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软岩遇水软化膨胀特性及其对拱坝的影响

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摘要 泥钙质胶结砾岩遇水后软化, 力学性质会发生较大变化, 其强度及刚度均大幅度降低; 同时, 软岩吸水后会膨胀。首先, 通过试验研究泥钙质胶结砾岩在自由状态、受压状态下由于浸水而产生膨胀变形; 然后, 通过数值计算, 分析几种拱坝运行期间可能出现的工况; 最后, 结合原型观测得出结论, 在砾岩上修建结构物如拱坝时, 除了要考虑岩体由于自重等因素产生的初始应力场外, 还需根据实际情况, 考虑浸水对砾岩力学性质的影响。

关键词 [岩石力学](#) [膨胀软岩](#) [拱坝](#) [数值分析](#)

分类号

BEHAVIOR OF SOAKING ROCK AND ITS EFFECTS ON DESIGN OF ARCH DAM

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Abstract

Tasi River Hydraulic Project is located in the "Shimen" gorge section in the middle stream of Tasi River in Manasi County, Xinjiang Uygur Autonomous Region of China. The U-shaped gorge is approximately 350 m long and 70-80 m width at bottom. The RCC arch dam is 109 m in height with a crest length of 176.5 m. The thickest part at the intrados is 31 m. The bank and riverbed are comprised of caesious and red rudite. The result of uniaxial tests shows that the behavior of soft rock changes when immersed. While soaked, the red rudite's deformation modulus drops to 3 GPa from 15 GPa at drying regime. Besides the large decrease of deformation modulus, swelling follows because of water absorbing. The dilatancies of soft rock are measured in liberty or compression condition. Even in compression the soft rock still swells while soaked; and the swelling deformation is comparable in magnitude to the deformation caused by the compression stress. Therefore, the swelling deformation cannot be ignored. Its effect on the deformation distribution of the arch ring will also be presented in the paper. Different processes will lead to different results. In the first scenario where the rock is soaked before the arch dam is built, only the low deformation moduli at different stress status will be considered. In the second scenario where the rock is soaked after the arch dam is built, the effect on dilatancies of soft rock will also be included. In the second scenario, the stress distribution may be inverted and thus pose a great danger to the arch dam. It is also shown that the Tasi River Hydraulic Project is close to the first scenario by analyzing its in-situ observation data. The arch dam safety will be improved by building curtain walls to maintain the water content in the rock. The effect of water should be taken into account in addition to the initial stress field in the practical situation during the design of arch dam on soft rock.

Key words [rock mechanics](#) [swelling soft rock](#) [arch dam](#) [numerical analysis](#)

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