Abstract

The majority of the extracted mineral raw materials in Germany are products of the industrial minerals industry. These minerals are used as a basis for building materials and almost every product of domestic manufacturing. The extraction is found almost exclusively in open pit mines and quarries respectively, through the use of drilling and blasting. Because of its influence on all downstream process steps, the blasting technique is of major importance to the entire economics of mineral raw materials production. For the description of this influence, terms like blast result and blast performance are often used. An integrated consideration of the blast result, its definition and a systematic characterization of influence and evaluation parameters are however not available.

The goal of this thesis is therefore to examine the blast result with a systematic approach which is then used as the basis for the non-bias evaluation tool which has been developed. Before the evaluation of a blast result, it is necessary to give a clear understanding of all terms and all parameters which influence the blast result or can be used for its appraisement.

Therefore, this thesis defines for the first time the terms blast result and blast performance with scientific methods. The basic principles of the application of drilling and blasting in a quarry are covered in detail. For the first time a system blast is distinctly defined, its system boundaries clarified, as well as all parameters of influence and evaluation are extensively described.

Important influence parameters of the blast system are: the blast geometry, quality of the drill holes, type and amount of explosives, as well as an initiation scheme can be identified. Considering the evaluation parameters, the preparation of a high quality drill pattern – drilled as planned, muckpile properties – focusing on form, location and fragmentation, as well as ground vibrations seem to be most important.

For the first time a systematic evaluation can be achieved and an assessment of the existing blast performance can be made, through applying the controlling methods to the blasting technique. This leads to the development of a new blast controlling concept. A particularly high demand

on an evaluation method for blast controlling is the integration of monetary quantifiable and non-quantifiable parameters.

From the variety of available controlling tools, this thesis chooses an adequate tool and transfers it to the blasting technique. The most appropriate method for this evaluation seems to be the use of a value benefit analysis with preference matrix. A combination of the non monetary benefit value and the calculable costs is then made through a cost effectiveness analysis.

The new evaluation tool was developed with the spreadsheet program Microsoft Excel© to facilitate its compatibility and ease of use. Major elements of the value benefit analysis, the weighting of the single ranks, the assessment of the alternatives, as well as the ranking of the single goals with a new pair comparison can be done by the user of this tool. The practical capability of this tool was tested successfully in two quarries through the introduction of electronic ignition systems.

Along with the newly developed blast control concept, there is now also a tool available, which is capable to systematically evaluate a blast result and return a value which can be used to verify whether or not the blast has successfully met the pre-defined blast target.