

The development excavation in Vietnam underground coal mine for period 2014 – 2020 the existing state and the solutions

Le Van Cong^{a*} , Luu Cong Nam^a

^a *Institute of Mining Science and Technology, Hanoi, Vietnam*

* *congimsat@yahoo.com (corresponding author's E-mail)*

Abstract

The Vietnam Coal and Minerals industrial group has currently invested in the development excavation of coal mine underground construction. Many modern equipment of world famous brands such as: Sandvik, Atlas Copco, Bolt tech ... was put into execution. Manual labor of the workers have been replaced significantly. The advanced of construction and labor productivity has already improved. However, so far the performance of the new equipment actually has not been promoted. The reasons can be seen as: Using the device is not suitable for complex construction conditions in Vietnam; the investment is only a model, not focused; of the line equipment, only a modernized equipment (drill rig, excavator), the equipment remains the most backward; drainage maintenance, spare parts not meet the requirements. Even in many fields, the modern equipment no longer used and has been replaced by the more out of dated equipment. The fact is, if no solutions will increasingly hold back the development of the coal mining industry in Vietnam.

According to the coal industry development plan in 2014-2020 period, coal production continued growth and expected 58 million tons by 2020. To achieve this task, there are a great of development have being constructed. According to the annual statistics, in order to exploit 20 to 30 million tons of coal by underground mining method in Vietnam today, Vietnam coal industry has to implement an average of 400,000 m the development. Through the initial survey, the general assessment above the construction in the Vietnam underground coal mines that the research on this problem, the solution at synchronization of the construction, improvement of technological scheme and labor organizations, to improve productivity, increasing of excavation advance should be necessary.

1. Introduction

Coal Industry Group - Minerals of Vietnam (Vinacomin) currently has certain investments in the excavation equipment. Many modern equipment of famous world of brands such as Sandvik, Atlas Copco, Bolttech... was put into excavation implementation. Manual labor of the workers have been replaced significantly by mechanization. The advance of excavation and productivity have improved.

However, the performance of the new device actually has not been promoted at all. The reasons can be listed as: Using the device is not suitable for complex construction conditions in Vietnam; the

investment is only a experiment, not scale; of the equipment line, only a modernized equipment (drill, loader), the device remains the most backward; maintenance, spare parts not meet the requirements. Even in many satges, the modern equipment no longer used and has been replaced by the obsolete equipment.

For example: of the 13 roadheader machines available in 12 companies, until 2013 only 5 machines are also in the operation of five companies (Vang Danh, Ha Lam, Quang Hanh, and Mong Duong, Huy Duong coal mine), quantity of the roadways is excavated very low by roadheader; 24 drill rigs available in 9 underground coal mine companies, until 2013 only two companies still use them (Ha Lam, Mine Construction company II). The drill rigs were replaced by portable drill and loader (or manual). The fact is, if there is solutions for this, the development of the coal mining industry in Vietnam will not be caught the plan.

According to the coal industry development plan period 2014-2020, coal production continued growth and expected 58 million tons by 2020. To achieve this arm, it must have constructed a huge amount of roadways. According to the annual statistics, to exploit the 20 to 30 million tons of coal by underground mines in Vietnam today, the average roadways are excavated up to 400.000 meters. With construction conditions increasingly complex, requiring increasing advance, the amount of roadways are increase for the current underground mine. Through the initial survey, overall assessment of the excavation in the Vietnam underground coal mines that need in-depth research in order to synchronize the construction equipment, improvement of technological scheme and labor organizations, to improve productivity and the advance.

2. Existing status of excavation in Vietnam underground coal mines

There are now two methods used: blasting and mechanical (road header) in the Vietnam underground coal mines.

In the blasting method, using portable pneumatic drill as PP-30, PP-24, PP-54, PP-63 from Russia; YT-27, YT-28, MZ-7665 from China; PLB-241K from Switzerland; compressor: 5m³ / min as ZIP (Russian), 4L-20/8 (of China). Thus compressed air providing is only for maximum 2 portable drill so drilling is affected. The use of portable pneumatic drill also lead to difficulties in determining the position of the holes on the blasting passport, should lead to quality and efficiency of explosion low.

