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The Application of Bim Technology in Tendering and Bidding Stage of Construction Projects

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Abstract: BIM is an emerging building information technology that has become a hot topic in current construction project research as it is applied to the full lifecycle management of construction projects. In the bidding stage of construction projects, applying it to the bidding stage of construction projects can significantly improve the bidding efficiency of construction projects, make the bidding work more standardized and refined, and better solve the conflicts of interest between the bidding parties. Given the important role of BIM technology in engineering bidding, this article analyzes the functional characteristics of BIM technology and focuses on the specific application of BIM technology in engineering bidding. Taking the Anhui Urban and Rural Planning Exhibition Project as an example, a detailed discussion is conducted on the application of BIM technology in engineering bidding, in order to provide better guidance for engineering bidding work.

1. Introduction

The Ministry of Housing and Urban Rural Development issued a notice in 2015 on the issuance of guidance on promoting the application of building information models, proposing the application of BIM technology in the bidding process of construction projects to achieve accurate engineering quantity and cost accounting[1]. The application of BIM technology in China's construction industry is an important aspect of its development, as well as an important aspect of its development[2-3]. Bidding is a key link in the execution and management of engineering projects, directly related to the construction and operation of the later stage of the project[4]. The application of BIM technology in engineering project bidding management can reduce errors, save time, improve efficiency, achieve dynamic supervision, and achieve ideal application results[5-6].

2. Functional Characteristics of Bim Technology

2.1 Visualization Function

The focus of the visualization function is on building 3D models and converting 2D drawings into 3D models. This system breaks through the functions of traditional drawing, such as plane, vertical, and section, and achieves three-dimensional display[7]. The 3D display also supports specific construction dimension information, which is intuitive and vivid. In other words, the

project information can visually see the entire process from investment to operation completion.

2.2 Coordination Function

The integration of BIM technology has two key points. On the one hand, it is based on the information sharing platform of BIM technology, coordinating various stages of the project, collecting digital information from investment, decision-making, design, bidding, construction, completion and operation stages of the construction project, and effectively adjusting each stage and content. At the same time, by coordinating the design of space between components, it can effectively reduce the unreasonable arrangement between components, especially the collision between components and pipelines. On this basis, based on the 3D model of BIM, all problems are presented intuitively for construction personnel to solve in advance.

2.3 Simulation Function

Simulation technology based on BIM can effectively simulate various stages of the engineering project lifecycle. As an example, it can help us to comprehensively coordinate and analyze the influencing factors of the building, simulate the building scheme in the bid evaluation stage, simulate the daily progress of the project, and make rational use of supporting resources and funds. During the operation and maintenance phase, it is possible to simulate the daily maintenance of equipment and personnel evacuation, with a high level of simulation, providing important reference for subsequent decision-making.

2.4 Optimization Function

BIM technology provides information support for construction projects in terms of geometric, physical, and regular shapes. However, many information cannot be grasped solely by one person. By analyzing this information, the project can be optimized and adjusted, and unreasonable and non-standard aspects can be identified in a timely manner, reducing the probability of rework and improving the construction efficiency of the project.

3. Application Value of Bim Technology in the Tendering and Bidding Stage of Construction Projects

3.1 Software Calculation Can Reduce Errors

During the bidding process, due to strict time control, the tenderer must calculate the quantity of work and the bidding control price in a relatively short period of time, while the tenderer needs to calculate the bidding quotation. So, when formulating bidding documents, the calculation of engineering quantities is very important. At the same time, the increase in the total amount of engineering also provides a strong guarantee for reducing difficulties such as claims and over budget settlement in the later stages of the project. With the advancement of technology, the design of modern architectural forms is becoming increasingly complex, and the difficulty of calculation is increasing. By utilizing BIM technology and modeling according to drawings, automatic calculation of engineering quantities can be achieved, and there are also some special processing methods for irregular or complex structures. At the same time, improvements have been made to relevant software, such as specialized decoration quantity calculation software and precision decoration quantity calculation software. The research results of this project will provide a new approach for engineering cost calculation, provide new technical means for rapid and accurate evaluation of

engineering costs, and also provide new ideas for engineering cost personnel. Compared with manual calculation, this method has higher accuracy and can effectively reduce errors caused by human factors, making the measurement data more accurate and the measurement results more objective.

3.1.1 D Presentation Can Save Time

In the traditional bidding process, textual descriptions account for a large proportion, and many aspects are communicated through text. However, textual expressions are too abstract and prone to ambiguity, making it difficult to vividly express the comprehensive information of the project. Due to the short bidding time, bidders find it difficult to identify the shortcomings and shortcomings of the project from the text. After the introduction of BIM technology, the model can be assisted in design drawings and bidding requirements, presenting the project in a more vivid and specific 3D model, thereby helping bidders make more accurate judgments on the project and fully consider the feasibility of bidding, thereby saving time and reducing unnecessary friction between both parties. The tenderer applies BIM technology to the preparation of bidding documents, which not only enables timely display and scheme simulation, but also effectively applies BIM technology to engineering construction and improves the quality of engineering construction. When evaluating, it is generally done by experts based on their rich experience. With the help of BIM technology, experts can clearly see every part of the building structure, analyze and compare it based on simulation data, and intuitively observe the construction simulation to compare and select schemes. This is greatly helpful for the fairness and efficiency of bid evaluation work.

