Abstract

Since several millenniums ago and still today adobes are being used in construction of buildings. The adobes are made from dried clayey soils. If water is in contact to the foundation of such buildings, it rises in the walls up. Building measures for example sealing the surrounding surfaces particularly for historical and culturally significant civil works gained recently more attentions. For non-burned adobes this uprising moisture is followed by reduction in strength of the material.

The aim of this research is to explain the uprising moisture in a masonry work made from adobes as a function of time and boundary conditions and to realize the effect of this raised water content on the shear strength of adobes unreinforced and reinforced with natural fibers. According to this basis the effectiveness of the selected countermeasure method is investigated.

Initially the materials used and the preparation of adobes are described. From this preparation method it is clear that in order to solve the problem the mechanics and hydraulics of unsaturated soils should be taken into account. In order to analyze the moisture transport in the fine grained soils of adobes, the water content-suction relationship and effect of reinforcement with natural fibers on that must be experimentally determined and discussed. The shear strength of this material is derived using a Biaxial device as a function of water content or its corresponding suction and also fiber content. In perception experiments the capillary uprising of moisture in a model wall which is in contact with water at the bottom are investigated and the volume changes related to this uprising are also monitored.

With a numerical simulation in which the input parameters are derived from basic investigations, the perception experiments are recalculated. The comparison of the results shows that the numerical modeling is able to represent the observed phenomenon. The model is then used to calculate the uprising of water with realistic dimension, to observe the efficacy of the countermeasure methods, and to evaluate the wall with the knowledge of changes in shear strength due to changes in water content and suction.

The investigations show that the uprising moisture over periods of several years can reach up to several meters height. The performance of the top surface of the wall is an essential boundary condition. The opening in the impermeable facades is an effective method
to reduce the height of wetted zone. An unobtrusive but effective method is to drill ventilation holes with regular intervals through the masonry work.