A few recent years, some mines have invested some modern drilling rigs such as 1F / E50 (Sandvik Tamrock) or BFRK1 (Deilmann - Haniel Mining Systems). This equipment is working stable, high productivity. However, due to the synchronization with the other one in loading, transport, support is low, so advance is limited.

A survey in 41 faces under construction shows that the drilling and blasting time Ý about 35% of a cycle time in many roadways. Thus, this is one of the most important factor affecting the rate of

tunneling. In the faces surveyed, the proportion using handheld pneumatic drill is very high, 37 out of 41 faces (illustrated in figure 1).

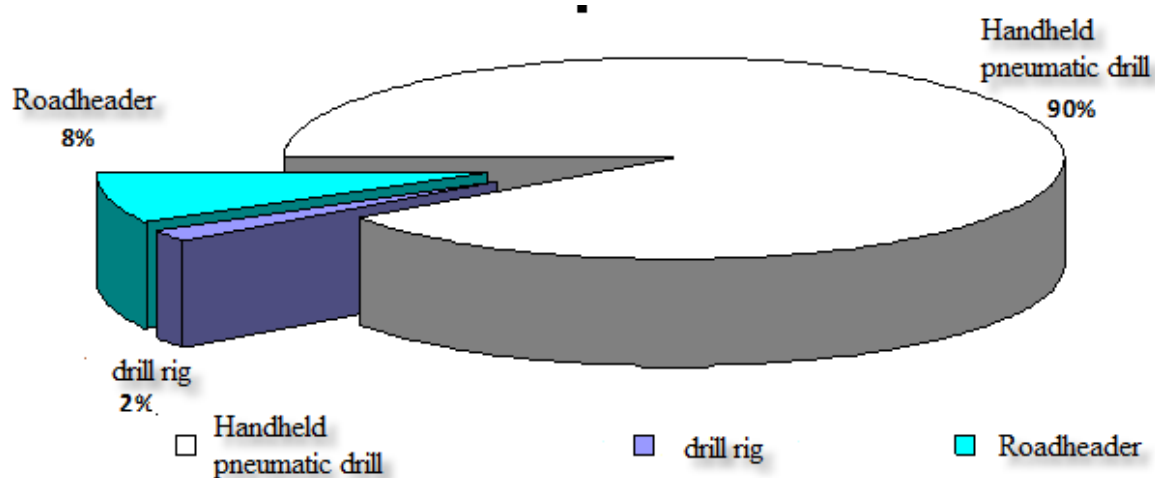


Figure 1. proportion of using the drill equipment in Viet nam underground coal mine.

The explosive is currently used mainly in: AH1 and P113, NTLT, NTLTD product of Vietnam; detonators with 25 % seconds MS is mainly from China. The explosive strength of the explosion are not enough high for hard rock, the Velocity of Detonatio is short so explosive blasting efficiency is not high; coefficients used blast hole is about $\eta = 0.8$, mine hole depth normally is 1,2 mertrs. The amount of oversize pieces are too much, so not suitable for excavators working. Blasting passports are not reasonable, the layout is not appropriate boundary borehole so many faces in the both sides and above abutment have column gapping from 30 - : - 50 cm, high over cross section, sometimes up to 1.2 - - 1.3 or more. The design blasting passport for each boundary condition of roadway is not interested.

In the mechanical method, int construction statge (2004-2005), road header brought relatively high efficiency, such as tunneling rate increases 2 - : - 3 times (gain medium average 200 m / month), labor productivity increased by 2 - : - 4 times, but only applied in coal. In recent years, due to the construction location, the availability of spare parts, maintenance, The roadheaders have met a lot of difficulty.

Number of Roadway excavated annually by roadheader very low, a small proportion (less than 1%) ocompared to the total annual construction product of Vinacommin. Specifically, in 2012 the the amount is 763 meters, 2.354m in 2013, this percentage is insignificant compared with the annual one (200,000 meters).

