CASE STUDY ON LONGWALL MINING

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Abstract - The so - called "Longwall Mining System" have been effectively applied for 60-70 years in coal mining practice in USA, Australia and the Germany. In general, those are the systems of underground coal mining with mine entries directly communicating to the surface. Now at present in the Asian continent and in India, Telangana state has implemented the longwall mining method was adopted in Singareni collieries limited at Adriyala longwall project and GDK 10A incline. Therefore, it is important to know about a case study of longwall mining method because in India currently, about 2% of underground coal production comes from longwall mining, but it is planned to increase production by longwall to 40%. In the modern world day by day, mining plays prominent role for the extraction of minerals, which are necessary. So we go for open cast mining and underground mining. As the day-by-day extraction rate is faster, the mineral availability at shallow depth is becomes rare. So we have to introduce Modern mining methods to go for deeper depths, one of the method is longwall mining. In this method, the total supporting system is done with power supports i.e. chock shields and the whole face is well-supported compare to the conventional mining method. This method of cutting the coal with the help of shearer, which eliminates the drilling and blasting. The stage loaders and conveyors are used to transport the coal from face to the surface.

Keywords- Longwall Mining, Underground Mining, Suport System Of Longwall, Longwall Equipment, Adriyala Longwall

1. INTRODUCTION

Longwall Mining method is one of the latest mechanized method and classified into two types

1. Longwall advancing.
2. Longwall retreating.

Majority in Indian coalmines we go for longwall retreating method rather than longwall advancing because advancing has many dangerous issues like gas leakage from pack walls and supporting is difficult but it is mostly used for quick return of capital.

The shallow coal seams, which are extracted through opencast mines are gradually being exhausted. Therefore, taking this in to consideration researchers are focusing to develop a highly productive underground methods that can be used to extract coal at a faster rate and can fulfill all the demand of power. So bulk production and safer modes of extraction has become important for future needs.

Longwall technology was first implemented in SCCL in 1983 in GDK7/ VK7 mines where two faces was successfully extracted. After that, equipment's were shifted to GDK 11 A, where it was unsuccessful because of the poor strata and underrating of supports. After that, improved power supports were brought and implemented in GDK 10A Incline which was proved very successful and production rate was increased and a yearly production of about 3.5MT.

2. WORKING METHODOLOGY:

In longwall mining, the coal is extracted by the machine called shearer. It is mounted on the armoured face conveyor. It cuts the coal and acts as power loader by loading the coal on to the AFC. Shearer is preferred normally for seams more than 2.0m up to 6m.Has to be rotated 180°when shearer machine reverse its direction of the travel.

It has ranging arm, cowl, shearer body, sides on AFC and cutter drum. The shearer drum is helical in shape and having no picks fitted to it. The cowl swings to 90 degrees either way to behind the drum while cutting.the purpose of cowl is to loading and for better track cleaning.While cutting water is sprayed from the shearessssr drum for the purpose of suppressing and controlling the dust and to cool the picks of the shearer. This is applicable to seams flatter than 20degrees and medium to hard rock and seams having srong roof and floor.
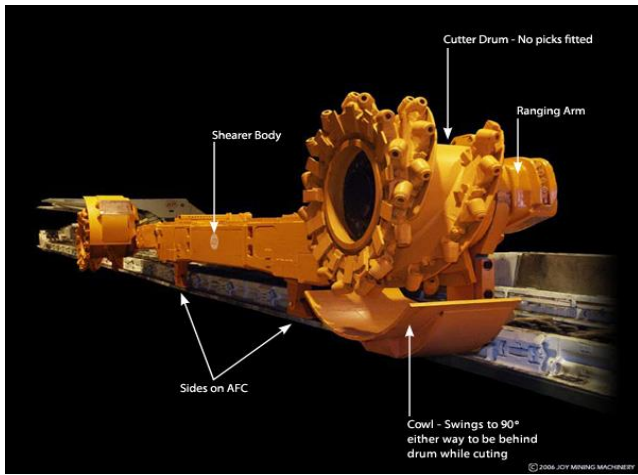
FIG-1: LONGWALL SHEARER

SUPPORTING SYSTEM:

