

CONTRIBUTION TO THE PANEL DISCUSSION IN SESSION I : ENGINEERING PROPERTIES OF CARBONATE ROCKS.

CONTRIBUTION A LA DISCUSSION DANS LA SESSION I : PROPRIETES GEOTECHNIQUES DES ROCHES CARBONATEES.

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The word "rock" is used in two ways in our technical literature :

1. to describe a small laboratory or hand specimen which might more precisely be called a sample of the rock substance or of the rock material ;
2. the term is also used for the large volume of the subsurface which a major construction project may act on. Here we will use the term rock mass.

The relationship between the two ambiguous uses of "rock" can be illustrated by writing the informal equation.

Rock mass properties = Rock substance properties + properties of discontinuities in the rock mass.

Discontinuities such as joints, faults, bedding planes and unconformities break the mechanical continuity of the rock mass. The equation above indicates the fundamental problem of extrapolating from the properties of the rock substance to those of the rock mass which are needed for design – somehow the often-controlling influence of the discontinuities must be included.

Discontinuities are of overriding importance in determining the permeability of carbonate rock masses ; the primary permeability of carbonates is typically small compared to the secondary permeability arising from solution – widened joints. The discontinuities also strongly influence the strength and deformability of carbonate rock masses.

One method of moving to design parameters can be drawn from tunneling practice. The important innovations of the Austrian school of tunnel design and the ideas of Bieniawski and Barton among others have led to the creation of a single design parameters variously named the Rock Quality Index or the Rock Structure Rating. The details of this process have been described elsewhere (Cruden *et al.*, 1981).

The parameter may have a number of uses particularly in works in carbonate rock masses. Changes in mass properties

caused by the erosion of joint filling or joint widening by solution can be quickly and roughly estimated. Similar guides to the effect of remedial work can also be quickly derived. The parameters might prove one possible basis of contract documents, avoiding disputes about changed conditions.

Notice, however, that the method is empirical rather than analytical. But if geologists will use this method, they will more easily benefit from the experience of others and they will formalize and simplify the task of transferring their own experience from one site to another. The more the method is used, the more precise, elaborate and useful will the parameters become.

There is presently little experience recorded from carbonate rocks. But one major advantage of working in carbonates is that natural underground openings frequently exist in problem rock masses where the openings have collapsed, a back-analysis analogous to those used to check assumptions about effective parameters acting during slope movements, can be carried out. Such an analysis is a valuable check on empirical methods.

It is appropriate to make these remarks in Istanbul where Karl Terzaghi began his academic career. Terzaghi, whose first contributions to geotechnique were to karst geomorphology, emphasized the need to learn from natural phenomena by careful observation. Such advice is still relevant today.

REFERENCE

- CRUDEN D. M. – LEUNG Y. P. – THOMSON S. (1981) :
A collapse doline in Wood Buffalo National Park, Alberta, Canada. Symposium on Engineering Geological Problems of Construction on Soluble Rocks, Istanbul, September, 14-18.