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Thickness effect on flexural strength of natural stone

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Few scientific works deal with size effect on mechanical resistance in the case of stone, but for the concrete size effect has been widely verified. In fact, the stone size effect is not always ruled by well-known statistical laws as Weibull because of the intrinsic complex structure and features of the materials analysed.
Previous studies on natural stone size effect have been made mainly taking into account compression strength. However, flexural strength test under concentrated load, according EN12372, is applied to assess the mechanical resistance of stone and it is well correlated with the petrographic properties of stone. For this reason, to further investigate the size effect on stone , this research analyses the variation of mechanical resistance in relation to thickness of the specimens, taking into account the petrographic characteristics (mineralogical composition, heterogeneity, anisotropy, porosity)of different kinds of rock.
From previous studies on 15 different stones (Bellopede et al. 2015) it was observed a negligible values variation for different thickness and a data scattering caused by: intrinsic properties (porosity and structure), defects distribution (fractures, cracks, voids), heterogeneity characterizing each specimen.
According to EN 12372:2006, the suggested dimensions for the determination of flexural strength under concentrated load are 50x50x300mm. Other dimensions are possible, but the following requirement need to be fulfilled. The thickness should be minimum 25mm and maximum 100 mm, the width should be within 50 mm and 3 times the thickness and the distance between the supporting rollers span should be 5 times the thickness.
In this research, in order to further investigate the thickness effect even in relation with the stone structure and heterogeneity, eight different stones have been tested: four with anisotropic features and four homogeneous. The distance between the support knife was equal to 2/3 to specimens length.
The thickness effect on the flexural strength of most of the material tested is negligible considering the uncertainty (except for gneiss).
From the data obtained some remarks has been found on the test methodology and on the specimens thickness. Moreover, in view of obtaining reliable data with low uncertainty by means of flexural strength test, a minimum thickness specimen both for fine and coarse grained stones has been detected.