In longwall mining we mainly use power supports to support the strata. Powered supports are ercted at the face skin to skin.Power supports are placed along the face from main gate to tail gate.The supports should cover and protect the AFC & SHEARER.The suppotrs should be of 4x200te capacity.The distance between two adjascent chockshields should not be more than 150mm and the distance between face and the canopy should not be more than 0.5m.
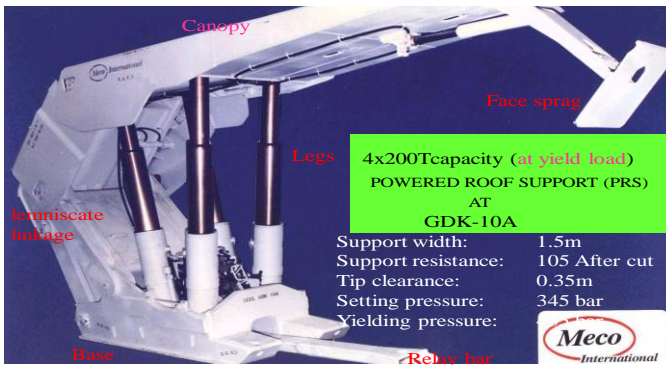

FIG-2: LONGWALL CHOCK SHIED

CLASSIFICATIN OF LONGWALL MINING

According to the direction of advancement

  1. Longwall Advancing

   a) Longwall advancing with stowing

   b) Longwall advancing with caving

  2. Longwall Retreating

   a) Longwall Retreating with stowing

   b) Longwall Retreating with caving

According to the number of faces

  1. Single unit face longwall mining

  2. Double unit face longwall mining

According to the method of working

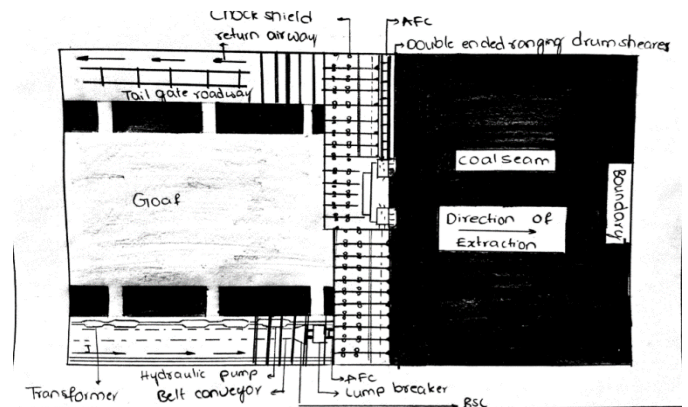 1. Cyclic longwall mining

  2. Non-cyclic longwall mining

FIG-3: LONGWALL ADVANCING METHOD

In longwall advancing the face advances from the shaft pillar to the boundary of the mine. The method is rarely used in our country because this is very risky method to extract coal i.e. there may be chances of leakage of gasses through pack walls.
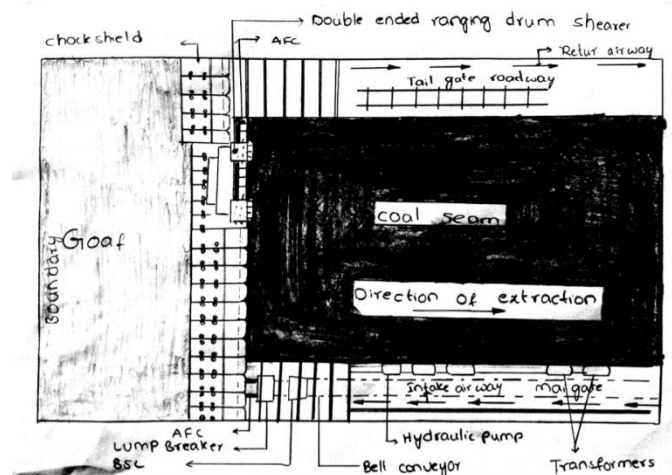

FIG-4: LONGWALL RETREATING METHOD

In longwall retreating method the face advances from boundary to shaft pillar. This method is commonly used in our country because it is a safest method i.e. there is no chances of leakage of gasses.

LONGWALL STRATA CONTROL:

Monitor the bed separation in the gate roads while retreating the longwall face. Monitor the load on the supports within the abutment zone. To monitor the abutment stress in the longwall pillar and barrier pillars Monitoring of the longwall supports pressures for analyzing the parameters like the weighting on longwall supports, actual roof load coming on to the supports To coordinate with the scientific agency in monitoring the longwall face, gate roads and caving behavior while retreating the longwall panel no.2.