3.2 Multipurpose One Model Can Improve Efficiency

Architectural model is an important development direction of building information model, but the traditional plan model is difficult to establish, and consumes a lot of time. To meet different requirements, repeated modeling of the model at different stages will generate more workload. Currently, BIM technology is relatively mature and can achieve models for multiple purposes. On this basis, Revit is used to model the planar CAD drawing, and the GFC insertion method is used to combine the BIM calculation method with the BIM reinforcement calculation method. Apply the list and quota to the engineering model, input them into GBQ for pricing, and obtain the required reports. At the same time, the model established by Revit can also be introduced into Naviswork for conflict detection and roaming production. When formulating technical specifications, the preliminary steel reinforcement model, civil engineering model, and valuation, as well as the network plan prepared by the project and the site model constructed by 3D site distribution software, can be input into BIM5D to analyze funding and progress, and simulate construction progress.

3.3 Information Sharing Can Achieve Dynamic Supervision

On the basis of BIM technology, utilizing network platforms can save commuting time between enterprises, enable bidding processes to be conducted online, and enable sharing and interoperability based on BIM models. In the network environment, bidders and bidders can break through traditional geographical limitations and achieve online bidding. Bidders can use the BIM model provided by the tenderer to prepare bidding quotations, construction plans, and construction organization designs in a relatively short period of time, thereby reducing communication barriers between bidders and reducing the difficulty and cost of manual operations. At the same time, through the deep integration of network platforms and BIM technology, the entire process of electronic management and real-time approval have been achieved, breaking the limitations of

manual supervision. The implementation of fully traceable monitoring and fully traceable monitoring information greatly improves the efficiency of monitoring work.

4. Real Application of Bim Technology in the Tendering and Bidding Stage of Construction Project

4.1 Basic Information of Anhui Urban-Rural Planning Exhibition Hall

The Anhui Urban Planning Exhibition Hall and Hefei Urban Planning Exhibition Hall are located to the northwest of Yungu Road and Huanhu North Road in Binhu New Area, with Chaohu Lake to the south and the Cross River Campaign Memorial Hall to the west. The project covers an area of 82000 square meters and has a total height of 21 meters. There are a total of "Anhui Urban Rural Planning Exhibition Hall", "15 prefecture level cities", "Hefei Urban Planning Exhibition Hall", and "Urban Planning Exhibition Hall". The total land area of the headquarters in Hefei is 32000 square meters, including 52000 square meters of ground land and 30000 square meters of underground land. The 3D model established using BIM technology is shown in Figure 1.

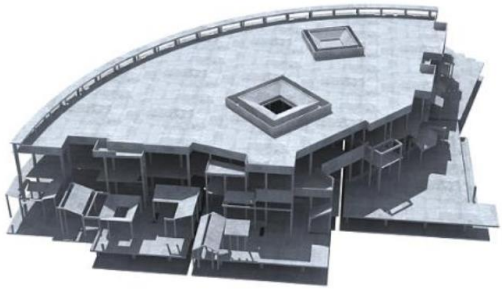

Figure 1: 3d Model Formed under Bim Technology

4.2 Specific Application of Bim Technology in the Tendering and Bidding of Construction Projects

4.2.1 The Establishment of Building Structural Models

The attributes of building specific models should comprehensively reflect the graphic information in engineering design, including geometric information, target names, material information, system information, model information, etc. a. Different levels of walls; b. Outdoor floor, ground floor, each floor, mezzanine, platform, ceiling, ceiling Truss, and ceiling shall include different structural levels; c. The location and size of elevators, escalators, and walkways, which include attributes such as function, quantity, tonnage, and speed; d. A strengthening section of a secondary partition; e. Fire doors and rolling shutters: Update the information of fire doors and rolling shutters based on the construction drawings and enlarged drawings of each stage of the project. In a building specific model, it is necessary to reflect the graphical information of the building specific model, including geometric information, object names, material information, system information, model information, etc. a. Correctly setting BIM modeling for construction engineering majors; b. Modeling components such as irregular sections, reinforced concrete, and steel tube concrete; c. Determine the location, size, and practice of deformation joints; d. When the finished floor elevation of the building is the same, but there are differences in the construction floor elevation, the template should be clearly expressed; e. The difference between a cement wall and a filler wall; f. Construct steel structures, different steel structure components, steel grades,

cross-sectional dimensions, connection nodes of steel structures, and gaps in steel structure components.

4.2.2 Design and Examination

Utilizing BIM5D technology to conduct professional collision detection on building structures, making the overall construction process of the building more intuitive and accurate.

