

Practical application of BIM technology in building mechanical and electrical installation engineering

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Abstract: BIM technology, as a new digital architectural design and management tool, is gradually becoming the mainstream technology in the construction industry. In the construction of mechanical and electrical installation engineering, BIM technology is also widely used, especially in pipeline integration, construction simulation and other aspects show advantages. This paper will analyze the importance of BIM technology, and discuss its practical application in building mechanical and electrical installation engineering from the aspects of pipeline comprehensive optimization design, construction simulation, construction cost control, material management, BIM operation and maintenance.

Key words: BIM technology; Importance; Building mechanical and electrical installation engineering; Practical application

Introduction

With the rapid development of information technology, BIM technology, as its typical representative, has been widely used in the construction industry, and is bringing subversive changes to the practice of building mechanical and electrical installation engineering. Through BIM technology, the mechanical and electrical installation engineering team can realize the whole digital management from design to construction, and better coordinate the work of various professions. Specifically, the realization of visual and parametric management enables designers and engineers to better simulate the construction of mechanical and electrical systems, identify potential problems and conflicts in advance, ensure the quality and progress of the project, further enhance the competitiveness of enterprises, and promote the sustainable development of the construction industry.

I. A brief analysis of BIM technology

BIM technology is a digital technology based on 3D modeling. By establishing a virtual building model and synthesizing various parameter information including the geometric shape, material information, engineering data, time line and spatial relationship of the building, BIM technology can realize collaborative work and information sharing among multiple project participants. It is not only a 3D model, but also a real-time database, which can contain the whole life cycle information of the building. The core idea of BIM technology is to integrate the design, construction and operation stages of the building, and realize the comprehensive management of the whole process of the construction project through the visualization, parameterization and intelligence of the model. BIM technology can help designers, architects, engineers and other project participants make more accurate predictions and decisions in the design, construction and operation process, reduce errors and conflicts, and improve efficiency and quality. Overall, BIM technology is a completely new digital tool that can transform construction projects from traditional two-dimensional graphic design to full life cycle management of three-dimensional digital models.

II. The importance of BIM technology application analysis

1. Improve design quality

The application of BIM technology can significantly improve design quality. Traditional two-dimensional design is difficult to fully present the details and spatial relationships of buildings, which easily leads to frequent errors and conflicts in design. However, BIM technology can establish 3D modeling and integrate all design information in one model, so that designers can detect and solve problems in the design in real-time simulation. At the same time, BIM technology can also realize the collaborative design between different professional teams, and promote the design results to be more comprehensive and consistent. By improving the accuracy and coordination of the design, BIM technology provides a strong support for ensuring the design quality of the construction project.

2. Allocate your budget wisely

Based on the above, by establishing a complete building model, BIM technology can accurately calculate the cost of materials, equipment and labor of a construction project, and update the budget information in real time. By integrating with the supply chain and construction schedule, BIM technology can identify potential cost problems and risks in advance, and make early warning adjustments. In addition, BIM technology can also enable the simulation of the cost impact of different design schemes and changes to help decision-makers analyze and avoid unnecessary budget wastage and financial pressure. Through the application of BIM technology, construction projects can achieve reasonable budget allocation, thereby improving financial control and ensuring maximum benefits.

III. The practical application of BIM technology in building mechanical and electrical installation engineering

1. Pipeline comprehensive optimization design

In the process of installing building mechanical and electrical equipment, it is necessary to involve air conditioning, water supply

and drainage, fire protection, electrical and other pipelines. If the design is unreasonable, it is easy to have pipeline collision problems. The application of BIM technology in the comprehensive design of pipelines can effectively solve this problem. Specifically, based on the various pipelines in the model, advance planning to ensure integrity and accuracy can lay a solid foundation for the comprehensive design of pipelines. On this basis, the detection software can automatically detect all kinds of pipelines in the model, and quickly find the collision and friction between the pipelines. If there is a problem, the specific location of the collision can be confirmed in time, and the design scheme can be quickly improved by adjusting the parameters, and potential construction conflicts can be found in advance to avoid delays and re-construction in the field construction process. Through the application of BIM technology, the optimization of pipeline layout can be realized. Through the visualization and parameterization characteristics of the model, various pipelines can be flexibly arranged and optimized, thus achieving the purpose of saving materials, reducing engineering complexity and improving construction efficiency. For example, by adjusting the direction and height of the pipeline, collision with other equipment or structure can be avoided, the layout density of the pipeline can be optimized, and the space utilization efficiency of mechanical and electrical equipment can be improved. Then it can realize the precise and accurate comprehensive design of the pipeline, and can continue to optimize and improve according to the actual situation, and improve the installation efficiency. For another example, in the design of support and hanger, BIM technology is used to integrate the design information of pipeline synthesis and support and hanger into a model to realize data sharing and collaborative work. Designers can add the property information of the support hanger in the modeling process, such as the type, size, material and installation requirements of the support hanger, which is directly connected with the comprehensive model of the pipeline to ensure that the design of the support hanger is suitable for the layout of the pipeline. It can even evaluate the stability and safety of the support hanger through the simulation and analysis functions. That is to say, the pipeline comprehensive design optimization level is also improved based on information technology, and different from the traditional, single-line construction process, can effectively improve the efficiency and quality of building mechanical and electrical installation engineering landing.

