Technology for monitoring side friction of caisson in deep overburden layer

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Summary

Abstract:Until now, directly monitoring the sidewall frictional resistance is difficult because it is a kind of shear stress and we lack effective monitoring instruments. A Technique is presented in this paper to measure sidewall frictional resistance of a caisson directly and is applied in the north anchorage caisson of Taizhou Bridge. Mutual authentification can be made between this monitoring result and measuring result from soil pressure gauge. The result shows that this technology can monitor frictional resistance directly and effectively with high precision, which anticipates a possibility of direct measurement of frictional resistance between rigid structure side wall and soil.

Key Words: frictional resistance, caisson, monitoring, soil pressure

1 Introduction

Medium and large scale caisson foundations with deep overburden soil usually have large sizes and the frictional resistance between caisson sidewall and soil is a major factor in controlling the sinking of caisson. It is important to know the actual distribution of frictional resistance in order to fulfill structural design, study mechanical models and guide the construction process[1-3]. However, it is difficult to directly monitor the sidewall frictional resistance as it is a kind of shear stress and effective monitoring instruments are absent for this purpose[4]. Therefore, indirect profiles are usually adopted to monitor the resistance. For example, concrete strain gauge or steel bar strain gauge is employed to monitor the axial force in a pile or the vertical stress of the caisson structure and the sidewall frictional resistance is indirectly calculated from the obtained data[5] . The method has a shortcoming that it can only obtain the mean frictional resistance between two sections and it is unable to get the sidewall frictional resistance at a selected spot and meanwhile, the accuracy of the method is very low due to the measured strain or stress is very small and sometimes is in the same order of magnitude with measurement errors. During the caisson construction stage, sometimes pressure cells are buried onto the side to measure normal stresses, which can be converted into frictional resistance after being multiplied by friction factor[6-8]. But in the same time, this method has obvious limitations: firstly, it is difficult to accurately measure the friction factor; secondly, even when the accurate friction factor is obtained, the frictional resistance is not equal to the product of normal stress and friction factor if the rolling friction is not at the critical state; in addition, under some circumstances, it is impossible to determine the direction of friction. For example, the direction of frictional resistance may possibly reverse when the anchorage caisson foundation deflects under the pulling force of the cable[9,10]. These problems cannot be solved by the buried pressure cells. In geotechnical model tests, it is often required to simulate and measure the friction force between the soil and the model structure. The test model resembles the actual structure but is much smaller in size. As scale models are usually used in the tests, the loads and the responses are usually very small. So the test instruments are required to have high resolution, and this is another difficult problem to be solved.

This study presents a technique that can directly measure the sidewall frictional resistance of a caisson. The technique has been applied in the sidewall frictional resistance monitoring in the north

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