4.2.3 Construction Drawing Inspection

During the model establishment period, each BIM engineer should annotate the drawing problems encountered and report the drawing problems to the BIM project leader. The record of the issue will be saved in the form of a Word file for submission. The BIM project leader is responsible for summarizing the drawings and providing feedback to the technical chief engineer. The chief engineer verifies the drawings and sends them back to the design department. The parts that can be changed can be optimized and corrected in the model first, and the change locations that need to be contacted with the design unit will be temporarily retained. For example, the foundation of the foundation pile was wrongly detected and partially corrected, as shown in Figure 2.

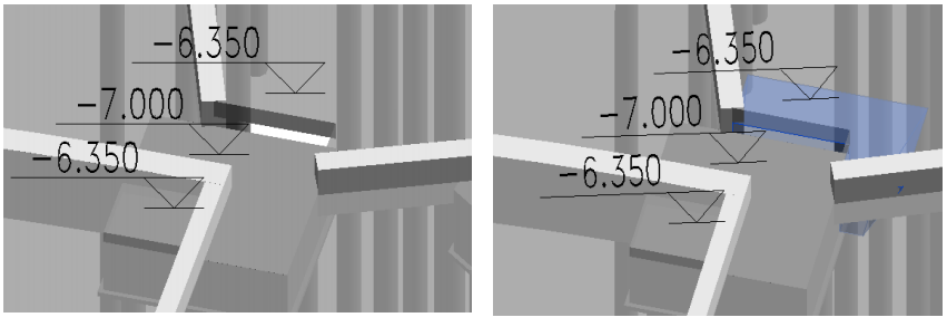

Figure 2: Error Checking Diagram in Deepening Design

4.2.4 Multi-Professional Pipeline Collision Inspection and Optimization

Multiple-professional collision accidents include: HVAC, drainage, electrical equipment, pipelines, structures, buildings, etc. To achieve accurate and rapid detection, two aspects must be emphasized. Firstly, in this exhibition hall, the number of pipes is very large and complex, and their arrangement is also very complex. If done only once, it will make the computer's calculation speed very slow and cannot display conflicting results well. In the process of image processing, in order to ensure the speed and clarity of the image, this paper proposes a layered conflict detection algorithm.

Secondly, it should be noted in advance that the drawing habits of each profession are different to ensure that there is no leakage of water and heating facilities between adjacent floors. For example, HVAC generally refers to the air conditioning system on this floor, while water supply and drainage refer to many drainage pipes on this floor, with their actual locations located on the next floor. The collision detection technology studied in this project includes two types: one is a single tube collision detection technology based on Revit, and the other is a multi-disciplinary cross detection technology based on Naviswork. The report generated by Navisworoks contains both text and images, while Revit only contains text and uses element IDs to locate the base column, as shown in Figure 3. The workers identified the location, identified the conflict points, and made revisions to the construction drawings through the identification of the beams.

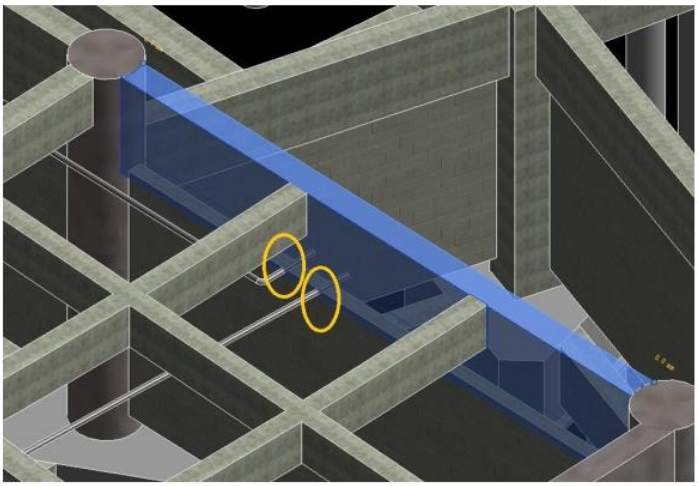

Figure 3: Revit Detection of Collision Points

The introduction of BIM technology enables bidders to use BIM models for rapid calculation of engineering quantities. During the bidding stage of the project, BIM technology was used to prepare bidding documents. In the process of calculating the cost of the commercial bid, bidders first use plugins to import 2D drawings into Revit software, generating building structures and electromechanical BIM models. Afterwards, the bidder will import the unified IFC format into Glodon software for engineering quantity calculation, which not only saves time but also achieves good processing results.

5. Summary and Conclusions

BIM technology is a kind of building information management model technology. It takes the relevant information in the construction project as the basis for operation. Through collecting information, it builds a three-dimensional architectural model, so that people can better obtain the information presented by the building in a three-dimensional intuitive way. The integration of engineering information data provides new ideas for optimizing project management, improving construction and management efficiency, and reducing construction risks. In the future bidding process of construction projects, it is necessary to flexibly apply BIM technology and fully leverage its role.

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