

The new engineering geological map (*carta litotecnica*) of Tuscany (Italy)

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Abstract:

Municipal administrations in Italy must be provided with thematic maps and documentation which describe the geological, geomorphological, lithological, hydrogeological and hydraulic characters useful to manage spatial planning issues. Among these documents, a "Lithotechnical" (or "Lithological-Technical") map is drawn up, generally at the scale of 1:10,000, by organizing the geological formations into lithotechnical units according to their lithological and physical-mechanical properties. Often, this map also integrates the results of previous field and borehole investigations. However, this map is characterized by a certain degree of subjectivity because it is supported by few specific quantitative data.

We present a new method for the regional scale engineering geological classification of sub-surface rock and soil masses obtained by integrating the geological map at the scale of 1:10,000 as a reference document, with a large set of data obtained through the collection and processing of new lithological and physical-mechanical observations and measurements of the outcropping geological formations. The adopted procedure involves both the extensive in situ use of the Schmidt's hammer and the execution of laboratory tests, such as the Slake Durability Test (Franklin & Chandra, 1972) and the determination of the rock unit weight. These tools and tests allow us to acquire a large set of quantitative in situ and laboratory data with known repeatability to obtain a regional scale GIS database providing the classification of the lithological and physical-mechanical characteristics of a wide range of geological formations.

As a first step, each outcrop is classified according to a new engineering geological nomenclature system described by the code XXv[y]_[Z] whose values are obtained by integrating: i) a lithological parameter XXv evaluated from both typical characters of the geological formations under analysis and outcrop observations; ii) an engineering geological parameter [y] obtained by the results of the Slake Durability Test; iii) an engineering geological parameter [Z] (Rockmass Quality Index - RQI) evaluated at the outcrop scale on the basis of a large set of sclerometric measurements. The results of outcrop classification are stored into a point topology GIS dataset and are then processed and spatialized in order to assign the XXv[y]_[Z] code to the geological formations, thus obtaining the new engineering geological map.

Within the framework of research agreements among Regione Toscana administration, the Consorzio LaMMA, the CNR-IGG and the Department of Earth, Environmental and Physical Sciences of the University of Siena, the latter being the leader for their implementation, more than 300 geological formations were analysed and classified, and the new engineering geological GIS map was realized in Tuscany for the provinces of Arezzo, Florence, Lucca, Massa-Carrara, Pistoia, Prato and Siena (ca. 15,000 km²).

References:

Franklin J. A., Chandra R., 1972. International Journal of Rock Mechanics and Mining Sciences & Geomechanics Abstracts, 9(3), 325-328.