

Advanced Application and Research Practice of Building Construction Process based on BIM+VR Technology

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Abstract. BIM+VR technology is a very key technology in the construction of fabricated building projects. The effective application of BIM+VR technology in fabricated building projects is conducive to the construction enterprises of fabricated building projects to better analyze the information resources held by the enterprises. Therefore, it is time to vigorously develop prefabricated buildings. However, due to the complexity of prefabricated engineering buildings and the comprehensiveness among multiple specialties, a large number of problems often occur in the construction process, resulting in waste of resources, slow progress of the project and low working efficiency. BIM+VR technology can significantly improve the overall quality of construction. Relevant construction units should flexibly use BIM+VR technology to build high-quality construction projects. The comprehensive application of BIM+VR technology has strengthened the ability of project risk identification and enhanced the safety awareness of operators, which is of great significance to the risk management research in the construction process.

Keywords: BIM+VR technology, Assembled building construction, Application.

1. Introduction

Virtual Reality (VR) takes computer technology as the core and combines with related science and technology to generate a digital environment that is highly similar to a certain range of real environments in terms of vision, hearing, touch, etc. There are many large-scale complex buildings and group buildings, with unique shapes, complicated construction, many construction units, high cost, tight construction period and other factors, which make quality management face more and more challenges. BIM+VR technology has the characteristics of informatization. BIM+VR technology can organically integrate three-dimensional information technology into the structural construction of prefabricated buildings and construct a relatively perfect construction model of the building structure, thus creating favorable conditions for the construction of the building engineering to develop towards integration and comprehensively improve the construction effect of the whole building [2]. BIM+VR can be used for three-dimensional collision inspection, engineering calculation, simulation construction, etc. The development of BIM+VR technology has also brought a breakthrough for the risk management of subway construction projects [3]. Architectural design and VR technology have been pushed to a hot topic again. The use of real-time visualization and VR as communication tools in digital tools has slowly opened up new possibilities for overall architectural design, and one cannot help but wonder whether it will become the third revolution in architectural design [1]. Therefore, the risk management research of VR technology based on BIM+VR in subway installation and construction is of great significance to the risk management of subway installation and construction.

2. Summary of Assembled Architecture

Prefabricated building is mainly to select prefabricated structural components and to complete the assembly construction of the whole building according to the assembly requirements of the design process. It is an important construction method for the construction efficiency, cost reduction and time limit for a project. Prefabricated building construction is simply to choose a way to prefabricate work pieces first, design the structural components of the building according to the actual needs of the building construction, and then hand the designed components to the construction site, which assembles the components according to the specific design scheme [4]. The

actual situation of the construction site and the site facilities are added to the building model in the form of data by BIM+VR technology, and a three-dimensional site layout is established to realize the combination of site layout. Through the VR technology of BIM+VR to carry out integrated management of engineering information and project scheme simulation, the key nodes of project risk management can be captured, the process of project quality and safety analysis can be simplified, and the project risk prediction and control can become more accurate and operable [5]. This kind of building form has obvious characteristics, which can effectively reduce the working intensity of staff, shorten the construction period, improve the construction efficiency, and reduce the overall cost of the construction project. It is a kind of building design and construction type that is very consistent with modern building design and construction, so it has a very broad prospect in the construction industry.

3. Technical Advantages of BIM+VR Technology

3.1 Visualization

BIM+VR technology can present the traditional linear components into three-dimensional physical graphics to users, which can effectively reflect the interaction between various components, thus improving the feasibility and scientific of engineering design. The building information model is divided into geometric information and parameter information by VR-based digital-analog separation technology. Then the geometric model is imported into the virtual reality engine, and the material, environment and light are processed by physical dynamic rendering technology. With the help of VR technology of BIM+VR, the post-stage process simulation of each scheme can be carried out, and each participant can timely feed back the opinions to the decision-makers so as to analyze and demonstrate all aspects of each scheme [6]. BIM+VR technology is conducive to straightening out construction strategies, improving the trust of owners to construction enterprises, and demonstrating the professional skills and comprehensive business capabilities of construction units. BIM+VR technology is based on a 4D construction model, i.e. a space-time model, which effectively simulates and compares the construction progress and actual progress dynamically. It can dynamically display the layout of the site and greatly promote the progress control of the project.

