RESEARCH ARTICLE

Cost Management of Mechanical and Electrical Engineering Project Based on Bim Technology

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Abstract:With the further development of social economy and science and technology, society has brought new impetus and new challenges for the development of mechanical and electrical engineering. In order to safeguard the sound operation of mechanical and electrical engineering, we must take into account the management effect of project costs while strictly controlling the construction quality of electromechanical engineering projects. There have been some attempts to apply BIM technology to the cost management of electromechanical engineering projects. In this environment, this paper takes the cost management of mechanical and electrical engineering projects of BIM technology as the research object. First, it briefly introduces the theory and characteristics of BIM technology. On the basis of this, it points out the advantages of cost management in combination of electromechanical engineering and BIM technology. Finally, the actual application of this technology in the cost control of electromechanical engineering projects is the final point of view, in order to provide a reference for the project construction time, energy saving, project quality assurance and so on.

Keywords:BIM technology; cost management; mechanical and electrical engineering projects; application

Introduction

As we all know, the construction industry has been a typical labor-intensive industry since its beginning. At present, the modernization process of construction management is not obvious. There are some problems to be solved in the actual construction. For example, technological backwardness lacks updating, labor productivity and construction efficiency are not high; labor intensity is high; safety accidents and quality problems occur frequently; this series of problems ultimately leads to an increase in project construction costs. In particular, the key point of China's economic transition is that domestic labor costs continue to rise, and demographic dividends in the past are fading away[1]. And the resource advantage is no longer the same. The deterioration of the ecological environment makes it necessary for us to adhere to sustainable development. The emergence of these conditions makes the problems of high energy consumption, heavy pollution and high incidence of accidents occur frequently in the construction industry, which also makes the modernization of the construction industry more urgent. In order to find a new development port, we must persist in building the resource saving and environment-friendly industry tenet, and do everything possible to achieve sustainable development of the industry, transforming the construction industry from traditional labor-intensive industries to new production methods such as standardization, mechanization, and management informationization. Complete the integrated design, production, construction, service and other complete industrial chain, to achieve the

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requirements of building product energy conservation, environmental protection, life cycle value optimization, combined with BIM technology to ensure the quality of the construction industry and production effectiveness, and promote the transformation and upgrading of the construction industry.

1. An overview of BIM technology and its characteristics analysis

1.1 Overview of BIM Technology

In general, BIM technology is based on multiple data information of a construction project. Through the construction of a building model, relevant information at all stages of a construction project is accurately marked on a specific model[2]. For example, the overall project material and quantity, time involved, location elements, physical space positioning and geographic information, etc., in order to assist the project organization to carry out the scientific management of operations, the project schedule of effective supervision and control. Auto-CAD software plays an auxiliary role in this technology, and BIM technology is the main means to achieve efficient, accurate and comprehensive control and processing of projects. Therefore, BIM technology has shown more and more important postures in the modernization process of construction projects, and its application scope has also been expanding, which is worth our in-depth discussion.

1.2 Characteristics of BIM technology applied to mechanical and electrical installation engineering

1.2.1 Building a whole building information model

A typical feature of BIM technology is the function of building full information mode[3]. By analyzing its principle, the whole building information is to manage and divide the data and information of all kinds of information(project cost, connection method, engineering method), design information(dimensions, standards, fire resistance and material properties), production information(product code, function, product model) and operation information(engineering maintenance, maintenance cycle, use details), which are involved in all the mechanical and electrical installation projects, through the establishment of a specific building information model. In the electromechanical installation process, the capacity of the entire building information is relatively large, and the design content involved is numerous and complex. The unified management of integrated pipe network, project cost, product specifications and material manufacturers is implemented to facilitate real-time query and effective management, and then improve the management level of electromechanical enterprises and control the probability of accidents in engineering management.

1.2.2 Covering the entire life cycle

With the design, decision-making and optimization of the project as the starting point, the design and concrete construction of the building shall be included, and the project maintenance, trial run and operation will be the end of the project after the completion of the project. This is a complete process that can be seen as a complete life cycle consistent with the entire construction phase, with a long span of time and many personnel structures involved. Combining BIM technology with electromechanical system can achieve its full life cycle management, which greatly facilitates the query and modification of all data in the system, which is of great benefit to the complete construction cycle.