2. Simulate the construction scene

In the building mechanical and electrical installation project, simulation construction is an important application direction of BIM technology, through the simulation of the building model, to achieve the prediction and optimization of the construction process, so as to better control the construction quality. First of all, the use of BIM technology to simulate construction can help the technical person in charge of mechanical and electrical engineering before the installation of a comprehensive task allocation and resource arrangement. Through the BIM system, the technical leader can combine the construction plan with the building model, set various tasks and related resources in the construction process in the model, and carry out reasonable time and space allocation. This helps to plan the construction process as a whole, predict the correlation and conflicts between the various processes, and formulate solutions in advance to ensure the smooth progress of the construction process. Secondly, in the construction process, the actual construction situation is timely fed back to the BIM system, which can help managers to understand the actual situation of the construction site in time. The technical person in charge can record and check the actual construction progress through the BIM system, and compare and analyze it with the plan. By combining the information model and the construction plan, real-time construction progress management and quality control can be carried out. For example, by comparing the difference between the three-dimensional model and the actual construction scene, possible construction conflicts or design problems can be found, and timely adjustments and optimization can be made to avoid later modifications and cost increases. Taking hoisting simulation as an example, it is necessary to create a BIM model that contains the target building, including information such as the structure of the building, building components, equipment and materials. Then, the BIM model is imported into specialized construction simulation software, such as Fuzor, etc. In combination with the special hoisting scheme, hoisting equipment such as tower crane or crane is arranged in the software. By setting relevant parameters such as lifting task, route and lifting height, the software will simulate the hoisting process of the scheme and discover the risk points in the hoisting scheme in advance. Finally, based on the corresponding three-dimensional animation or report, it guides the implementation of hoisting on site to ensure the safe and orderly carrying out of hoisting work. Specifically, it can also connect with the Internet of Things technology, artificial intelligence technology, etc., to achieve additional auxiliary functions, ensure the construction safety and complete the task with quality and quantity. The simulation construction based on BIM technology can comprehensively predict and optimize the construction mechanical and electrical installation management process, and can also provide a better optimization of the construction scheme, which is worth our in-depth study and attempt.

3. Control the construction cost

The model constructed by BIM technology can simulate the entire construction process of the project, accurately and efficiently calculate the materials, equipment and personnel required by the project, and realize the accurate budget control of the cost of mechanical and electrical engineering. In terms of technology, the construction scheme and material performance parameters of mechanical and electrical engineering can be optimized by using BIM technology to build a model. By setting the parameters of different construction schemes in the model, each construction scheme can be simulated, analyzed and evaluated quickly, so as to select the best scheme. In addition, the simulation, analysis and processing module of BIM technology can quickly respond to problems, help managers and construction personnel find problems in time, ensure that the technical disclosure is detailed enough, and reduce the economic loss caused by technology. In terms of economy, BIM technology can assist relevant managers to control the cost accounting, procurement and material use of mechanical and electrical installation projects throughout the process. Through integration with the cost management system, the BIM model can update the relevant data such as material and equipment cost and labor cost in real time. Managers can conduct cost accounting and forecast according to real-time data, adjust procurement plans in time, reasonably control the amount of materials used, and avoid unnecessary waste. In

addition, the application of BIM technology can also efficiently process a large amount of data information, provide comprehensive material inventory management and supply chain management functions, and help managers effectively control the cost of mechanical and electrical installation. With the support of BIM technology, the optimized design scheme based on the model and the auxiliary economic management will achieve the effect of twice the result with half the effort and further realize the reasonable budget control.

4. BIM material management

In the construction mechanical and electrical installation project, material management is a crucial link, and the application of BIM technology can greatly improve the efficiency and accuracy of material management. First of all, the use of BIM technology can be all the relevant material types, prices, quantities and other information statistics into the building model. By interacting with the supply chain information, the BIM model can track the purchase, storage and use of materials in real time. This enables the purchasing staff to reasonably adjust the purchasing plan according to the actual situation, ensure the timely supply of the required materials, and avoid unnecessary material waste. At the same time, through the integration with the cost management system, BIM technology can accurately calculate the cost of materials required for mechanical and electrical installation engineering, helping the project team to control the construction cost and avoid budget overruns. Through the BIM model, the use, supply and price update of materials can be detected in real time. This helps the purchasing staff to accurately understand the actual consumption and delivery time of the materials, so that they can better develop the material scheduling plan and ensure a reasonable time for the entry of materials. At the same time, real-time material management can help project managers to control the construction progress, find the delay or shortage of material supply in time, and take corresponding measures in time to ensure the normal progress of construction. It can be seen that BIM technology has significant advantages in material management, which plays a promoting role in integrating work tasks, realizing accurate material control and cost control, and further improving the efficiency of project budgeting.

5. BIM operation and maintenance

Through BIM technology, the whole life cycle management of construction equipment is realized, including the monitoring and analysis of equipment operating status, the formulation and implementation of maintenance plans, and the prediction and treatment of failures. Using BIM model to obtain real-time equipment operation data, through data analysis and intelligent algorithm, improve equipment operation efficiency, discover and solve possible faults in advance, reduce operating costs and extend equipment life. In addition, real-time monitoring and remote control of equipment, convenient operation and maintenance personnel to remote operation and management of equipment, improve operational efficiency and safety. When there are real failures and operational problems, fully carry out process review and troubleshooting, scientifically use effective means, do a good job in operation and maintenance, improve the efficiency of building operation and maintenance, and enhance the level of building intelligence.

Concluding Remarks

The application of BIM technology has brought revolutionary changes to the building mechanical and electrical installation project. Through the application of pipeline comprehensive optimization design, construction simulation, construction cost control, material management, BIM operation and maintenance, BIM technology has improved the design quality of the project, realized reasonable budget allocation, and further improved the management efficiency of the project. In the future, with the continuous development and improvement of BIM technology, it will continue to play a greater role in the field of building mechanical and electrical installation, and provide more reliable support for the efficient implementation and safety of the project.

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