3.2 Harmony

There are a large number of coordination and cooperation relationships in the process of project construction. Only through efficient coordination among various construction related subjects can the overall quality of project construction be effectively improved. In the background of the virtual reality engine Unity, data is called to realize the VR display of building information based on BIM+VR. According to the actual situation, it is required to carry out rapid estimation for different stages of prefabrication and preliminary preparation, and for different stages of rapid estimation, so as to prevent excessive feeding and secondary treatment problems, so as to better store and control other materials. BIM+VR technology can identify the contradictions and conflicts in the construction design in advance, and meet the needs of users for detailed understanding of building information as much as possible. The VR technology of BIM+VR simulates the construction process dynamically, so that operators can intuitively feel the risks existing in the construction process, thus improving the risk awareness of operators [7]. By loading the model of materials into VR equipment and converting the display effect of VR equipment into a refined decoration scheme, multiple materials can be imported and the decoration style can be replaced in VR equipment to achieve the satisfactory effect of the householder.

3.3 Simulation

Simulation refers to that BIM+VR technology can simulate various building models and various things that cannot be operated in practice. BIM+VR models can be used for rendering by exporting, optimizing, merging, mapping and other steps. Do a good job in the selection and design of

pipelines before the construction of the project, and use the visualization function of BIM+VR technology to clearly show the relationship between the system and the individual. Complete the 3-D collision detection for pipeline design. The innovation and perfection of BIM+VR technology; The combination of BIM+VR and VR makes contact with the public, makes abstract concrete, realizes the ideological exchange between users and creative developers, and stimulates developers' imagination and development of BIM+VR in the future [8]. The most common ways to improve the safety awareness of building users are emergency evacuation simulation and heat conduction simulation. The construction of BIM+VR construction model maps the process of the whole construction case into a virtual environment. Through the operation of the virtual environment, the observation, tracking, control and guidance of the whole construction process are realized, and the purpose of verifying, optimizing, adjusting and optimizing the construction scheme is finally achieved.

4. Application of BIM+VR Technology in Construction of Assembled Building Engineering

4.1 Application in Data Acquisition of Building Construction

Making full use of database technology to store data, platform layer can be established by means of maps and on-the-spot investigation, etc. to complete the functions of data reading, storage, verification and integration, etc. Three-dimensional virtual construction and collision inspection are also required in the whole building construction process. Key technologies that enable users to obtain the same or similar sensory cognition as the real environment, such as hearing, feeling, touch and force perception, from the virtual environment. If the construction sequence of the fabricated building project is wrong during the construction of the fabricated building project, the previously designed and manufactured building components in the factory will mean that they cannot be used. Applying BIM+VR technology to actual project construction is beneficial to the development of Chinese construction industry. Analysis and comparison are made and a dynamic system is established. Dynamic management of system resources can automatically calculate nodes and quantities and make statistics on information. Can grasp the running situation of all equipment in the building in real time and find and deal with damaged or unqualified equipment in time. The most effective way to ensure engineering quality and realize standardized construction is to use professional steel bar making equipment, adopt uniform steel bar making molds and steel bar installation auxiliary tools.

4.2 Application in Construction Organization

The construction organization consists of drawing design and preparation work. The drawing design should be specific and accurate because it is the reference basis for the whole project. Construction personnel have a clear grasp on the basis of the existing materials and material inventory, which can make the assembly preparation work orderly and avoid the orders issued after the occurrence, because the production cannot be completed smoothly due to insufficient material preparation. The steps of mold closing and demoulding are completely programmed. When steel bars are manufactured, the types and quantities of steel bars needed are set on professional steel bar manufacturing equipment, and the operating procedures are controlled by operators to complete the manufacture of various types of steel bars; In the process of grasping the overall pattern, it is easy to find problems that are not in place or not thorough. Because in the assembly building construction, the quality of the assembly building construction cannot be guaranteed if the design concept of the designer cannot adapt to the actual situation of the project. It also makes VR technology in BIM model more energetic and more practical, and makes users more aware of the difference from pure BIM technology and VR technology. The placement of materials and equipment shall be strictly in accordance with regulations. When materials enter the site in accordance with the construction sequence, the usage of materials shall be marked to avoid confusion. This sequence is determined

by the sequence of materials. The number of scheme discussions has been greatly reduced, thus avoiding extensive design rectification of the construction model house and improving the overall project progress.

