Modification of Schimazek Abrasivity Index for Improving its Application in Rock Engineering

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Extended Abstract

(Paper pages 73-90)

Introduction

Up to now, various indexes and methods have been presented for evaluating the abrasivity of rocks. In total, these methods can be divided to two main groups; the methods based on nature of rocks, methods based on heuristic tools. Schimazek F-abrasivity index is one of the most powerful and applicable indexes for evaluating the rock abrasiveness. This index uses the grain size, Brazilian tensile strength and equivalent quartz content for abrasivity analysis. Since the values of these parameters are equal in Schimazek index, therefore, in some cases this index doesn't have suitable ability to distinguish and classify the rock abrasiveness. This paper tries to modify the Schimazek index considering the weights of its applied parameters.

Material and Methods

In this research, Fuzzy Delphi Analytical Hierarchy Process (FDAHP) has been used to calculate the weight of dominant parameters in rock abrasivity. For this purpose several questioners have been distributed and the expert opinions were collected. The results showed that the quartz content, grain size and tensile strength have the weight of 0.4, 0.31 and 0.29 respectively and new Schimazek F-abrasivity index is as presented in equation (1).

$$F = \frac{(EqQtz^{0.4} \times \phi^{0.31} \times BTS^{0.29})}{100} \quad (1)$$

In the next stage, in order to facilitate the application of new index, a new classification system was developed. This classification and related weighing graphs (Figure 1) help to change the discontinuous classification to continuous one.

Results and discussions

In order to verify the application of the new developed index, ten ornamental stones have been studied and the old and modified Schimazek indexes were calculated for all of them. Then, the cutting rate (sawing rate) of each stone was recorded in laboratory and the mathematical relationships between new and old indexes have been achieved. The results show that the new Schimazek abrasivity index has higher ability to predict the cutting rate than old one (Figure 2).

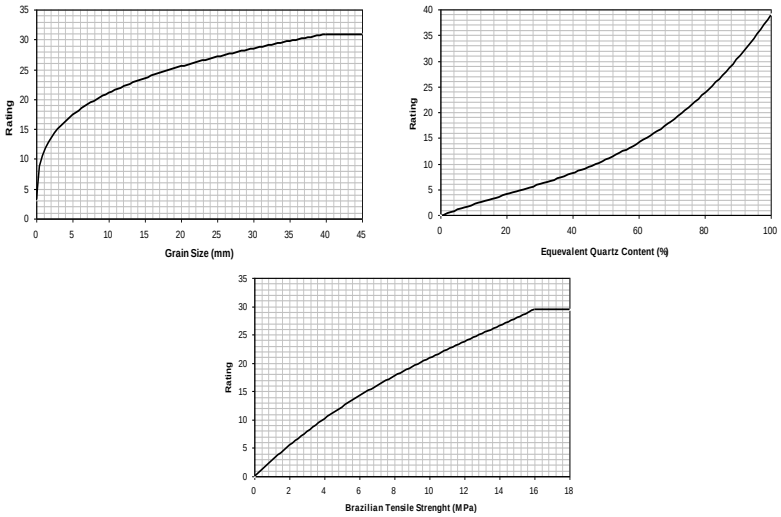

Figure1. Continuous weighting for parameters of Schimazek F-abrasivity index

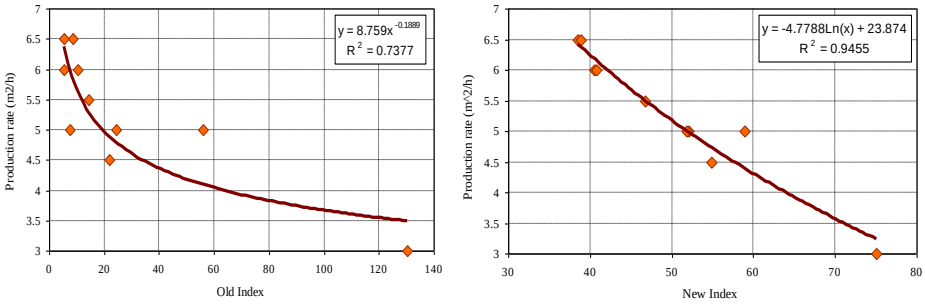

Figure2. Regression of old and new Schimazek F-abrasivity index with cutting rate of granite ornamental stones

Conclusion

Generally it could be concluded that, the main weakness of Schimazek F-abrasivity index which is the equality of parameters' importance, has been removed by idea developed and confirmed in this study. The different weights which allocated to grain size, Brazilian tensile strength and equivalent quartz content in study, improves the Schimazek index applicability in rock engineering applications specially rock cutting and drilling. Therefore, it is recommended to use new method instead of old one in future applications.

Keywords: rock, abrasivity, Schimazek index, cutting rate.

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