



高渗透孔隙水压对混凝土力学性能的影响试验研究

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EXPERIMENTAL STUDY ON MECHANICAL PROPERTIES OF CONCRETE DUE TO HIGH SEEPAGE PORE WATER PRESSURE

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摘要 模拟大坝混凝土工作环境, 将混凝土标准试件浸没于高压水体中, 在混凝土内造成高渗透孔隙水压, 研究高孔隙水压作用后混凝土产生的强度、弹性模量, 含水量和声速等宏观指标的变化。试验中具体开展了混凝土试块外不同水压(孔隙水压)、不同时间、不同混凝土等级、不同最大骨料粒径4个因素的影响研究。试验采用正交试验设计法进行设计, 关于高渗透孔隙水压对混凝土抗压强度、含水量变化和声速的影响研究共进行了28组试验, 而抗拉强度试验进行了9组。研究表明, 随着渗透孔隙水压的增加, 混凝土的抗压强度、劈裂抗拉强度和弹性模量逐渐降低, 其损失率逐渐增大。其中外界水压(孔隙水压)、粒径和混凝土强度等级对混凝土抗压强度损失有显著的影响。在同一孔隙水压作用下, 粒径越大、混凝土等级越小, 其损失率越大。混凝土含水量随着外界水压(孔隙水压)的增加而增加, 并与孔隙水压的作用时间和混凝土等级有关, 时间越长、强度等级越低, 含水量越大。混凝土波速随着外界水压(孔隙水压)的增加, 波速呈现波动性变化。

关键词: 混凝土 试验 力学性能 孔隙水压 渗透

Abstract: In order to simulate work environment of high dam concrete and effects on the mechanical properties of concrete due to high seepage pore water pressure, standard concrete samples are immersed into a high water pressure container and high hydraulic gradient is produced in testing samples. The concrete mechanics and physical properties studied in the paper are included strength, young's modulus, water content and wave velocity. The effects due to different water pressure in the container (concrete pore water pressure), time, concrete grade and aggregate maximal grain size are considered in experiments. Experimental scheme is designed by an orthogonal experiment design method, thusly, 28 groups of experiments for the studying effect of compressive strength, water content and wave velocity, 9 groups for tensile strength are obtained. The study shows that the lost rates of concrete compressive and tensile strength, young's modulus are gradually increased with the increase of pore water pressure. The significance test shows that pore water pressure, grain size and concrete grade are significance to compressive strength. Under same pore water pressure, the lost rates are increased with increase of grain size and reduction of concrete strength. The water content relates with pore water pressure, and concrete grade. The water content of sample is increased with increase of time and reduction of concrete strength. The wave velocity of concrete sample shows a fluctuation character with increase of pore water pressure.

Key words: concrete experiment mechanics property pore water pressure seepage

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