Vibrating-wire type stress cell: This instrument is designed for measuring unidirectional stress change in coal/rock. It consists essentially of a wire ("vibrating-wire") tensioned across a steel cylinder of 38 mm outer diameter. The wire is plucked by an electric pulse of high energy. As the stress within the rock/coal changes, the cylinder deforms, causing tension in the wire to change.

The change in stress on the cell results in variation of frequency of vibration of the wire. This frequency is recorded by a digital read-out unit, and is converted into stress using calibration charts. Convergence indicators are used for measuring the roof convergence. This will give good idea about the how much roof is converging and bed separation in the roof. Convergence can be measured with the help of convergence indicators.

LOAD CELLS:-

The load cells can be installed either to roof bolt or to props to measure the load coming on to supports. The load cells are hydraulic type with dial gauge attached to it. The load acting on the load cell can read directly. The load on load cells indicates that the bed separation is occurred and separated dead load is acting on that. The load cells are 25T capacity.

VENTILATION:-

Adriyala Project is planned to work in the depth range of 300m to 640m. The geothermic gradient is about 69m/0C. To meet the ventilation requirements, a study was done by ISM, Dhanbad and according to the requirement mine drivages were developed. Adriyala Mine is accessed by

four Punch entries and one shaft. Two main fans of 400kw and 15,000 Cu.m/min and four booster fans of 75kw of 4,000 Cu.m/min capacities were procured from M/s Zitron, Spain and installed.

NEED FOR AIR-COOLING SYTEM:-

As the workings are planned at depth of 300-720, virgin rock temperature is expected to be 39.0 0C at 420m depth (Geo-thermic gradient @ 1.0 0C/40m depth). Temperature at workplaces is expected to be higher than 32.5 0C even with an airflow of 50m3/s. Workings are planned at depth of 300 – 720m; Virgin Rock Temperature (VRT) is workplace ambient conditions are expected to further deteriorate during mining operations due to high capacity machines.

Separate ventilation split is also planned to be provided for conveyor roadway to avoid heat addition to intake stream of workings. Though coal mining operations are permitted at maximum ambient temperature of 33.5 0C, for comfortable and productive mining operations, workplace temperature is to be maintained at about 28.0 0C.

AIR CHILLING PLANT:-

To provide cool ventilating airs to the workings it was proposed to install Air conditioning system at ALP. A study was carried out by ISM, Dhanbad for the design of Air cooling system. The procurement of above chilling plant was delayed due to some technical reasons. Meanwhile, to meet immediate requirement of longwall face, outsourced air chilling plant of 1400TR was installed at mouth of Punch Entry-5 (PE-5).

About 3500Cu.m/min of chilled air is being supplied at 11 to 13 0C at the entry of PE-5. From there cooled air is ventilated to longwall face through a separate air way via PE-5 and MainGate-1.After commissioning of air chilling plant and supply of cool air, the temperature has been brought down by 3 to 4 0C. Efficiency and effectiveness of men and machinery increased considerably.

NITROGEN FLUSHING:-

CSIRO, Australia has recommended to install Nitrogen Plant to carry out Longwall goaf inertization continuously as a proactive measure to prevent spontaneous combustion in LW goaf. Accordingly, N2 plant was installed with a capacity of 800 Cu.m/hr and N2 flushing is being done. To increase the rate of flushing, a new

Nitrogen plant of 1200 Cu.m/hr capacity is under installation and likely to be commissioned by August 2016. In addition to N2 flushing, CO2 is also being flushed at the rate of 3Tonnes/day in to the goaf

3. CONCLUSIONS

The productivity and economic factors can be determined in various prospective but the bottom line is that they should contribute to the best possible overall mining method and safety.

This case study helps to the students and mining companies to better understanding of the various equipment's and process involved in the longwall mining because in the coming days as we are going to deeper we only use modern method and also our pear present the operation of the shearer which helps to the companies to take necessary precautions.

REFERENCES

[1] **RD SINGH** -Principles and practices of modern coal mining**.**

[2] **SYD.S.PENG** -Study of Longwall mining.

[3] **H.S.CHIANG**-power support in longwall mining.

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