

Energy of destruction as an indicator of resistance to degradation of stone architectural elements under the sustainable development goals

ALICJA BOBROWSKA, ANDRZEJ DOMONIK AND
NADIA SZYPUŁA

University of Warsaw, Faculty of Geology

Presenting Author: a.bobrowska@uw.edu.pl

Understanding the geotechnical properties of rocks used as building material of structures is particularly important in the context of their susceptibility to deterioration caused by weathering. This is especially significant in the case of historic buildings, which are often degraded and require conservations. In rock engineering, geomechanical studies play a key role in diagnosing the susceptibility of rocks to geoenvironmental hazards and the loss of strength, and consequently, the energy of destruction of stone structure. The energetic criterion for assessing the rock deterioration process seems promising in architectural rock engineering, as it can be applied at various stages of degradation of rocks. The analysis of the energy of destruction was conducted on the Szydłowiec sandstone. This stone has been used for centuries in architecture and sculpture along the Royal Route in Warsaw, recognized in 1994 as a historical monument. Durability of sandstone structures depends not only on its physicochemical properties but also on the influence of geoenvironmental conditions. To determine the susceptibility of sandstone to destructive factors, the influence of frost was analyzed by conducting studies modeling frost fluctuations, as well as the impact of anthropopression, i.e., acid rain and smog [1]. Subsequently, tests were conducted to determine the compressive strength [2]. Based on the strength tests, deformation curves were obtained, describing the character of pre-critical and post-critical destruction of the structure. From the analyses of the deformation curves, it follows that the determination of energy components allows us to assess what part of the potential energy has been used up to a given moment of deformation and what part of the energy remained accumulated and used for cracking. The value of the potential energy of the rock at a certain stage of deformation informs us about how advanced the state of cracking of the stone material is, and thus, to what extent its strength has been reduced due to the action of deteriorative factors.

[1] A. Bobrowska, E. Jagoda, A. Domonik, G. Ryzynski (2022). *Resource Policy* 77,102698

[2] A. Bobrowska, A. Domonik (2015). *Studia Geotechnica et Mechanica* 7, No. 3, DOI: 10.1515/sgem-2015-0027