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Study on the Relationship Between Void Ratio and Empirical Relationship of Depth and S-WAVE Velocity in Clay

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Soil layer shear wave velocity is a key parameter in numerical simulation models of ground motion of various sites. For three-dimensional models, there is a high cost to measure the shear wave velocity. It is a common method to estimate the shear wave velocity by an empirical relationship of depth and velocity depends on several drilling data. This paper studies the depth-shear wave velocity empirical relationships of various soil layers in Yuxi, Qingdao, and Fuzhou. It is found that the correlation degree between depth and shear wave velocity is higher in the soil layers with obvious grain characteristics, such as breccia layer, round gravel layer, gravel layer and fine sand layer, and the error of the empirical relationship is lower. Conversely, the correlation degree is lower and the error of the empirical relationship is high in clay layers. The possible reason for this phenomenon is: the layer description in the drilled histogram cannot represent the clay layers with different properties effectively.

For soil layers with obvious particle characteristics, the shear wave velocity has a significant positive correlation with the particle size. The size of the sediment particles is related to the carrying capacity of the surface water. A larger the water flow and faster flow velocity lead to a larger sediment particles. Therefore, this paper considers that the shear wave velocity of the soil layer in the study area is related to the hydrodynamic deposition environment. Smaller sediments carry longer distances in the water stream, resulting in lower sedimentary layer wave velocity; larger sediment particles carry shorter distances in the water stream, resulting in higher sedimentary layer wave velocity. Further analysis shows that the shear wave velocity of the clay layer has a certain relationship with the particle characteristics of the other soil layers in the same drill. In the environment where the sedimentary soil layer with larger particles is formed, the shear wave velocity of the clay layer is also higher. This article discusses this phenomenon and further analyzes the influence of the porosity ratio of the clay layer on its depth-shear wave velocity empirical relationship in the Yuxi area. It is found that the void ratio of the clay layer has a negative correlation with its shear wave velocity. The depth-shear wave velocity empirical relationship of the clay layer in Yuxi area was modified to improve accuracy.

The study of the relationship between the sedimentary characteristics, particle characteristics of the soil layer and the shear wave velocity, a key factor in the site conditions, is an attempt to improve the accuracy of geophysical model parameters using geological data. In the research of numerical simulation of site ground motion, it is possible to use abundant geological data to

supplement models using few geophysical exploration data, or areas where it is difficult to carry out geophysical exploration, and it has certain application value.