Application of 3D scanning measurement and BIM technology in the construction of large special-shaped buildings

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Abstract: 3D scanning measurement is one of the most mainstream measurement methods at present, and has been widely used in the field of construction engineering due to its characteristics of high efficiency, high accuracy and complete non-contact measurement. Combining it with BIM technology can deal with some difficult problems in the field of construction engineering, improve the design efficiency, and ensure the efficient and quality of construction engineering. By introducing the 3d scanning measurement with BIM technology principle, combined with the data contrast and reverse modeling application mode, analyzes the installation and quality monitoring in the building, ancient buildings and cultural relics protection and reconstruction engineering applications, and points out the problems existing in the application process. The BIM technology and 3D laser scanning technology are combined to measure the main structure by using laser scanning to generate the correlation model in reverse, and then cooperate with the structural model and the sub-structure model to solve the problem of cooperation between professionals, and successfully achieve the goal of deepening the design and construction. This paper introduces the application principle, operation process and operation key points of 3D laser scanning and BIM technology, and summarizes its advantages and application value in the construction of large special-shaped building projects.

1. Introduction

3D scanning measurement can be described as a major technological innovation after GPS, RS and other technologies in the field of construction engineering at the present stage, with self-measurement, data collection and processing, real-time generation and transmission of point cloud, 3D images, digital basic data sharing and other functions [1]. BIM technology promotes China's construction industry to accelerate into the information age. BIM information model-based construction project management information can effectively improve project production efficiency, shorten the construction period, improve the quality of construction engineering, and reduce the project cost. The consistency between the parameters of BIM information model and the parameters during the design, construction and completion of the actual construction project has become the key to project information management [2]. There is no need for direct contact in the process of measurement work, so it has been widely used in construction engineering [3].

Through the combination of 3D scanning technology and BIM technology, it can effectively deal with the shortcomings in construction engineering, improve the design efficiency, and the most important thing is to better guarantee the construction quality of construction engineering. At present, there are few cases that combine 3D laser scanning and BIM technology in large special-shaped building projects [4]. In this paper, from the construction control point of GRC peripheral protection panel of a large conical building, in order to realize the coordinated construction of main structure and panel structure, and ensure the rationality and applicability of GRG panel processing size, with the help of 3D laser scanning technology and BIM technology, through professional collaboration and interaction design, Explore its application value in large special-shaped building construction [5].

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2. Overview of 3D scanning measurement and BIM technology

2.1. Application of 3D scanning measurement and BIM technology in construction engineering

On-site data implementation and archiving. 3D scanning measurement technology is the best method for collecting actual measurement data of construction engineering, which not only has high accuracy, but also can collect engineering data and convert the collected data into electronic data for archiving [6]. Through the joint operation of 3D scanning measurement and BIM technology, it can provide relatively reliable guarantee for the development of engineering construction. Reasonable technical measures should be selected when using BIM model. Among them, 3D scanning measurement technology can fully record the actual situation of engineering construction site and compare with BIM model. It provides reference for the detection and acceptance of construction engineering quality [7].

A large-scale special-shaped building project is designed as a conical curved surface. GRC is a kind of fiber-cement composite material, which is made of cement mortar as the matrix and alkali-resistant glass fiber as the reinforcing material. It has good tensile strength, flexural strength and toughness. In engineering applications, GRC materials can be spliced to generate arbitrary curved surfaces or curved surfaces, which can fully satisfy the imagination of designers and realize the design of complex shapes. GRC materials are a new type of decorative materials favored in the market at present. This technology can be described as a new technology in the whole 3D data acquisition and reconstruction technology system. It is also called "real-scene replication technology" and "high-definition measurement", and has been widely used in industrial manufacturing, medicine, military and other fields. Especially in the background of informatization and industrialization of construction industry, this technology is applied more and more frequently in the field of construction engineering. The data application process is shown in Figure 1.

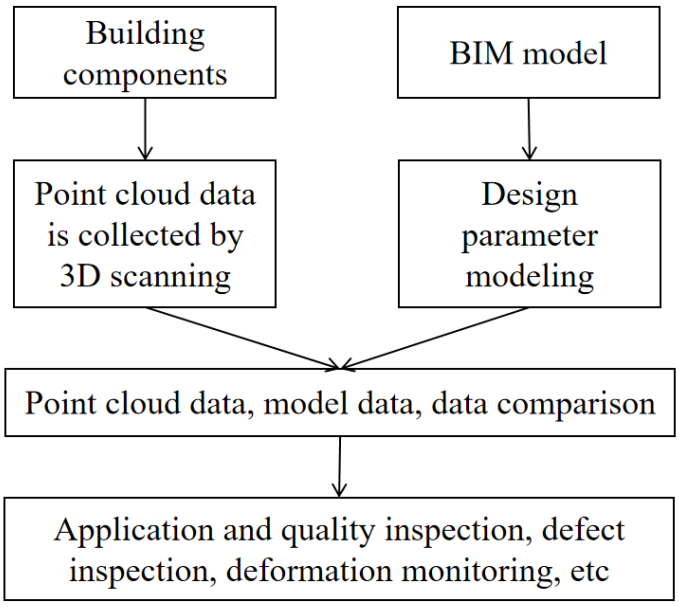

Figure 1 Data comparison application process

2.2. Typical Application Cases

The integration of 3D laser scanning and BIM technology can be comprehensively applied to engineering quality detection and installation of prefabricated components in prefabricated buildings. By comparing the application process with data, the displacement difference between the construction components on site and those in the design drawings can be checked, so as to guide the installation of structures, check components and ensure assembly quality. Ancient Architecture and Cultural protection [8]. Using 3 d scanning measurement technology, able to scan the comparative history of ancient buildings and cultural relics, get accurate parameters, at the same time more

quickly and accurately an electronic record, at the same time the implementation of digital archive, then using BIM technology reverse modeling to permanent design drawings, this can bring convenience to the back of the repair transformation [9].

