

Construction Design and Maintenance Measures for Underground Concrete Construction

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Abstract: The coal production operations are mainly concentrated in the mine shafts under the ground. For the architectural design of the mine shafts, many factors should be considered to ensure safety and normal production of coal. Currently, as regards China's coal production environment, the design of mine shaft is mainly on basis of its firmness and corrosion resistance. However, in the daily course of construction, maintenance measures for underground building still need to be considered. Therefore, the focus of this article is to analyze the construction design for underground concrete building and explore the main measures for the maintenance and operation of the mine.

1 INTRODUCTION

The level of industry is an important symbol of a country's comprehensive strength. Therefore, the importance of industrial development is obvious. The energy resources such as coal and oil etc., as the basis for industry guarantee the development of industries. The production status of energy resources can directly affect the industrial level. In addition, many rare metal mineral resources also play an important role in industrial development. Yet mining of coal and rare metal minerals usually require mine shafts. In the past, there was not enough understanding of mine construction to a certain extent, affecting mining efficiency in actual production. In the early times, due to lack of funding, foreign companies and investment were attracted, in hope of promoting China's economic development with foreign funds and the rich mineral resources were the main driving force for foreign companies to come into China (Li Jing, 2012). Until now, the exploitation of resources through the mine shafts remains the main driving force of economic growth, but by the survey it's found that companies attach more importance to productivity and economic benefits than to the construction of mines,

which didn't only influence mining efficiency, but also resulted in some safety incidents.

2 CURRENT STATE OF CONSTRUCTION DESIGN FOR CHINA'S UNDERGROUND CONCRETE BUILDINGS

2.1 Features of Underground Concrete Buildings

Underground buildings compared with ordinary concrete buildings are particular. Especially for some deep shaft buildings, the concrete needs to withstand greater pressure. The mine shafts as auxiliary facilities provide the channel for exploitation and transportation, besides, with some special buildings, the efficiency of mining can be improved. In actual process, the underground concrete buildings should vary according to different resources. For instance, in the mining of coal resources, the safety measures like fire prevention must be taken into account. As for mining of rare minerals, the mining efficiency must be paid more attention (Ren Jinlong, Zhang Jian and Zhang Long,

2012). The deeper the resources are stored the greater load should the building bear, thus the correspondingly thicker concrete. China is vast in territory and rich in resources. There are large numbers of mine facilities. Adjustment should be made according to different geological and geographical conditions. In the process of the excavation of the mine shafts, if the favorable geological and geographical conditions could be made use of, it can largely improve the efficiency of construction, such as the use of layer with larger bearing capacity which could reduce the bearing load of the respective building. So the most conspicuous feature of underground concrete buildings is the bearing capacity.

2.2 Factors Affecting Construction Design of Underground Concrete Buildings

Many factors need to be considered, with regard to the underground concrete buildings, such as the resources to be exploited, geological and geographical conditions, etc. Factors should be taken into full consideration in construction design. The first is the geological condition. As the discovery of mineral resources require certain exploration methods. There will be a detailed geological and geographical information report in the exploration process and this report contains the information of layer formation and resource reserve, etc. In addition, the construction design would differ according to different resources (Cheng Hong, Lin Shuai, Wang Shibing, Lu Qiwei, Yang Zijing and Xintian, 2012). Especially for some flammable or toxic resources exploitation, it's quite different from the ordinary underground buildings, and no flammable materials should be used. Also corrosion resistance must be considered so that the construction quality can be ensured to maximum extent. In order to improve the mining efficiency, the mechanical equipment should also be considered in the construction design, such as placement of equipment facilities. If the design and construction could be based on the existing equipment, the efficiency in use of equipment could somehow be improved. In addition to these factors, the quality level of a designer is also an important factor which influences the construction design of underground concrete buildings. Only the personnel with high quality can reach a scientific and rational construction design on the basis of these above factors. Survey shows that the average quality of construction designer in China is still low and

foreign designers are employed for many large underground concrete buildings.

3 MEASURES FOR CONSTRUCTION DESIGN OF UNDERGROUND CONCRETE BUILDINGS

3.1 Quality Improvement of the Designers

In order to improve the situation of underground concrete building fundamentally, it's critical to ensure that the designers are of adequate professional quality and well aware of all the factors influencing the design. However, the quality of a designer is decided by the education. With the current situation of China's education system, the quality of designers is low. Obviously the education system reform can't be completed in a short period. Under such circumstance, companies can train their designers to learn from the western countries. Surveys show that the construction designs of underground concrete buildings in developed countries are comprehensively considered. Besides factor of production efficiency, the safety for personnel and production is also paid much attention. Designers gained comprehensive knowledge in colleges or universities, but they didn't have any design experiences. When they first entered their company, they learned design from experienced staff, and then they started to design some small part of the construction. In contrast, many enterprises in China have adopted this model, it is difficult for new entrants who just graduated from college to calm down to learn from the experienced staff, thinking that they could design underground buildings independently. It causes the age of China's high-quality designers to be relatively high. In order to change this situation, a reward mechanism might be introduced to give a certain reward to those who complete a stage of learning.