4.3 Application in Safety Management of Building Construction

The construction unit shall do everything possible to improve the safety and stability of the construction personnel and the overall project in the process of building construction, and reduce the probability of all kinds of safety accidents to the minimum. While ensuring 3D effects and highly realistic images similar to VR, the display mode similar to 3D movies ensures that users can clearly understand the focus of the current discussion. At the same time, BIM+VR technology can also be used in the construction of prefabricated building projects to carry out dynamic simulation of the project. The dynamic simulation method can be used to identify the risk factors in the actual construction and reflect the influence range of the risk into the model [9].

Using BIM+VR technology to build a sharing platform (Figure 1) and using VR technology of BIM to directly feedback information to all participants will promote information exchange among all participants, achieve real-time information sharing and reduce project construction risks.

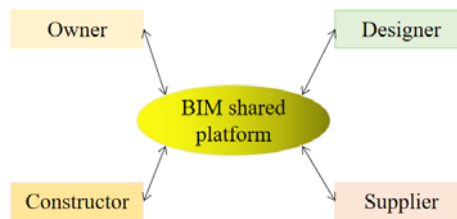


Figure 1. BIM+VR sharing platform

BIM+VR technology can deeply analyze the causes and consequences of safety risks and summarize a set of effective preventive measures, thus significantly reducing the potential safety hazards in construction. Before construction of each process, BIM+VR technology is used to virtually display each construction process, especially for detailed display of complex nodes, so as to reduce misunderstanding caused by subjective factors and make communication between departments more coordinated and efficient.

4.4 Application of BIM+VR Technology in Collision Detection

The construction unit uses technical software to carry out three-dimensional construction data modeling for the construction process of the construction project, effectively reducing the possible conflict between structural drawings and construction drawings. Its risk management is also multi-stage. Managers make analysis and decision on the risks that may occur in each stage, resulting in ignoring the feedback and communication of risks, and the participants lack communication with each other. According to this requirement, a complete site model is established through BIM+VR technology, construction plan and analysis information of actual construction, so that prefabricated components transported to the construction site can be directly stacked on the construction space within the effective range of tower crane together with the transport frame, and a reasonable layout is determined in the model to ensure the smooth implementation of all materials.

Collision simulation can be carried out in the construction and installation model, which saves the collision problems that can not be solved by the traditional two-dimensional drawings. According to the simulation results, the designer can adjust the pipeline in time to reduce the risk of rework in the later stage. The collision simulation process is shown in Figure 2.

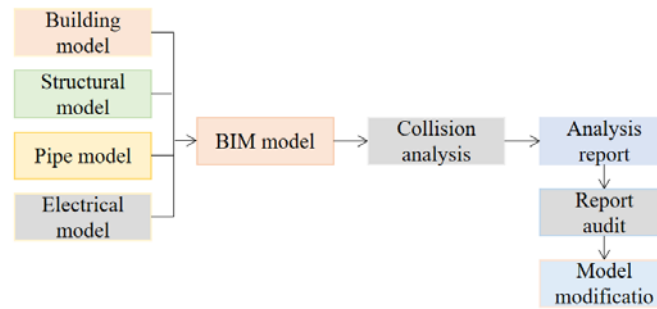


Figure 2. Collision simulation process

To this end, BIM+VR technology can not only optimize the traditional design concept and design drawings, but also continuously construct different steel bars and different pipelines to make each link of the prefabricated building construction clearer and more accurate through multi-party cooperation. This technology not only saves time and labor, reduces repeated calculation of various data variables by construction personnel, greatly improves work efficiency and saves manpower and material resources.

5. Summary

To sum up, BIM+VR technology plays a vital role in improving the construction efficiency of prefabricated building projects, controlling project construction cost and ensuring the construction period. BIM+VR technology plays an irreplaceable role in improving production efficiency, saving cost and shortening construction period. The effective application of BIM+VR technology in the construction of construction projects, especially under the premise of tight time limit for a project, high requirements for project quality and complex engineering foundation structure, fully demonstrates the very important practical significance of BIM+VR technology in the construction of fabricated construction projects. BIM+VR technology and VR technology are a development trend in the construction information industry. I believe great progress will be made in the near future. The two types of products, whether software or hardware, will become more and more compatible, bringing the construction industry into a new era.

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