Mucking: Through the monitoring and implementation of statistical results, in general, loading manually in rate has decreased compared to the previous year, but still holding a lagre rate. According to statistics, timer, time loading, transporting rock after explosion so long about 3 - : - 5 hours. Some equipment are used, such as loader ZWY-80 and 1PHБ-5 (China), after 1PPN-5 (Russia), LBS-500W (Poland), ZCY-60 (China) ... Currently, most of these equipment have been used for a long time or

malfunctioning, synchronization between equipment is not high so productivity and work efficiency is limited.

In addition, the exchange of wagon don't have the specialized equipment that is mainly used to temporary switch, pushing the wagon by hand. While the distance between the switch to and face is more far away (200 - 300m) leading to time duration exchanging a wagon long. Loading time in 41 surveyedfacee is illustrated in Figure 2:

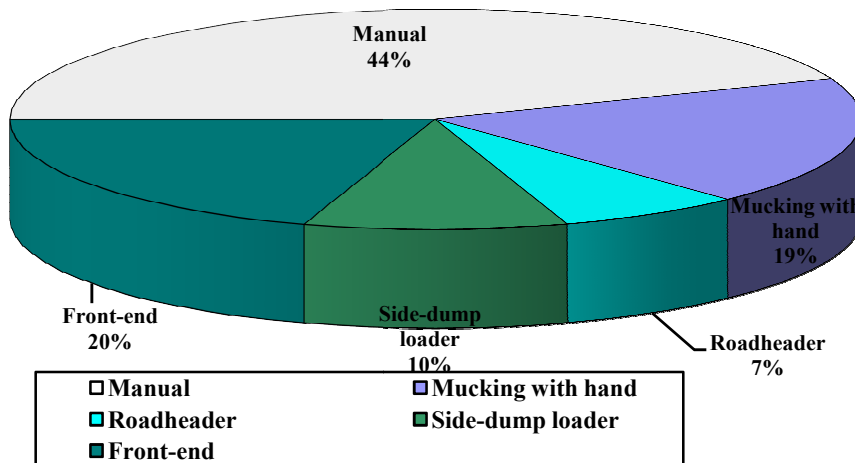


Figure 2. Proportional part of various loader types in underground coal mines

In Figure 2 shows, the rate of loading by manual in coal mine is still very high up to 44% resulting in very low labor productivity. There need to invest mechanized loader more to reduce the cost of manual labor and increasing the advance.

Support: Currently, support types in Vinacomin coal mines still apply passive structure with steel arches SVP, reinforced concrete lagging, and concrete. Vinacomin has a lot of instructions, on the application of rockboltt o reduce the cost and increasing the tunneling advance .

Almost coal mines companies have invested in equipment exclusively used for rockbolt such as Khe Cham, Ha Lam, Ha Long, Hon Gai, Uong Bi, Vang danh, Mao Khe, ...the results in Vinacomin are: in 2011 there was 2.944 m, in 2012 was 3.808m , in 2013 was 4.266m rockbolt roadways. Although the amount of roadway bolted increased in recent years but the total of annual development, that is still very low (2013 4.266m / 347.649m by 1.2%).

Transportation: The transport is mainly applied:

Type 1: Bridge convey → Bunke → Conveyors : continuous transport is applied in the Ha Lam, Nam Mau project ... to serve mechanized excavation .

Type 2: Wagon + Shuttle → Bunke → Conveyors : Line flexible transportation is commonly applied in the Trang Bach –Uong Bi, Thanh Cong- Hon Gai, Mong Duong Quang Hanh, Duong Huy projects.

However, in the implementation process, the investment is not in time, synchronized (Bunke system, feeder, conveyor inclined shaft) leading not to promote efficiency.

Type 3: Train wagon → shaft hoist: this transportation has low productivity, applied to the Vang danh, Thong Nhat, Ha Rang, North Coc Sau - Ha Long mines... due to low transportation capacity through shaft / day - night , affect the construction work.

In some mines, transportation scheme often connects deeply with the general transportation system leading to many stages of transportation, no continuity, no requirements of the faces for loading, typically at the Mong Duong coal mines: at level -250, transportation through many equipment and general over level -97.5; in underground mining projects below -35 in Lo Tri Zone – Thong nhat Coal Company: level -140 transportation through several stages and with the upper level leading to obstruction regularly occur.

