

Application of BIM Technology in Intelligent Construction Management

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Abstract: With the rapid development of information technology, BIM (building information model) technology, as an innovative force in the construction industry, is gradually changing the traditional engineering management mode. This paper focuses on the application of BIM Technology in intelligent construction management, analyzes the advantages of BIM Technology, aims to explore how to promote the transformation of engineering management to a more efficient and intelligent direction, and analyzes the specific application of BIM Technology from the three stages of project planning and design, construction, and operation and maintenance, and analyzes that BIM Technology has a certain impact on the progress, cost, and safety of engineering projects. The future development suggestions and directions are put forward to provide a reference for the application of BIM Technology in intelligent construction management. The abstract is to be in fully-justified text as it is here, below the author information.

Keywords: BIM Technology; Intelligent Construction; Project Management; Cost Control

1. Bim Technical Basis

1.1 Concept of BIM Technology

BIM Technology, namely building information modeling technology, is a construction engineering management method based on digital platform. BIM Technology has strong information integration capability, can integrate multi-dimensional information, and runs through the whole life cycle of the building from planning and design to operation and maintenance[1]. By creating and using a three-dimensional digital model containing the

complete information of the building, it realizes the information integration and sharing in various stages of architectural design, construction, operation and maintenance. This technology breaks the limitations of traditional architectural design and construction methods, and no longer relies only on two-dimensional drawings to express architectural information. The previous two-dimensional drawings can only show the spatial geometry of the building, while the BIM model is like a huge information database, which can integrate all relevant information including structure, equipment, pipelines, etc., and present it in a three-dimensional visual way, greatly improving the efficiency, quality and sustainability of the project. For example, in the construction project of a new campus of a university, with the help of the three-dimensional model built by BIM Technology, all parties can clearly see the internal structure and the layout of various systems of buildings such as teaching building and scientific research building, which provides comprehensive and intuitive information support for the planning, design and construction of the project[2].

1.2 BIM Technical Features

1. The core of BIM Technology lies in its powerful information carrying capacity. The traditional two-dimensional drawings can only express the spatial geometry of the building, while the BIM model can integrate all relevant information including structure, equipment, pipelines, etc., and present it in a three-dimensional visualization way. For example, bim5d Technology (extended from BIM) can integrate three-dimensional space, time and cost information[3]. In the construction of prefabricated buildings, the information in the BIM module is the same as the two-dimensional code and RFID tag information. The construction unit can use this information

to understand the needs of prefabricated parts, make a plan for prefabrication production and transportation in advance, and effectively solve the problem of stacking work pieces on the construction site[2].

2. BIM Technology is highly collaborative. Different professionals can share the data in the same model in real time to ensure smooth and efficient communication between all parties[4]. In the design stage of a high-rise residential project, designers of architecture, structure, electromechanical and other specialties share data in real time through the BIM platform to jointly optimize the design scheme, avoiding design errors and omissions caused by poor information transmission in the traditional design process, and improving the design efficiency[2]. In addition, BIM also supports the cross platform data exchange standard IFC, which further promotes the compatibility and interoperability among software systems.

3. BIM Technology has good scalability and adaptability. With the development of information technology, BIM has evolved from a simple modeling tool to a comprehensive solution covering the whole life cycle management. It can integrate with emerging technologies such as the Internet of things, big data and artificial intelligence, and play a greater role in all stages of intelligent construction. In the construction operation and maintenance stage, combined with the Internet of things technology, the BIM system can monitor the operation status of construction equipment in real time, realize the predictive maintenance of equipment, and reduce the operation and maintenance cost[4].

BIM Technology has brought revolutionary changes to intelligent construction management with its unique advantages. It not only improves the design quality of engineering projects and reduces the cost risk, but also promotes the digital transformation process of the entire construction industry. In the future, with the development and application of more related technologies, it is believed that BIM will play a greater role in a wider range of fields.

The state has promulgated relevant provisions and regulations on intelligent building in 2017, and vigorously promoted the development of intelligent building, which itself covers a series of advanced technologies. Artificial

intelligence and big data have played an important role in intelligent building; Intelligent construction is characterized by its flexibility and real-time performance, which strengthens the intellectualization and digitization in building construction. The development of BIM Technology has brought new opportunities and challenges to the development of intelligent construction; Therefore, the application of better BIM Technology in intelligent construction management is an urgent problem to be solved at present. It is hoped that the research in this paper can provide some reference value for the development of intelligent construction.

