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The Practical Application of BIM in Intelligent Building Design

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Abstract

With the continuous development of science and technology, the former engineering architecture model has been unable to meet the needs of building structure design. How to connect intelligent mode with architectural design, BIM technology came into being. BIM technology mainly refers to building information model, which plays an important role in intelligent building design. At the present stage, BIM technology has been widely used in intelligent building design. BIM technology can not only improve the building design level in our country, but also promote the development of intelligent building design and solve many difficult problems in building design. In this paper, the practical application of BIM technology in intelligent building design is studied and analyzed.

Keywords

BIM Technology; Structure Design; Intelligent Building.

1. Introduction

1.1 Overview

BIM is an information model, it is the basis of building information model, building information model is an innovative application of BIM technology. It plays an important role in the design and construction process of the building structure. The effective application of BIM technology to construction projects can comprehensively improve the quality and safety of construction projects. Compared with traditional construction, BIM construction can better meet the modern standards of intelligent building design. In traditional construction, it is impossible to effectively obtain comprehensive construction engineering related data and engineering information is blocked, and it is impossible to realize efficient communication and exchange of construction engineering data. BIM technology can effectively solve this problem, the so-called BIM technology is a comprehensive collection and processing of building information, which is conducive to relevant technicians and construction personnel to make reasonable decisions. In short, it can build a scientific and reliable three-dimensional model after collecting building information, and this model not only provides a macroscopic visual image for designers, but also contains a large amount of engineering information. After it is fully designed and summarized, the settlement data required for the next stage can be obtained. At the same time, it can also convert the model into three-dimensional spatial information and rationalize it, so as to achieve the consistency of structural design quality control objectives and building functional requirements. Because the BIM construction model can connect the buildings, floors and floors reasonably. In addition, the workload of rendering three-dimensional drawings with complicated functions is relatively large. Therefore, in the design process, appropriate modeling methods and structural model sizes should be selected according to the actual situation, and applied in engineering projects to solve the problems existing in building structures [1]. Ensure the safety and stability of the construction process, and ensure the overall quality and construction safety of the construction project to the greatest extent.

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1.2 Features

The most prominent feature of BIM technology is visualization, followed by strong coordination and simulation. Therefore, in the process of prefabricated building construction, the three-dimensional model of the building can be intuitively presented, which is conducive to the design and construction personnel to put forward the corresponding design and construction plans. The traditional construction project management is based on two-dimensional plane drawings, and the three-dimensional control of construction is not in place, so that the problems in management can not be solved in time, it is difficult to provide security for the orderly construction of the project, and it will seriously affect the overall construction quality of the construction project. However, the 3D model presented by BIM technology is not an independent empty shell, but a building information model that integrates pricing calculation rules, design drawings, engineering profiles and engineering material properties. Once the model is perfect, the relevant personnel can clearly check the flaws in the construction project, and can further view the properties of the various details of the structure. After finding the problem, we can also make improvement plans in time. At the same time, the coordination of BIM technology is manifested in that it can not only realize the three-dimensional management of prefabricated building construction, but also integrate and analyze information data resources, and build a construction engineering simulation model. For example, the rationality check can reflect the uncoordinated parts in the building model, such as the arrangement of columns and beams, and the elevation can be easily found, and then modify and improve the corresponding positions of the components according to the prompts, so as to obtain a reasonable structure and an overall coordinated appearance of the building information model. BIM technology also has the characteristics of simulation. In terms of building models, we can import engineering information into the system to obtain relevant model data. Under various calculation rules before establishing the model, the system will automatically prompt whether certain components are reasonable, which not only simulates the properties of the physical building but also improves the coordination of the building structure. In addition, in addition to the common engineering data entry, in the process of prefabricated building construction, the construction site can also be simulated layout, such as zebra field layout software can not only simulate the reasonable placement of construction tools on the construction site, to avoid the risk caused by inaccurate human experience in the actual construction process. Moreover, the use of BIM technology can also simulate the normal flow of people in the building, making the safety and rationality of the physical buildings built by BIM technology greatly improved. In addition, BIM technology can also make a scientific and reasonable prediction of the service life of the building, so as to ensure that the construction of the construction project can be carried out efficiently.