1.3 Whole process collaborative management

In the complete life cycle of the electromechanical installation project, the BIM model can be considered as a "transfer station", which can provide a channel for cooperation and management in many aspects. We must make it clear that the design department should consider the entire cost of the entire mechanical and electrical installation project as a whole, focusing on the long-term operating state, cost input and saving from a macro perspective, rather than simply saving the initial input or paying attention to the input in a certain link and ignoring the whole[4]. Under the macro guidance of BIM technology, a large number of project participants can achieve more effective collaboration and cooperation, achieve the goal of joint management, and ultimately realize the ideal state of controlling the construction progress, construction quality, operation and maintenance of electromechanical installation projects.

2. Advantage of BIM technology in cost management of mechanical and electrical engineering

2.1 Optimize the program and improve the quality

Before the installation of mechanical and electrical equipment, the building units can use BIM technology to complete the integration of various professional drawings. In this process, the defects or loopholes in the design can be displayed, and then the existing design schemes can be repaired and optimized, and the mechanical and electrical installation caused by the design error can be avoided. [6]In addition, the BIM technology has the advantages of simulation and visualization, which can realize the dynamic simulation of the site layout and the mechanical and electrical installation process, in order to clear the defects in the installation design in advance, and finally complete the re optimization of the installation design.

2.2 Quick calculation, improve accuracy

For a long time, our commonly used calculation method of engineering quantity is necessary to clear the corresponding attributes of the calculation rules and drawings of various components. Therefore, the efficiency of the calculation of the traditional engineering quantity has been difficult to improve obviously, and the accuracy needs to be improved, and it is very easy to make mistakes. The three-dimensional model built by BIM technology is different from this. It completes the corresponding attributes and matching of the drawing components at the design stage, and the BIM engineering quantity calculation software is embedded in the calculation rules, and can complete the automatic calculation operation of the engineering quantity. In this respect, the efficiency of computation is greatly improved. On the other hand, the calculation of engineering quantity is more accurate and reliable compared with the previous methods[5].

2.3 Speed up the settlement and reduce the cost

The BIM model data is complete, and the update time is short. With this technology, we can more accurately count the project volume of the split project, which can save the settlement time of the relevant money in the mechanical and electrical engineering to some extent. At the same time, when the project is completed and cleared, the business unit can directly obtain the required data in the BIM database, which can save the time cost of data preparation to a great extent, speed up the settlement speed, and ultimately reduce the time cost.

3. The application of BIM technology in the cost management of mechanical and electrical engineering

3.1 Statistics of construction materials

At the beginning of creating a building information model, an engineering designer will set specific parameters for building elements. After the completion of the three-dimensional virtual model, we must carry out a one-by-one estimation of each system, and calculate the amount of material required in advance according to the actual conditions, so as to provide support for large-scale increase of budget efficiency. At the same time, the level of budget accuracy is improved, which is of great benefit to the scientific and effective construction management. Because the contrasting conditions in the design process are not the same, this software has set many screening conditions at the same time. Which paves the way for the project conditions screening. The related material staff can refer to the project progress and use the simulation model built by BIM to collect and analyze the information and data of each part, so as to master the actual consumption of materials and smoothly carry out the material tendering work. This is also beneficial for material storage management. Compared with BIM technology, the traditional situation is generally that the relay equipment project is based on the manager's personal experience to determine the project arrangements and division of labor, subjective and empirical color, lack of precision, scientific and planning. After selecting BIM technology, the construction process is developing towards data and accuracy[7].

3.2 Selection of simulation optimization program to promote the refinement of construction

IM modeling provides the possibility for us to obtain accurate engineering data. With the deepening of this application, we can also calculate and simulate all aspects of construction in a timely manner and can coordinate the relationships among multiple variables. At the same time, the informatization method that BIM technology has can also rapidly derive the results of the relationship between variables, thereby improving the reference decision-making for the program decisions of project personnel. For example, in the process of construction, a project is simulated by BIM modeling, such as the construction scheme of the large floor, the support dismantling scheme, the construction plan of the core tube climbing model of the West Tower, and so on. By comparing and analyzing various situations hidden in the three schemes, we can ultimately balance the safety, quality and duration of multiple indicators through comprehensive comparison of multiple factors.

