INFLUENCE OF SATURATION DEGREE ON THE TRIAXIAL BEHAVIOR OF CONCRETE

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Concrete is a building material used for sensitive infrastructures like dams or nuclear reactors; however its behavior remains poorly known under extreme dynamic loading like rock falls, explosions or ballistic impacts. This is due both to the difficulty of reproducing experimentally such a loading which generates transient high triaxial stresses and to the intrinsic complexity of concrete. Predicting its dynamic response needs first an experimental characterization of its behavior under extreme triaxial stresses and various controlled loading paths. Some authors [1] argue that inertia, producing an effective confining stress, plays a major role in the apparent rate dependence in compression. The influence of defects may explain the important rate effect in tension [2]. According to the previous references, the identification of the constitutive behavior of concrete under high dynamic loading by means of quasi-static tests is then possible.
An experimental study performed on a standard low strength concrete with a maximum aggregate size of 10 mm is presented. The specimens are cylinders of 140 mm length and 70 mm diameter. They are conserved in water until weight stabilization. The experimental device consists of a large capacity triaxial press. The experiment originality is due to the level of stresses (of the order of one GigaPascal) regarding the specimen size. "Real" concrete specimens (centimetric aggregate dimension) can then be tested. The use of gauges to measure strains at very high confinement is another original feature of that experimental study. Different loading paths can be followed by means of independent controls of the axial stress and the confining pressure. The influence of the loading path on the triaxial behavior of dried concrete is presented in another communication [3]. Since sensitive infrastructures are generally massive and constituted with low porosity concretes, the saturation degree is heterogeneous. It varies between the dried state (on the facing) and the saturated one (in the core of the structure). The present paper will focus on the influence of the water content on the response of concrete under severe triaxial loading. Test results show that the saturation degree has a major influence on the material behavior. There is a clear bifurcation in the responses of dried and saturated concrete samples during the hydrostatic and deviatoric loading phases at a confining pressure depending on the saturation degree.

References

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