

Health Safety Awards 2012

Topics

Leadership; Training and Management Systems Initiative

Ref. Number

6

Entry Title

The Rockfall Hazard Appraisal System (RHAS), A practical approach to Rockfall management

Description of Entry

This entry proposes a Rockfall Hazard Appraisal System (RHAS) for use by non geotechnical specialists in UK quarries which complies with the requirements of the 1999 Quarries Regulations. This analytical system can be used to quantify and manage rockfall hazard and clearly identifies when a geotechnical specialist should be consulted.

Research undertaken for this work has shown that systems currently in place for the routine inspection of faces do not adequately measure or quantify the hazard posed by rockfall. As a result operators may be exposing people to risk and may be in breach of a number of regulations.

A review of existing rockfall hazard evaluation methodologies has been undertaken to determine those parameters which are most significant in the analysis of the hazard that rockfall poses in UK quarries. Simple, visual, non subjective methods of estimation of these parameters have been proposed which do not rely on a high level of experience and expertise. In line with the requirements of the 1999 Quarries Regulations, the appraisal systems focuses only the consequences of rockfall, the risk of rockfall actually occurring is not considered.

The appraisal is divided into 3 areas;

Rockfall Potential (sections a to g) this is an estimate of the destabilising forces and the potential magnitude and frequency of any resulting rockfall. A score is given to each section (a to g) based on what the appraiser can actually observe and other relevant documentation, for example rockfall records, site surveys, and blasting records. The scores for each section a to g are then added to produce Sub Total I. Where different combinations of block size and height are present separate areas or "domains" within the rock face should be used, in each case the combination of height and block size with the highest score should be used for each domain.

Rock Trap Efficiency (sections h to j) is a measure of the effectiveness of mitigation measures currently in place. In UK quarries scaling of loose rock from the face and the use of rock traps placed at the toe of faces are the principle defences against rockfall from unreinforced faces. A well designed rock trap can be very effective at capturing rockfall, but the efficiency of the design will depend not only on the width and depth of the trap but also the profile and angle of the face above. The scores for each section h to j are then added to produce Sub Total II. The numeric values given to scores in this area are all low, below 1 (in most cases the Sub Total II will be less than 1).

Exposure To Risk (section k) this last category looks at the exposure of individuals to the hazard. In terms of the quarries regulations if rockfall cannot do harm to anyone it is not a significant hazard (damage to machinery or infrastructure is not considered) the score in this category can therefore be zero if no one can be harmed by rockfall. In historic areas of some quarries the complete exclusion of people may be the only practical means of managing rockfall hazard. Clearly a direct impact on a pedestrian will have the most severe consequences, a rock which rolls out of a rock trap and strikes a pedestrian is the next most severe and so on, the score for section k is the only value used in Sub Total III.

The 3 Sub Totals are then multiplied (I x II x III) to give a final score. A total score of less than 50 indicates a low hazard requiring no immediate action. The appraisal should be repeated at appropriate intervals or whenever significant change to circumstances affecting the hazard (for example blasting in a different part of the quarry) occurs.

A score of 50 to 60 indicates a significant hazard is currently present. Measures should be identified to reduce the hazard as part of the routine maintenance where possible, for example scaling loose rock or increasing rock trap width.

A score of 60 to 70 indicates high hazard and remediation measures should be undertaken as soon as possible.

Scores over 70 indicate a very high hazard and immediate action to protect people is required. This is likely to include a temporary complete exclusion of people until the hazard is reduced. Where the hazard score cannot be reduced to a figure less than 50 by the modification of any of the scoring categories a geotechnical specialist must be consulted as soon as possible.

Benefits Following Introduction

There is currently no analytical system for the appraisal of rockfall in quarries that is easily accessible to the non geotechnical specialists who conduct the vast majority of face inspections.

If the industry has no way of quantifying or measuring the hazard posed by rockfall how are

we to manage that hazard?

The Rockfall Hazard Appraisal System (RHAS) is a simple, rapid, visual method of quantifying the hazard from rockfall and testing how various mitigation measures could reduce the hazard, it also clearly identifies when a geotechnical specialist must be consulted.

The system has undergone extensive field trials and sensitivity analysis over a two year period.

The system has been applied to historic rock slopes, final faces, working faces, and natural rock slopes.

The system has demonstrated its value as a rockfall hazard appraisal tool and is in daily use at a number of working quarries. The system has demonstrated an ability to consistently and accurately quantify rockfall hazard when applied by users of varying qualifications and experience. Significant hazard, as defined by the 1999 Quarries Regulations, have in all cases been correctly identified and users have demonstrated the ability to use the RHAS to identify basic mitigation measures.

The system will be rolled out to all AI quarries over the coming year, its introduction has lead to improved awareness and understanding of rockfall issues amongst site management and

Supporting Photographs

- 5 The RHAS Score Sheet
- 6 Estimating block height with a hand held clinometer.
- 7 When is the minimum rock trap specification not sufficient?

Recognition of Individuals

Reasons for Nomination

Company

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