2. The Function of BIM in the Design of Intelligent Building Structure

2.1 3D Visualization Function

Traditional design is mainly presented in two-dimensional drawings, but with the improvement of science and technology, old-fashioned buildings can no longer meet the full living needs of people, which also makes the diversity and complexity of building structures, and its internal details are more difficult to grasp, and it is difficult to break through the upper limit of building structural design with two-dimensional drawings and spatial imagination. The three-dimensional model obtained through BIM technology can not only intuitively understand the detailed structure of the building, but also further stimulate the design inspiration to create a more comfortable living environment for people. At the same time, designers can also reflect their own design ideas more comprehensively, which provides a strong guarantee for the transmission of information, feasibility study and project schedule. In addition, the use of BIM technology to intuitively control the construction process of engineering flow can effectively solve the conflict of different professions and teams, and maximize the saving of time and resources.

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2.2 Collision Check Function

Collision inspection is an important symbol of the two-dimensional era to the three-dimensional era, collision is divided into hard collision, soft collision and gap collision three kinds, these are the design stage of the professionals did not do a good job of communication caused by. The traditional construction method uses two-dimensional drawings to build a building, and its pipelines may have spatial contradictions, resulting in rework by construction personnel, which greatly increases the construction period and cost. However, using Revit, ArchiCAD and other software to establish BIM models, The collision check system runs the operation and automatically finds the collision point in the model after the model check cleans the link. After finding out the collision point, the corresponding pipeline is adjusted and optimized, which not only improves the rationality of the project, but also provides convenience for structures, HVAC, fire fighting, water supply and drainage, electrical bridge and other majors, and is conducive to the diversified development of architectural design methods [2].

2.3 Construction Simulation Function

BIM construction simulation is a highly dynamic process. As the building structure becomes more and more complex, the building scale continues to expand, the construction difficulty continues to increase, and the construction management becomes more and more difficult. In order to achieve a better track to follow before construction and reduce the uncertainty factor in the construction process, BIM construction simulation dynamically displays the entire construction process based on the model. For example, the actual size information of components is imported into the BIM model, and then the difference between theoretical construction and actual construction is obtained by using the construction simulation function. Timely adjustment of construction problems to avoid later rework. In the traditional construction method, many problems can only be found after the completion of one stage, resulting in a large amount of construction time and resource waste, while the use of BIM construction simulation can dynamically present the entire construction process, once found problems can be solved in time, improve the rationality and feasibility of construction, and greatly reduce the time for rework and rectification. In the past, the construction animation production focused on the effect display and lacked the simulation of the real situation. BIM construction simulation will bring intuitive construction experience and let people feel the various scenarios they will encounter in the construction process, reducing the occurrence of accidents. In addition, in a complete project, the construction party, the supervisor and the owner can also communicate more clearly and deeply through construction simulation to reduce unnecessary disputes [3].

2.4 Cost Management Function

First of all, after the BIM building information model is summarized and calculated, detailed cost estimation reports can be obtained. These reports can provide information such as material cost, labor cost and equipment cost to help the project team carry out cost control and decision-making. BIM software helps the project team to make reasonable cost planning through visual analysis and evaluation of the building model. Through the analysis of the building model, the potential cost risks can be found and solved, and the budget and resource allocation can be made in advance. BIM software can track and monitor the cost of construction projects in real time. By comparing the project schedule and actual costs, cost overruns or savings can be identified and resolved in a timely manner to ensure that the project is on budget. BIM software can record and manage information about cost changes. When the project changes, BIM software can help the project team track the cost changes and their causes, formulate corresponding adjustment measures, and avoid unnecessary cost waste. BIM software can provide a comprehensive analysis of the cost of a construction project. Through the integration of building models and cost data, cost-benefit analysis and cost-risk analysis can be carried out to help project teams make reasonable cost decisions.

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3. Application of BIM in Intelligent Building Structure Design

3.1 Building Structure Performance Analysis

The structural properties of a building include safety, durability and suitability. Firstly, by using BIM technology to input engineering information, the system can automatically detect whether the building structure meets the requirements of safety performance. For example, whether the height of a project matches the seismic grade, and whether the engineering materials used and the main frame are reasonable. It also uses ETABS, STAAD.PRO, SCIA and other software to provide analysis of the seismic performance and structural elasticity of building structures, as well as the response ability of designing building structures under earthquake action. In addition, they offer comprehensive finite element analysis and design solutions for structures subject to dynamic loads such as earthquakes. In addition, BIM technology can be used to simulate the lighting, earthquake resistance and other performance of buildings, and improve the effect of natural lighting by adjusting the building orientation, spatial layout and window size ratio, so as to comprehensively improve the overall performance of building structures [4].