The organization: almost tunneling crews were organized to work for 3 shifts per day. Except for some fast tunneling in 4 one. During blasting, only mine workers were working in the face and miners must stay outside far away face to keep safety. The combination working in shifts is not balanced. This leads to wasteful use of working time.

The technological equipment line: Currently in Quang Ninh mine area is using as follows:

(1) - handheld pneumatic drill (YT-27, YT-28, MZ-7665 ...) → manual muck → wagon / conveyor.

This process has a low mechanization level, mainly used to excavate the roadway with a small cross section in coal, rate is relatively high. Lines are not suitable for the roadway with medium to large cross section area and in rock, while the labor cost of the stages of blasting and loading is so great.

(2) - handheld pneumatic drill (YT-27, YT-28, MZ-7665 ...) → loader → wagon / conveyor → train / conveyor.

This process is not high level in mechanization due to still use portable drilling machines with low productivity. Advance is not high, especially with large section roadway. However, due to difficulties in investment and production habits that this line has been widely used in a lot of coal mines.

(3) - hydraulic drill rig (with 1 or 2 booms) → loader → wagon → train.

This line has a high degree in mechanization, the process stages are synchronous. Lines are consistent with the roadway in rock with average cross section to bigger , the advance is rather high about 60 - 80m / month).

3. Analysis of the causes which affect the effectiveness of excavation in Vietnam coal mines

- Almost of the coalmines have not synchronized excavation equipment lines, some production stage remain to be done manually or equipment not in accordance with cross section (especially drilled stage: majority still use hand-held drill that has low productivity, difficult to comply with blasting

passport).

- Qualifications, skilled mechanized equipment operators still lack to grasp and control the technology and modern equipment .
- No incentive mechanisms improve advance. Lack of norms, construction mechanization regulation, leading to underestimate the economic mechanization effect.
- The type of drills, modern loader usually require maintenance services and spare parts from the manufacturer. However, the services of these in Vietnam are lacking with the high cost.
- Types of explosives and detonators service excavation currently in the coal industry has not varieties. In almost underground coal field using differential electrical detonators, explosives P113, emulsion AH1. The explosives and detonators are only effective for rock with hardness $f < 8$. When hardness $f \geq 8$, roadway has large cross-sectional area, explosives and detonators have greater ability is better.
- Geological conditions in Quang Ninh complex, coal seam thickness and angle varies in both direction, rocky clamp leads to equipment operate very difficult. In the stage of the investment project set up is conditional unexpected difficulties.
- The underground coal mines almost have little experience in construction roadheader. Moreover, the roadheader mainly imported from Europe very far from Vietnam, the supply of spare part, maintenance and replacement of parts not meet the requirements.

4. Proposed solutions to improve the effectiveness of excavation for the period 2014-2020

To encourage the investment in modern equipment to improve productivity, excavation advance.

To set up technology and passport form towards mechanization applied to Vietnam underground coal mines, as a basis for investing equipment with high degree of mechanization, to overcome the shortcoming of the existing excavation equipment.

To Enhance the training of labor resource development with high skill. Capacity, qualifications, ability to control technology and modern equipment. This will determine the effectiveness and success of mechanized excavation in Vinacomin.

To research and product on equipment (domesticization) such modern mechanized drill rig, loader to reduce investment costs, operating in accordance with the conditions of Quang Ninh coal.

5. Conclusion

Excavation work takes part an important role for the development of the coal industry in Vietnam. The main objective of development construction until 2020 gradually mechanized equipment, enhanced advance, increase productivity, reduce the heavy labor works. However, with the actual existing status of the excavation technology, it is difficult to achieve. There are many causes affecting the effectiveness of investment, involving geological conditions are not favorable; the investment is not scale; maintenance, spare parts not meeting the requirements; lack of management experience...

On the basis of these reasons, research and propose specific solutions and urgency to accomplish goals against mechanized excavation to overcome the above causes in order to Vietnam's coal industry development period 2014-2020.

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