2. Specific Application of BIM Technology in Intelligent Construction Management

2.1 Application of Project Planning and Design Stage

In the project planning stage, BIM Technology can quickly put forward different design schemes for Party A to choose, and can compare and select different schemes, and can clearly show the design intent, which provides good technical conditions for reducing the time of early planning.

In the design phase, the application of BIM Technology provides strong support for intelligent construction management. The establishment of BIM model makes the three-dimensional visualization of the project possible. By visually displaying the spatial structure of the building and the relationship between various parts, designers can more clearly understand the design scheme, and timely discover potential design conflicts and risks. In the design of a building project, with the help of the collision detection function of BIM Technology, the conflict between the pipeline and the structural column was found in advance, which avoided the rework in the construction and reduced the risk and cost of the design[1,5].

At the same time, BIM Technology can realize multi-disciplinary collaborative work. In the traditional design process, designers of different specialties often act in their own way, and the information transmission is not smooth, which is easy to lead to design errors and omissions. The construction team can establish a 3D data model corresponding to the project through BIM Technology, simulate the

construction process, and solve the problems encountered through accurate control of these processes[6]. Moreover, the BIM platform supports multiple professional teams to collaborate on the same model, ensuring the consistency and integrity of information. For example, in the design of a hospital project, designers of architecture, structure, electromechanical and other specialties share data in real time on the same BIM platform to jointly optimize the design scheme and improve the design efficiency[7].

BIM Technology can also simulate and analyze the performance of the project, such as energy consumption, sunshine, ventilation and other environmental factors. Through these simulation analysis, designers can comprehensively evaluate the performance of green buildings in the early stage and select the optimal design scheme, so as to achieve the goal of energy conservation and environmental protection and achieve the goal of intelligent construction. In the design of an office building, BIM Technology is used to simulate the energy consumption of different design schemes, and finally the scheme with the lowest energy consumption is selected to realize the green energy-saving design[2]. After the completion of the design, preview the whole construction process in advance to identify and solve the difficulties and risks in the construction. This forward-looking planning helps to formulate a more scientific and reasonable construction plan and ensure that the project is completed on time and with quality.

At the same time, the BIM model can also be used to generate a detailed bill of quantities, provide accurate data support for budgeting, and avoid cost overruns caused by inaccurate estimates. In a residential project, with the help of the bill of quantities automatically generated by the BIM model, the budgeting is more accurate and the project cost is effectively controlled[8]. The application of BIM Technology in the project planning and design stage not only improves the design quality, but also lays a solid foundation for the subsequent construction and operation and maintenance management.

2.2 Application in Construction Process Management

In the intelligent construction management, the

construction process management is the key link to ensure the smooth progress of the project, and it is also the most important stage of BIM Technology Application, which provides the necessary technical support to ensure the construction of intelligent construction.

BIM Technology can realize the visual management of construction progress. The traditional construction schedule management mainly depends on two-dimensional drawings and tables, which is difficult to intuitively display the complex construction process. The BIM Technology can present the construction progress in the form of animation through the three-dimensional model, so that the construction personnel can clearly understand the work content and time node of each stage. In a large bridge construction project, the BIM Technology is used to display the construction progress in real time, and the project management personnel can timely find the progress deviation and adjust it[2]. At the same time, the development of the Internet of things can enable all departments to master the completion of the project progress at the same time and reduce the difference of information among departments; The construction enterprise can timely complete the supply of labor, materials and machinery according to the list of materials, so as to avoid affecting the project progress due to the shortage of labor, materials and machinery. At the same time, it can find and solve the position with special factors affecting the progress in time through visual operation. This will not only help to improve the communication efficiency of the construction team, but also find and solve potential schedule delays in time, so as to ensure the timely delivery of the whole project. BIM Technology also plays an important role in quality management. By combining with the Internet of things and equipment, the BIM platform can monitor various data of the construction site in real time, such as temperature, humidity, material quality, etc. Once any abnormal condition is found, the system will immediately send out an alarm to remind the management personnel to take corresponding measures. Reducing unnecessary loss and waste of materials has played a great help in reducing the project cost. In the construction of a building project, the quality of prefabricated components is

monitored in real time through the BIM platform, and quality problems are found and handled in time to ensure the quality of the project[8].

