential Project No.1-14 floor. According to the geotechnical engineering investigation report (detailed survey) of Jilin Architectural and Civil Engineering Institute survey company, The No.12 building are selected as the location of the undisturbed soil. The soil processes are shown in Fig.5.



(a) Digging foundation pit



(b) Put the geotome
earth



(c) Quietly pressed into the



(d) Dig out the geotome



(e) arrangement



(f) Sealed

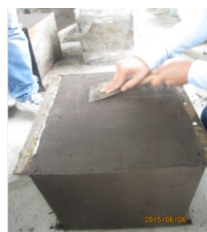
Fig.5 The process of soil sampling

The model pile embedded in undisturbed soil

After transporting the geotome in the laboratory, the next job is making the model piles embedded into the undisturbed soil. Taking the actual test as an example, this paper introduces the main processes as shown in Figure 6.



(a)



(b)



(c)



(d)



(e)

Fig.6 Buried pile process

(a) Put the geotome on the clean plastic, then tear the steel plate that buried half section model pile down with the wrench and pliers.

(b) Use a small shovel to clean the original soil surface, so as to be able to observe the failure pattern of the soil in the following experiments.

(c) Fix the piles in the middle of the soil with two 90 degree steel strip to ensure semi section steel pile buried in undisturbed soil vertical. Then mark the location of the bearing disk , and take the soil in the bearing plate location out with box cutters.

(d) Place the mat wood on the semi - section steel pile, and press the semi - section steel pile into the undisturbed soil with the method of static pressure.

(e) Clean the steel plate to ensure the surface clean, and install the plate on the geotome. Then make sure the geotome upright to ensure the work principle of the model of pile-soil and engineering of pile-soil consistent.

This paper is mainly study the failure mechanism of the concrete expanded-plates pile under the action of vertical stress or vertical tension, and now as the actual tensile test an example, introduces the main test process, as shown in Fig.7.



(a)(b)



(c)



(d)



(e)



(f)



(g)



(h)

Fig 7 The main steps of experiment

(a) Firstly, clean up the loading table, and place the subplate on the bottom surface of the geotome, Then slowly lift the geotome and subplate onto the loading table artificially in order to avoid collision. Then remove the steel plate which closes to the buried pile of the geotome

with the spanner, pliers and other tools.

(b) Number the pile according to the scheduled testing scheme.

(c) Replace the steel plate which closes to the buried pile with toughened glass and fix the toughened glass and the geotome together with the clips

(d) Adjust the position of the geotome to ensure the semi section pile and the center of the circle of the hole in the reaction beam on the same vertical lines as far as possible. Then install the geotome beam, and fix them with bolts.

(e) Make the pull rod through the hole in the reaction beam and connect the half section pile by a pin. Assist the rod with hand in the vertical state, so as to ensure the force is vertical.

(f) According to the distance between the hole and the jack, install the jack and adjust the height .

(g) After installing the jack, Fix the displacement meter on the top of the jack and make it Keep vertical.

(h) After everything is ready, start the test. During the test, set a person to record the test data, and take the picture of the failure mode of the soil until the soil damage, this completes a full test process.

If it is the undisturbed soil damage mechanism under the action of vertical pressure, the first three steps of the test is similar to that described above. The different places is from the fourth step, the compression test is not required to install the reaction beam, and pull the rod. However, The pile cap needs to be placed on the top of the pile, while the jack and the displacement gauge are arranged on the pile cap, and the other parts are similar to the tensile test. At the end of the calculation, the gravity of the pile cap and the jack need to be subtracted.

Conclusion

The above is the test method of the new semi section model pile with the undisturbed soil, this method overcomes the disadvantages of the traditional test method, and can meet the many experimental requirements such as compress, anti pull, anti overturning and so on , it also has universal application significance.

Acknowledgments

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