3.2 The System for Design Check

To ensure the construction design of underground concrete building is scientific and perfect, not only should the designer be of certain level of quality, taking into account various factors, but also the design should be checked after it is completed. If the conditions permit, advanced computer-based simulation technology is advised, and the

construction shall be carried out when no problems are found in the simulation. In the phase of design check, in addition to find out the existing problems in the design, it's also helpful to optimize the design. If the inspectors for design check are not the designers, there would be differences in understanding of the design, and the inspectors can optimize the design according to their own understanding, so ensuring the design is reasonable to the maximum. Especially, the design of large underground concrete building is a complicated work, requiring long period, during which, some advanced construction technologies may appear and these technologies can be used in the design for optimization in the check stage. It's obvious that the design check weighs heavily in ensuring it is scientific and reasonable. For a comprehensive check of the design, a perfect checking system should be formed. Firstly, the inspectors should be themselves designers with rich experience, and then they should be divided into several groups and each group reviews a part of the whole design. During the check, they could propose their remedy, and discuss with the designers during modification.

4 MAINTENANCE MEASURES FOR UNDERGROUND CONCRETE BUILDINGS

4.1 The Problems in the Maintenance of Underground Concrete Buildings

After completion of the concrete building, certain precaution must be carried out to ensure the longest service life and the maximum bearing capacity of the building. And when quality problems occur, maintenance is required. As underground buildings are particular, especially with the use of large mechanical equipment, the concrete buildings are often seriously worn yet the companies in China have not paid enough attention to the maintenance of the buildings. When problems happen, the bearing capacity of the whole building shall be reduced if they are not timely maintained. In some serious cases, accidents were caused. Facts show that China's underground concrete buildings were not timely repaired when they were worn. Especially the less important buildings are repaired only during regular large scale maintenance. However, in western countries, the underground concrete buildings are immediately repaired as long as the

damage is discovered. For some sensitive parts, even experiments in mechanics are carried out and better materials are used to repair damages to ensure the safety. It's clear that maintenance not timely carried out is the main problem in China's underground concrete buildings at present. Although for some important buildings, the damages were repaired promptly, the materials and the technique used are relatively simple. Buildings could not even meet its original strength, thus resulting in bad influence on the safety of the whole building and re-damage of these repaired parts in future use. Therefore, in the process of maintaining underground concrete buildings, problem identification must be carefully carried out to ensure that measures are taken accordingly to solve the problems. And the safety of underground buildings is thus guaranteed. As for the problem solving process, comprehensive analysis on basis of the design and the actual construction conditions are required to ensure successful problem solving.

4.2 Maintenance Measures for Underground Concrete Buildings

If timely maintenance needs to be performed when problems happen to the underground concrete buildings, there must be a perfect maintenance system. And it must be guaranteed to be practiced with a strict reward and punishment mechanism. The first thing of the system is the discovery of problems, and currently the problems of underground concrete buildings are mainly found out by two means, one is the report from staff and the other by maintain personnel from regular inspection. After a problem is found, close analysis should be conducted on cause of the damage of buildings and the effect on the mine production. According to the influence to the production, different maintenance mechanism is used, for example, if the problem is of considerable importance, it should be responded to in the shortest time. In addition to keeping the maintained part with sufficient strength, in order to ensure the safety of underground concrete buildings, regular maintenance should be conducted and potential hazards should be identified to keep the underground concrete buildings at their optimum state thus the prolonged service life. It can be seen from above that a good maintenance system, do not only ensure the integrity of the building, but also, at the same time, greatly improves production efficiency and safety of mine production and personnel. And the implementation of maintenance system relies on the

corresponding reward and punishment mechanism. Punish those who damage the building and reward those who protect it. A perfect reward and punishment mechanism is the key to successful implementation of maintenance measures. As in the process of maintenance by a team, it is very important to mobilize their initiative. Only when the construction personnel are positive and initiative could they deal with problems of their own accord in the maintenance process, and the total independent operational mode is achieved to some extent.

5 CONCLUSIONS

Mine shafts as auxiliary facilities play an important role in exploitation of underground resources. And the constructions of underground concrete buildings do not only affect the production efficiency directly, but also weighs heavily in the safety of production. We could know from the article that, as regards production in mine in the past, lacking of knowledge of the underground buildings, some accidents happened to the personnel and equipment greatly affected the company benefits. In order to avoid this problem fundamentally, all factors must be considered and a perfect maintenance system should be made for the construction design of underground concrete buildings.

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