

The geological model reliability in tunnelling and its influence on the geomechanical model: a quantification attempt

Paolo Perello^{1*}
(1) GDP consultants

*corresponding author: perello@gdpconsultants.eu

The reliability of geomechanical models for underground linear structures as tunnels, strictly depend on many factors as, for example, the quality of in situ and laboratory tests, their statistical representativeness and therefore their quantity, several other aspects.

Nevertheless, at the base of a solid geomechanical model lies a reliable geological model. Geological models are conceptual constructions that unavoidably include uncertainties and often also errors due to wrong estimates or lack of data. Errors, when unconstrained, directly propagate to the geomechanical model, that uses the geological model elements to extrapolate and distribute in space the mechanical properties derived by means of laboratory and field tests.

For this reason, the definition of a geological model reliability is the first fundamental step for defining the geomechanical model reliability. Wrong geological forecasts may compromise a tunnelling project, even if every other design element is provided with the adequate accuracy.

Whatever the investigations accuracy and the efforts dedicated to the definition of a geological model, a certain degree of uncertainty will always be present, irrespective of the ability and experience of the involved geologist(s). The Reference Geological Model reliability estimate has a great relevance and is an aspect that cannot be omitted if a complete risk analysis is needed.

In common practice, most geological reports for tunnelling purposes give general insights on the reliability of geological predictions; such insights usually consist of indications derived from the geologist's personal feeling about the degree of accuracy of the model (low, medium, high reliability) often obtained through a process hard to be retraced.

This presentation focuses on the analysis of the elements that cause uncertainties in Reference Geological Models, and on an effort to objectively define and quantify them. Starting from these elements a parametric procedure is then illustrated permitting to obtain an index called *Geological Model Rating* (GMR), which can be used to provide a more standardized definition of a geological model reliability.

GMR allows geologists and engineers to share, via standard definitions, a knowledge about the possibility of occurrence of unexpected events, critical for costs and time increase, and to constrain them to a better degree.

The index derivation is achieved through a simple process of key parameters ratings (e.g. drillholes number/depth, scale of available geological mapping, etc.). The complexity of the geological context and the interpreter skills, despite complex items, are also taken into consideration and quantified in order to obtain the index.

Keywords: *Reliability, Reference Geological Model, tunnel, uncertainty.*