

Experimental study on dynamic characteristics of rubber sand mixtures

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Abstract

As a new type of environmentally friendly lightweight composite material, rubber sand mixture has a wide application prospect in the field of engineering vibration isolation. In order to reveal the variation law of dynamic characteristics of different rubber sand mixtures, based on the dynamic triaxial test, the effects of rubber content and confining pressure on the backbone curve, dynamic shear modulus and damping ratio of mixtures were studied. The results showed that with an increase in the rubber content, the backbone curve of rubber sand mixture had a trend of 'ductile failure' and the dynamic shear modulus of mixture decreased. The nonlinear coordinated variation could be found between the damping ratio and rubber content with a characteristic threshold of 40 %. The mechanical properties of rubber particles may be influenced by changing the type of 'skeleton structure' inside the sample.

Keywords: rubber sand mixture; waste tire; backbone curve; dynamic shear modulus; damping ratio.

1 Introduction

With the rapid growth of the economy and transportation industry, the quantities of waste tires continuously increase year by year due to the annual consumption of a large number of tires [1]. According to the statistic in 2017, the annual production of waste tires in China is about 10 million tons with an annual growth rate of 8%-10% [2]. The recycling of waste tires in a reasonable and effective way has become an urgent social problem. Waste tires, as a new type of environmentally friendly lightweight composite material, can be called "black gold". This is because they not only have the characteristics of light density, strong deformation ability, and good durability compared to soil [3-5], but also can significantly improve the physical and mechanical properties of soil when mixed with sand [6]. Additionally, they can also play a role in vibration

reduction and isolation [6-13]. Therefore, the research on the mechanical properties and engineering applications of rubber sand granular hybrid soil can better resolve the current social problem of reusing waste tires, which is beneficial to sustainable development.

A certain number of experimental studies on the dynamic characteristics of rubber sand mixtures were carried out by using resonant column test. Through the analysis of the results of the resonant column test, it was found that the incorporation of rubber particles significantly improves the dynamic performance of the soil, so that the mixed soil has the characteristics of low shear modulus and high damping ratio [13-15,17]. The researchers found that rubber content and confining pressure are the main factors affecting the dynamic performance, energy dissipation characteristics and stiffness of rubber particle mixed soil [16,17]. However, the American test standard [18] compares the