SIZE EFFECT OF CONCRETE AND SANDSTONE IN COMPRESSION

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ABSTRACT

It is well known from literature that heterogeneous materials like concrete or rock show different strength and ductility for small and large sizes. Thus the experimental determined strength is not a material property. Numerous experiments were performed regarding the size effect in tension, very few experiments were performed in compression.
In structural systems concrete is applied to carry in compression and not tension. Compressive loading is very important in structural engineering, especially in unreinforced structures. The compressive failure in a load carrying member is brittle and in most cases more dangerous. Experimental investigations are therefore needed. Experiments from literature on column like specimens under compressive loading were performed up to a size range of 1:4. The size range of a series of geometrically equal specimens is given by the amplification factor of a characteristic dimension from the smallest to the largest specimen size. Large size ranges are advantageous, because the data can be fitted more accurately. The largest size range of the experiments under compressive loading will be presented in this thesis. These series were performed in one of the largest testing facilities available. The tests on sandstone were performed on a size range of 1:32 and the concrete series on a size range of 1:16. These test series have the largest size ranges of tests on granular materials under compression published so far.
Three sandstone test series were performed. Special attention was paid to minimize influences of testing facilities, determine an appropriate specimen machine interface, a suitable notch for compressive loading and the influence of strength between centric and eccentric loading.
A test series on concrete specimens was carried out. To eliminate additional sources of size effect in the molding process, the formwork and the concrete mixture were considered in the preparation of specimens. The influence between the different testing machines was determined. The increase of strength due to hardening of concrete during testing period was evaluated. A size effect was detected for both materials and the results are compared to the two most common size effect laws.