

Depillaring By Bord And Pillar Method With Stowing Operation In Underground Coal Mines

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ABSTRACT

The importance of mining is definitely significant to human civilization. In fact, as one of the earliest of human enterprises, mining and its development correlate closely with cultural progress. Mining is the mother industry for other industries. For effectiveness in mining, different methods have been approached keeping in mind the production and safety. One of such methods is the Bord and Pillar method of mining. Bord and Pillar method of mining is one of the oldest methods. The key to the successful Bord and Pillar mining is selecting the optimum pillar size. If the pillars are too small the mine will collapse. If the pillars are too large then significant quantities of valuable material will be left behind reducing the profitability of the mine. The issues relating to the stability of pillars and effective extraction from it is a major concern now-a-days. The most important parameter before designing a pillar is the Safety factor. The main purpose of this project is to increase the extraction ratio of Bord and Pillar workings without compromising the safety factor

INTRODUCTION

The contribution of mining has played a big part in the development of civilization, more than is usually recognized by the average citizen. In fact, products of the mineral industry pervade the lives of all members of our industrialized society. The chronological development of mining technology bears an important relation to the history of civilization. In fact, as one of the earliest of human enterprises, mining and its development correlate closely with cultural progress. It is no coincidence that the cultural ages of people are associated with minerals or their derivatives (i.e., Bronze Age). Today, products of the mineral industry pervade the lives of all people. Mining is the extraction of valuable minerals or other geological materials from the earth, usually from an ore body, vein or (coal) seam. Any material that cannot be grown through agricultural processes, or created artificially in a laboratory or factory, is usually mined. Mining in a wider sense comprises extraction of any non-renewable resource (e.g. petroleum, natural gas, or even water). Modern mining processes involve prospecting for ore bodies, analysis of the profit potential of a proposed mine, extraction of the desired materials and finally reclamation of the land to prepare it for other uses once the mine is closed. Coal seams can be mined both by underground methods and opencast methods depending upon certain conditions such as thickness and depth of the seam, dip of the seam, the ratio of overburden to coal (stripping ratio) etc. The growing needs have been pushing the limits, to which the mining industry has to reach to fulfill the demand. The effect can be seen from the methods of mining that have evolved over the years. One of the oldest methods of mining is the Bord and Pillar. It is a method in which the mined material is extracted across a horizontal plane while leaving "pillars" of untouched

material to support the overburden leaving open areas or "rooms" underground. It is usually used for relatively flat-lying deposits, such as those that follow a particular stratum.

AIM OF THE STUDY:

The goal of the present investigation is evaluation of the extraction ratio of the Bord and Pillar working. This is achieved by addressing the following specific objectives. 1.1.1 Specific Objectives: The primary objective of this project is to: To review current pillar design practices in terms of pillar size, pillar shape, seam thickness, depth of mining, etc To determine the safety factor as practiced elsewhere

METHODOLOGY

The above objectives could only be reached if acted upon with a planned approach. The first step towards a goal always starts with knowing everything about it. Thus we began with the literature review. The books, journals, papers proved a rich source of knowledge in this regard and were thoroughly studied and learned. Discussion with officials encouraged us further in our work. To investigate the same in relation to a particular mine The above goal and specific objectives are achieved by adopting the methodology as outlined in the next session

LAYOUT

This project report is divided into five chapters. Chapter 1 gives the general introduction, goal and objectives of the report. A critical review of the available literature has been done in chapter 2 followed by tests, analysis and discussions in chapter 3 and 4 respectively. Chapter 5 concludes the work with further scope.

