

Study Of Stress Distribution And Stress Control In Blasting Gallery Method Working

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ABSTRACT

In mining industry, the challenging task of a mining professional comprises of the extraction of maximum natural resources with utmost safety of the miners. This task becomes more problematic when the thickness of coal seam is larger. “Blasting Gallery” method is a unique technique of depillaring thick seams for higher recovery of coal. The extensive literature survey clearly helps to understand that the ultimate potentiality of the method is yet to be explored. Though a number of researchers, academicians and other stake holders attempted to work on it but impact of many significant parameters are still to be analyzed. The Blasting Gallery operation in a mechanized underground mine system depends upon many decisions influenced by the geo-technical parameters which are often interspersed with inherent strata configurations. The present study has been aimed to examine thoroughly BG method operational systems in Indian geo-mining conditions such as: – Study of roof convergence with respect to face advancement during different stages of extraction of coal in Blasting Gallery panels in SCCL mines. – Simulation of field conditions in the numerical model generated using FLAC. – Interpretation of strata behaviour through numerical modeling using FLAC. In order to study the strata behaviour of such coal mines with thick seams, GDK 10 incline, 3A panel of Singareni Collieries Company Limited (SCCL), Ramagundam was selected. This mine has a thick coal seam of 11m and is at depth of 350mtr, practicing Blasting Gallery method to the maximum extent. Convergence behaviour with respect to goaf edge distance (GED) was monitored with the help of high state-of-the-art equipment (calibrated) throughout the life of BG panel. An over emphasis was given on the field study where data of BG mine specially related to natural falls, induce blasting etc. were recorded. Convergence of roof strata in mm, corresponding goaf edge distance (GED) in meter (m), corresponding distance from face in meter (m) and depth of panel in meter (m) were measured to know the significant impact of different layers with varying overburden pressure which leads us to think some logical sequence of interrelated operations.

INTRODUCTION

Strata control or roof control implies the control of the strata to facilitate mining operation to be done efficiently and safely. Not only we are concerned with the roof falls and uncontrolled failure of strata or structure in the rock but also with the harnessing of the strata pressure to advantage so that there is ease in coal getting. There is less emission of gas and less production of dust and also the caved strata fills the goaf solid so that the risk of spontaneous heating is minimized. Obviously, the strata on the face, and in the adjoining area, i.e. in front and behind, must require attention so that no uncontrolled failure of the ground takes place. In order to design satisfactory strata control measures it is essential first to have a clear

understanding of the mechanics of the movement of the ground as a result of mining operation. In thick coal seams, coal bed forms the roof of the lower slices. A coal layer at the roof normally forms a good roof. But coals with joints and cleats are prone to fail without warning. Some seams have coal balls, nodules or rounded fragments, and these may fall unnoticed and cause fatalities. When coal bed is undermined, it may also develop induced cleavages and fractures and in such situations roof falls are common. So for complete or maximum extraction of such coal seams, the Blasting Gallery method is introduced.

Problems of Strata Behaviour Characteristics with Respect to Indian Coal Seams

The BG working is not suitable for higher degree of gassiness with irregular seam characteristics. BG method if applied in irregular seam will cause unblasted waste rock mixture with the coal. Overriding of galleries may be a regular phenomenon if a attention in not paid on the extraction pattern in time. Chances of air blast with consequent possibilities of spontaneous heating in the goaf seem to be a major problem in this working. The increasing roof pressure creates major difficulties with setting of goaf edge breaker line support. This leads to more chances of coal losses with a significant reduction in overall performance of the mine.

Objectives of the Project

The Blasting Gallery operation in a mechanized underground mine system depends upon many decisions influenced by the geo-technical parameters which are often interspersed with inherent strata configurations. The present study has been aimed to examine thoroughly BG method operational systems in Indian geo-mining conditions such as: → Study of roof convergence with respect to face advancement during different stages of extraction of coal in Blasting Gallery panels in SCCL mines. → Simulation of field conditions in the numerical model generated using FLAC. → Interpretation of strata behaviour through numerical modeling using FLAC

LITERATURE REVIEW

Blasting Gallery technology, the successful and popular method of extraction with a given set of input, has been a good source of underground production in India. The moderate to high overburden always poses a problem to tackle with the strata in day to day's work. The extensive literature survey has been a prime part of this system and has given a priority out of all subroutines considered here for this purpose. Blasting gallery method is a unique technique successfully developed in France, where it has been practiced in virgin thick seams in Carmaux colliery. Blasting gallery method was earlier experienced at East Katras colliery of the Bharat Coking Coal Limited and Chora colliery of the Eastern Coalfields Limited of the coal India limited. Overriding at East Katras colliery and loss of supports as well as coal had put some question marks on its further application in Indian coal Industry. But this technology has become successful and popular at some mines of The Singareni Collieries Company Limited, Andhra Pradesh and Chirimiri colliery of South Eastern Coalfields Ltd, India. (Singh R.D. 1998) 2.1 Blasting Gallery Method In this method a seam is developed into panels of about 100 m x 50 m. From the main headings rooms are driven to the full width of the panel and the coal between the rooms is blasted down to the full thickness of the seam and loaded by remotely controlled loaders. The layout of a panel for working by Blasting Gallery method is shown in Figure 2.1. The life of the rooms should be kept as short as possible so that they do not undergo excessive convergence and the movement of the vehicles is not rendered any difficulty.

CONCLUSIONS

Maximum rate of convergence and cumulative convergence recorded in field was about 4mm/day and 61mm respectively, measured at convergence station C-5 in 68 Level. Before the occurrence of main fall, rate of convergence showed a continuously increasing trend for five days. This may be considered as warning for impending main fall. From the triaxial testing, the major principal stresses of 22, 32 and 41.5 MPa were obtained at confining stresses of 0, 2 and 3 MPa respectively. The plot between the major and minor principal stresses had shown a trend line having an equation, $y = 4.875x + 22.083$ with an R² value of 0.9998. The results obtained from the RocLab software indicated the Cohesion, Friction Angle, UCS and Tensile Strength values to be 1.1MPa, 30.840°, 1.314 MPa and 0.32MPa respectively. Numerical modeling results indicated absolute roof deformation of about 7.5 and 8 mm in the gallery and development splits, and also a maximum cumulative convergence of 70mm at the time of major roof fall respectively. The results obtained by FLAC when compared with that of the Field data, the predicted values were within an approximation of 10% for stages I, III, IV & V whereas for stages VI and VII, its in 20% approximation except for that of stage II which showed a comparatively higher cumulative convergence values due to the occurrence of natural fall.

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