



Research on Design of Model in shaking table test box in soft soil

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Abstract

A reasonable choice of structure of a model box is significant for a shaking table test to be successful in geotechnical engineering. A model box has been designed for the shaking table test of a subway station structure in the soft soil of Tabriz in the paper. The reasonable geometric similarity scale of the subway station structure has been determined by a 3-D dynamic analysis under the action of lateral equivalent static loading. The shape, size and structure of the model box are chosen by considering all the involved factors comprehensively. The shape of the box is similar to that of a typical station structure, and the ratio between the plane dimension of the model ground and that of the model structure is big enough to reduce the influence of boundary condition effectively. The structure is strong enough to avoid being demolished by shaking during a test. The contact conditions between the model soil and box are clear to help the data gained from the test well fit that from numerical analysis. The total weight of the model soil and box is less than the bearing capacity of the shaking table apparatus and there is no resonance between the model soil and box. The results show that the model box can be used to simulate the dynamic response of a subway station structure very well, so it provides a firm foundation for the success of the shaking table test of a subway station structure.

Keywords: shaking table test, model test box, subway station structure, model soil

1. Introduction

With the speedy development of the economy, the subway construction scale in Iran has been expanding rapidly in recent years. Since it was shown from the Kobe earthquake in Japan that the subway structures also could be badly destroyed during an earthquake, Iranian researchers and engineers pay attention to the seismic design of a subway station and tunnel in soft soil for disaster prevention and mitigation. Researchers in Tabriz pay more attention to the seismic design of subway structures. The rapid development of computer and numerical simulation technology is helpful to provide efficient tools for the simulation of seismic response, and up till now several numerical simulation approaches in the field have been established. However, these approaches were established based on assumptions related to various influence factors, so that they generally yielded quite different results for the dynamic response analysis. So a judge of the rationality of these approaches by the shaking table model test is of great importance. Generally speaking, the results of a shaking table test are usually influenced by multiple factors. It is possible that any incomprehensive consideration in a test could make the results utterly far from the actual case. Since the shaking table test simulating a double floor subway station structure has no precedence in Iran, researchers had to overcome a lot of technical difficulties to successfully complete the test. Among them is the choice of the optimal structure of the test box, because the structure and conformation of the test box have remarkable influences on the rationality of the test results. Studies related to test box designs and resolutions are investigated in this paper. Test results show that the box structure chosen in the tests is rational and can provide a stable foundation for credible results.

2. Requirements for structure and components of the model test box

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