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不同应力路径下石灰岩碎石力学特性的大型三轴试验研究

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LARGE SCALE TRIAXIAL TESTING ON MECHANICAL PROPERTIES OF BROKEN LIMESTONE UNDER VARIOUS STRESS PATHS

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摘要

为了解不同应力路径下,昆明新机场石灰岩碎石填料的力学特性及该填料力学特性受水影响的程度,采用大型三轴试验机,对该填料进行不同应力路径下的三轴试验及等 σ'_3 压缩应力路径下的干湿对比试验。结果表明: $\Delta\sigma'_1 \geq 0$ 时,围压和应力比 k (即小主应力增量与大主应力增量的比值)增大,试件峰值应力及初始模量亦增大,但剪胀逐渐受到抑制;石灰岩碎石的剪胀及剪缩特性与应力路径有很强的相关性;石灰岩碎石的强度非线性特征显著,围压减小的应力路径下,试件剪切强度比等 σ'_3 应力路径下略低;水对石灰岩碎石的剪切强度、初始模量及剪胀性有较大影响。该文的试验成果可为构建考虑应力路径影响的高填方粗颗粒填料本构模型提供试验基础。

关键词: 高填方 石灰岩碎石 应力路径 大型三轴试验 剪胀 剪切强度

Abstract:

In order to acquire mechanical properties of the broken limestone of Kunming new airport as well as that affected by water, large scale triaxial tests were conducted. Both triaxial tests under various stress paths and contrast tests of constant σ'_3 compression under dry and wet conditions were carried out. The test results show that peak stress and initial modulus, under the condition of $\Delta\sigma'_1 \geq 0$, increase as confining pressure or stress ratio k (the ratio of minor principal stress increment to maximum principal stress increment) increases, while the dilatancy is restrained gradually. Furthermore, dilatancy and shrinkage behaviors of broken limestone are strongly related with the stress paths. The shear strength of broken limestone is of high nonlinearity. The shear strength under the stress path of reducing confining pressure is slightly lower than that under constant σ'_3 . Finally, water has considerable influence on the shear strength, initial modulus and dilatancy of broken limestone. This research provides experimental basis for establishing constitutive models of coarse-grained fills, considering the influence of various stress paths.

Key words: high fills broken limestone stress paths large scale triaxial test dilatancy shear strength

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