BIM Technology has significantly improved the safety management level of the construction site. With the help of virtual reality and augmented reality (AR) technology, construction personnel can be familiar with the construction environment and master the safety operation procedures through immersive experience before entering the site. At the same time, the BIM platform can integrate the data of site monitoring cameras, sensors and other equipment, monitor the safety status of the construction site in real time, discover and deal with potential safety hazards in time, and ensure the life safety of construction personnel[9]. In a high-rise building construction project, BIM - VR technology was used to build a safety virtual experience room, so that construction personnel could experience safety accident scenes in the virtual environment, and their safety awareness was improved[10].

BIM Technology also optimizes resource management. Through accurate statistics and analysis of human, material and financial resources in the construction process, BIM platform can help project managers reasonably arrange resources and avoid waste and idleness. For example, BIM model can predict the quantity of materials required in different construction stages, purchase in advance, and reduce inventory backlog; The manpower allocation can also be adjusted according to the actual progress to ensure that there are enough workers at each working face to participate in the operation and improve the overall work efficiency.

The application of BIM Technology in construction process management not only improves the fine management level of the project, but also provides strong technical support for intelligent construction and promotes the transformation and upgrading of the construction industry. The application of BIM Technology has brought revolutionary changes to the construction process management. Through digital and information means, the construction efficiency, quality, safety management and construction cost have been improved.

2.3 Application in Operation and Maintenance Management Stage

In the operation and maintenance phase of intelligent construction, the BIM model can realize the visual management of facilities and equipment. The operation and maintenance personnel can intuitively view the location, specification, model and other details of various facilities and equipment in the building, which not only improves the efficiency of equipment maintenance, but also reduces the risk of misoperation caused by information asymmetry.

BIM Technology plays an important role in energy management. Through real-time monitoring and analysis of building energy consumption data, combined with environmental parameters (such as temperature, humidity, etc.), the BIM system can optimize energy use strategies and reduce energy consumption costs. For example, adjust the operation mode of the air conditioning system according to the actual use, or give priority to the use of natural lighting when the light is sufficient to reduce the demand for artificial lighting. In an office building project, BIM Technology is used to optimize energy management and reduce energy consumption costs[10].

BIM also shows its unique advantages in space management and leasing. With the help of three-dimensional model, the owner can more clearly understand the distribution of available space and make reasonable spatial planning and allocation decisions accordingly. At the same time, for commercial buildings, accurate space division helps to improve rental income and attract more high-quality tenants. In a shopping mall project, BIM Technology is used for spatial planning, which improves the rental income of the shopping mall.

3. Conclusion

3.1 Conclusion Affiliations are Centered, Italicized, not Bold. Include E-Mail Addresses if Possible

Through the research on the application of BIM Technology in intelligent construction management, this paper systematically discusses the application effect and advantages of BIM Technology in project planning, design, construction, operation and maintenance and other stages. The research shows that BIM

Technology can not only improve the collaborative efficiency of the project and reduce the information island, but also realize more accurate design and construction management through three-dimensional visualization model, so as to significantly improve the quality and safety of the project and reduce the project cost.

BIM Technology can show its unique characteristics in the project planning and design stage, construction stage and operation and maintenance stage. It not only records all the data in the whole life cycle of the building, but also can be connected with intelligent devices through the Internet of things technology to realize the intelligent management and maintenance of building facilities. This not only extends the service life of the building, but also improves the user's living experience.

3.2 Outlook Strengthen the Research on the Integration of BIM Technology and Other Emerging Technologies

With the rapid development of Internet of things, big data, artificial intelligence (AI) and other technologies, the application scenarios of BIM Technology will be more extensive. At present, BIM Technology is mainly used in the design and construction stage, but its application in the operation and maintenance stage is not mature. Future research should focus on how to apply BIM model throughout the whole life cycle of buildings, including planning, design, construction, operation and demolition. Through the establishment of a unified data platform, ensure the seamless connection of information at all stages, realize the refined management of the whole life cycle of the building, improve resource utilization, reduce energy consumption and reduce environmental pollution.

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