For example, places such as the Palace Museum in Beijing have started to use 3D scanning to measure cultural relics in the museum, and at the same time implement the operation of documentation, and establish digital museums. At present, the integration of 3D scanning measurement and BIM technology is applied in construction engineering management, including engineering quality inspection, building transformation, deformation monitoring, etc. Today, with the booming development of 3D scanning measurement and BIM technology, the application of both in the field of construction engineering is bound to deepen, providing power for the development of construction engineering. The application flow of reverse modeling is shown in Figure 2.

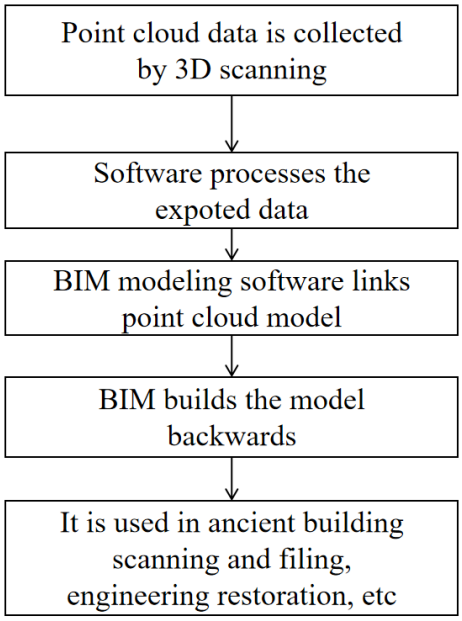

Figure 2 Reverse modeling application flow

3. Application of 3D scanning measurement and BIM technology in the construction of large special-shaped buildings

3.1. Key points of operation and implementation benefit

Relying on the construction case of a large-scale special-shaped building project, aiming at the difficult problem of coordinated design and construction between processing and manufacturing of tapered structural panels and internal steel main structure, BIM technology and 3D laser scanning technology were combined, and the main structure was measured by laser scanning, and then the related model was generated in reverse, which was matched with the structural model and the secondary structure model, which solved the difficult problem of cooperation among specialties and successfully achieved the goal of deepening design and construction. The application principle, operation process and key points of 3D laser scanning and BIM technology were introduced, and their application in large-scale special-shaped building projects were summarized. The development and progress of engineering projects can be promoted, and the quality management will become more accurate. At present, the construction, bridge, highway reconstruction and expansion projects are increasing, creating BIM model for the original design scheme is conducive to design scheme comparison and selection. During the reconstruction of Disney China Laboratory Building, tianbao TX53D laser scanning technology was used to obtain the original building parameters, and BIM model was reverse-built and sent to the foreign design team for scheme design. Real-time guidance was provided during the construction process through monitoring. However, in practical operation,

due to the interference of cost management, market operation and other factors, its application is usually divided into stages. When the application needs are met in a certain stage, without the support of previous BIM work, 3D scanning measurement technology should be used to scan the building entity and implement reverse modeling.

3.2. Comparison of construction quality

BIM technology can support the decision-making of the whole life cycle of engineering projects. However, due to the complexity of project construction, design changes and construction problems, the actual construction and BIM model are different, and it is difficult to effectively reflect the construction effect. Through the use of 3D scanning measurement, point cloud data can be acquired and converted into BIM model data after software processing, which has strong practical significance and guiding function. The accuracy of scanning data is related to operating instruments, weather, surrounding environment, target distance and other factors, and the instrument performance of each manufacturer plays a decisive role. In the actual engineering scanning process, it is necessary to comprehensively select and determine the corresponding scanning instruments according to the engineering site environment and scanning targets, so as to improve the accuracy of data.The traditional measurement mode is to collect the coordinates of the key points with the help of total station, and then compare the coordinates of the design points, so as to control the installation quality. In fact, such keypoint control method can not accurately control the installed surface, when the machining error of the hyperbolic plate, the control of the shape will be difficult to grasp. At the present stage, the rapid increase of domestic construction engineering reconstruction and expansion projects, the construction of BIM model based on the original design scheme can help the comparison and rational selection of design scheme. For example, in the reconstruction of Shanghai Disneyland, the previous building parameters were acquired through 3D scanning measurement, and the BIM model was reversely constructed and transmitted to foreign designers to discuss the implementation plan design. The construction process was supervised and guided in real time by video surveillance.

4. Conclusions

In a word, the application of 3D scanning measurement and BIM technology is very critical to construction engineering, which to a large extent promotes the information construction of construction engineering through the use of 3D scanning measurement and BIM technology. The high integration of science and technology in today's society has greatly promoted the rapid development of measurement technology. It has become a normal situation that different measuring instruments and different measuring methods are widely used in the same project. It is worth exploring and researching in the future to make use of various measurement data for joint adjustment and reasonable weight determination method. In this paper, 3D scanning measurement and BIM technology is first described, and then the application and typical application cases of 3D scanning measurement and BIM technology in construction engineering are analyzed, hoping to provide reference for the better development of domestic construction engineering.

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