3.2 Building Site Analysis

The application of BIM technology can reasonably calculate the construction operation area and site material transportation space, simulate the location of temporary buildings, refine the placement of traffic lines and pipelines, improve the utilization rate of construction sites, and avoid unreasonable factors while ensuring the safety of on-site manual work, reducing the negative impact of on-site cross-operation. In addition, BIM technology, the method of constructing virtual construction scenes, the use of three-dimensional simulation to demonstrate possible situations in the construction process, the analysis and optimization of construction schemes, and the reasonable allocation of construction resources can not only greatly reduce the rework rate of on-site construction, but also ensure constructability while saving project costs, and strengthen the control of construction quality. Improve engineering construction efficiency. In addition, the three-dimensional model constructed by BIM technology can form an information database of different aspects of the project, which can more intuitively reflect the actual information of the project. The information presented by different components such as steel bars, formwork and concrete is coordinated with the project construction plan through the computer, which provides data support for the actual construction machinery material entry and material procurement, thereby reducing the secondary handling and reducing the cost consumption caused by materials. In addition, with the help of BIM technology, technical disclosure can be visualized. Before the construction, gather all the personnel involved in the construction, and use three-dimensional panorama and on-site simulation operation to make the exposed person more clear about the environment of the site construction area, deepen the impression of the construction personnel, so as to improve the construction quality and efficiency, and achieve the effect of technical disclosure.

3.3 Space Design

When building the BIM model, the new construction work is carried out first, and the next step is to establish the axis network by drawing the axis of the axis network, and arrange the columns, walls, doors and Windows, and floors. Finally, the information of reinforcing bars and other dimensions of each spatial layout is improved. After the successful construction of BIM model, the final effect can be seen more vividly through 3D dynamic observation, and the design of the spatial layout of each building can be mastered at a deep level [5].

3.4 Pipeline Paving

In civil construction, BIM technology can convert two-dimensional drawings into building information models. In addition, related water supply and drainage, HVAC and other projects can also realize three-dimensional space, among which pipeline paving is an important part of hydropower in construction projects, and also an important link to improve a building project.

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Therefore, the whole system of water supply and drainage is displayed in a three-dimensional form, which is not only beneficial to the later rationality inspection, but also can provide an intuitive perspective for the designer. Therefore, strengthening the application of BIM in the design of water supply and drainage system is an inevitable demand for architectural engineering design. Similar to the construction of civil construction model, drawing personnel can use two-dimensional pipeline drawing information to build the pipeline system with the corresponding drawing method, and input pipeline materials, pipe length, pipe diameter and other parameters into the system, so that the three-dimensional model built can get the corresponding summary report. It provides the corresponding decision scheme for the designer and the construction personnel in the pipeline line laying. In addition, using the collision check function to correct some parts that have conflicts in space can not only effectively improve the rationality of pipeline paving, but also avoid the waste of pipeline materials to a certain extent.

4. Suggestions on the Application of BIM in Intelligent Building Structure Design

4.1 BIM software Application Selection

It is important to choose the right BIM software first. The cost of current BIM software is high, ranging from tens of thousands to hundreds of thousands, so you must be careful when choosing software. Be sure to make decisions based on the actual needs of the business or industry. Secondly, we should pay attention to training the 3D drawing ability of architectural engineers, inject relevant materials and component properties on the basis of building information model, so that engineering designers can design more comprehensively, understand the future development trend and experience the design process in place at once, avoid unnecessary trouble between too many disconnected software, so that the software can maximize the benefits. For example, moving from the building information model of Glodon to the REVIT model requires the corresponding intermediate software to connect.

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5. Conclusion

In summary, BIM technology is a comprehensive and highly intelligent application. With the continuous improvement of scientific and technological innovation, BIM has gradually been widely used. BIM technology plays a huge role in intelligent building design, improves the rationality and accuracy of building structures, and provides an important guarantee for the structural design of the construction industry. Designers can also improve their structural design ability through the use of BIM, so they should pay enough attention to BIM technology, constantly open up its future development prospects in the process of use, and promote the intelligent development of building structural design.

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