3.3 Concrete application of construction stage

3.3.1 Optimization of construction site

In the construction link, through timely acquisition and analysis of the relevant data of the BIM platform, we can timely and accurately coordinate the actual project quantity of a specific time period, and guide and achieve the scientific and accurate resource allocation according to the estimated value. Finally, effectively improve the equipment, materials, manpower and other resources, and ensure the planning quality of the layout of the construction site, effectively reducing the flow of a large number of funds to provide support for the effective scientific allocation of construction resources[8]. In addition, adopting BIM technology can also timely adjust the construction schedule and task schedule when the construction plan changes, and finally adjust the resource utilization plan according to the actual situation so as to avoid resource loss or inefficient utilization. In addition, using the completed BIM model, the resource consumption of each corner, component and various processes can be estimated in a more timely and accurate way, and the real-time resource data can be obtained according to the field monitoring. Select one-to-one supply mode for raw materials and facilities, so that raw materials and facilities are in place, minimizing the amount of raw materials and equipment handling, effectively increasing convergence between processes, and ultimately achieving effective control and utilization of financing fees[9].

3.3.2 Optimization design and change processing system

In the environment of cost control of mechanical and electrical engineering, the personnel concerned with cost management should build the corresponding analysis model according to the actual situation of the project, and consider the effective countermeasures in advance by considering the frequent occurrence of cost adjustment, cost control, project completion and so on, and further strengthen the effective control of the cost of mechanical and electrical engineering projects. Under the past project cost accounting, if there is a change in engineering design, it must implement the layers of approval and circulation, cost engineers must manually check the design changes, and finally complete the modification of the project cost, such a processing process is lagging behind and lacks authenticity. Virtual construction is the biggest advantage of BIM technology. Using BIM's 4D model can complete the simulation of mechanical and electrical engineering implementation[10], so as to quickly locate the hidden dangers of the construction plan. Based on this, make further research on the feasibility of the construction plan and try to achieve “no collision and no rework” as much as possible to avoid the increase in costs caused by rework.

3.3.3 Construction simulation analysis

After the opening of the electromechanical engineering project, it is necessary to cooperate with the construction process simulation analysis in order to achieve an effective assessment of the construction budget. According to the production tenet of “zero inventory”, the method of quota picking and the supervision system are adopted to maximize the utilization rate of the owners’ funds. Through the study of construction processes, cost planning software and BIM model data are combined to achieve the goal of real-time monitoring of control costs. In accordance with the simulation results of the use of funds, scientifically formulate fund allocation plans[11] to assist in the calculation and formulation of investment target values and improve the effectiveness of cost control. This process also laid the foundation for the

coordination of funds, in order to better predict the future use of project funds to avoid wasting funds.

3.4 Application at the completion stage

3.4.1 Completion settlement

In the past, we carried out the checking of the quantity of the project at the completion stage by artificial calculation, but limited to the complexity of the project and the capacity of the staff and the ability of the staff themselves, and the results are often not very optimistic. Not only the turnover rate is high, but also the work efficiency is difficult to improve. What's worse, it also leads to the leakage of a large number of mechanical and electrical engineering project information. By using BIM technology, the information model of each phase of the project is kept in the central database of the project. The related organizations of the project can obtain the information needed by the information retrieval and query, thus greatly speeding up the completion acceptance and settlement speed, and improving the efficiency and accuracy.

3.4.2 Digital transfer

First, the three-dimensional digital handover system can seamlessly connect with the projects in the BIM model, so that the data in the entire process of the electromechanical engineering project can be shared, and then support the coordination of operations and resources, and finally achieve the goal of controlling the cost of the electromechanical engineering project. Second, all data of project drawings, equipment information, BIM models, etc. are saved in the form of digitized forms in the central database of the corresponding project. Digital transfer ensures the integrity and systematization of the data during final acceptance.

Conclusion

In summary, BIM technology has unparalleled advantages in the cost control process of electromechanical installation projects. To save engineering costs and maximize the economic benefits of electromechanical installation companies, it is of great benefit. It brings a series of changes to the cost control and management of electromechanical installation projects. The whole process, refinement, and low cost will become the development trend of project cost management.

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