LITERATURE REVIEW

Coal seams can be mined both by underground methods and surface mining methods depending on certain conditions like:

- Thickness of seam
- Dip of seam
- Depth of occurrence

The ratio of overburden to coal(stripping ratio) Combining the features of both Bord and Pillar methods and Longwall methods, there is another method of mining coal seams which is known as the "Shortwall Method" of mining. It incorporates the advantages and disadvantages of both Bord and Pillar methods and Longwall methods. There are two basic methods of underground coal mining methods. They are i) Bord and Pillar method ii) Longwall method. Although the basic principles remain the same, there could be many variants of these two methods. In the U.K, former USSR, France and other European countries longwall method of coal mining is the main method of mining. In India, about 98% of underground output of coal is obtained by Bord and Pillar method and barely about 2% by longwall methods.

The other countries where Bord and Pillar method predominates are Australia, The USA and South Africa. However due to various advantages associated with longwall method, the present trend is to adopt longwall method of mining even in those countries also where Bord and Pillar method predominates The development of mine by the method of working known as Bord and Pillar consists of driving a series of narrow roads, separated by blocks of solid coal, parallel to one another, and connecting them by another set of narrow parallel roadways driven nearly at right angles to the first set. The stage of formation of a network of roadways is known as development or first working. The coal pillars formed are extracted after the

development of the mine leasehold and this later stage of extracting coal from pillars is known as depillaring.

Depillaring

After pillars have been formed on the Bord and Pillar system, consideration has to be given to the extraction of coal pillars; the operation is known as pillar extraction. It is also referred to as depillaring. In a method of depillaring, known as the caving method, the coal of pillars is extracted and the roof is allowed to break and collapse into the voids or the de-coaled area, known as goaf. As the roof strata above the coal seam break, the ground surface develops cracks and subsides, the extent of damage depending upon depth, thickness of the seam extracted, the nature of strata, thickness of the subsoil and effect of drag by faults. Depillaring with stowing is a method of pillar extraction in which the goaf is completely packed with incombustible material and generally plasticized where it is necessary to keep the surface and strata above the seam intact after extraction of coal.

The following circumstances would require adoption of depillaring with stowing:

1. Size of the Barrier

The width of the barrier depends on the load which it has to carry and its strength. Greater the depth of working, wider is the barrier and also softer the coal, the more, the width of the barrier. In practice, the width of the barrier enclosing pillars in a panel is usually the same as is the width of the coal pillars which are enclosed within the panel. In deep mines the width of the barrier may become quite large (up to 45 m) and so during extraction they are thinned down consistent with safety. Too much reduction in the width of the barrier is not advisable as in that case the barrier may be crushed and two goaves may be joined, thus encouraging safety. For the determination of "Yield Pillar" technique, it is necessary to take into consideration the load at the abutments of the pressure arch and the strength of barrier pillars.

2. Size of Pillars

The size of the pillars is influenced by the following: Depth from the surface and percentage extraction in the first workings or development. Strength of the coal: Seams with weak coal require large pillars. Effect of atmosphere and escape of gas also influence the size of pillars. The nature of the roof and floor. These influence the liability to crush and creep. A strong roof tends to crush the pillar edges whilst a soft floor predisposes it to creep and both calls for large pillars. Geological Considerations: In the vicinity of faults, large pillars are required. Dip and presence of water also influences the decision as to the size of pillars. Time dependant strain: With time the strain goes on increasing, the load remaining constant and if the size of the pillar is not sufficiently large, then it may fail under the time dependant strain, although initially it might be stable

CONCLUSION

The key to the successful Bord and Pillar mining is selecting the optimum pillar size. If the pillars are too small the mine will collapse. If the pillars are too large then significant quantities of valuable material will be left behind reducing the profitability of the mine. The most important parameter before designing a pillar is the Safety factor. The observed safety factor for the coal pillar as per the CMRI method comes to be: 2.93 The extraction percentage was calculated to be 33% The typical lifespan of a coal pillar is around 3-4 years due to paneling. So the recommended safety factor for the coal pillars should be around 1.5-2. But the observed safety factor is 2.93. So it gives a possibility of decreasing the safety factor to around 2. This would increase the extraction percentage without compromising the safety factor

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