Research on Deformation Analysis and Forecast Technology of Civil Engineering Buildings Based on BIM Standard

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Abstract: With the rapid development of information technology, BIM (Building Information Modeling) technology has gradually been widely concerned and studied by the construction industry. China has become the country with the largest number of new buildings and the largest output and consumption of building materials in the world. When the differential deformation of a building exceeds its allowable value, it will cause damage to the structure of the building and even endanger safety. BIM technology carries out rigorous and systematic evaluation planning for construction land. Combined with some natural factors such as the specific ecological environment, the practical application of the land is determined from a comprehensive perspective. With the deepening of BIM application and the continuous improvement of analysis tools, it can provide some reference for the practice of building rational performance analysis. Because of the uncertainty and complexity of deformation, new ways of thinking and methods will be gradually involved. Based on the brief introduction of deformation monitoring technology for civil engineering buildings, this paper focuses on the in-depth study of deformation analysis and prediction technology for civil engineering buildings.

1. Introduction

With the rapid development of current information technology, BIM technology has gradually been widely concerned and studied by the construction industry. The process of construction of various kinds of projects has been greatly accelerated, thus bringing about endless levels of various types of buildings [1]. Such as large bridges, various hydraulic structures and high-rise buildings, etc., with the increasing number of these buildings [2]. With the rapid growth of economy and urbanization, China has become the country with the largest number of new buildings and the largest output and consumption of building materials in the world. The progress of science and technology and the development of social economy have accelerated the process of Engineering construction. Deformation monitoring is an extremely important means for checking the stability of various engineering buildings and their geological structures [3]. Because deformation monitoring can accurately obtain the deformation data related to the deformation body. With the improvement of people's living standards, the requirements for the comfort of living environment are getting higher and higher [4]. Architectural design is the most important part of the energy and comfort of the entire building. How to complete the efficient analysis of the physical properties of the building in the design stage has become a direction that needs attention.

The traditional management of building facilities is based on property management. This management mechanism has low information preservation. It is prone to “information islands“ and “information interruptions“ [5]. The consumption of energy and resources and the disposal of solid waste in the construction, use and dismantling of buildings have and will continue to bring huge greenhouse gas emissions. When the differential deformation of a building exceeds its allowable value, it will cause damage to the structure of the building and even endanger safety. In the deformation monitoring of buildings, we should pay attention to the differential deformation index of the building foundation, and timely process and accurately predict the differential deformation monitoring data [6]. BIM technology carries out rigorous and systematic evaluation and planning of

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construction land. Combining with the specific ecological environment and some other natural factors, the practical application of the land is determined from a comprehensive point of view [7]. This paper discusses the necessity of deformation monitoring of civil engineering buildings, and introduces the deformation monitoring technology of civil engineering buildings and the methods of deformation analysis and prediction. The development trend of deformation analysis technology for civil engineering buildings is prospected.

2. Deformation Monitoring Technology of Civil Engineering Buildings

Different stakeholders can support and feedback their respective collaborative work by importing and exporting updated and modified information at different stages of the project. The information model based on BIM, as an information platform, is the foundation of successful application of BIM. With the development of modern science and technology and the improvement of computer application, $various theories and methods provide a wide range of research approaches for deformation analysis and prediction. The key work of deformation monitoring is to design the technical scheme of deformation monitoring of civil engineering buildings reasonably. Building rational performance analysis refers to the analysis of building ventilation, lighting and energy consumption, so as to meet the requirements of building energy saving, green and comfort [8]. The traditional concept equates building management with the management of the state of the building equipment, focusing only on the state of use of the equipment, maintenance, etc., and fails to distinguish between facility management and equipment management. Processing and analyzing deformation data, and physical interpretation and prediction of all aspects of deformation, this is the main research content involved in deformation analysis.

During the deformation monitoring process, a series of observations from a certain measuring point will normally form a random BIM model with discrete characteristics. The built environment is determined by outdoor climatic conditions, the heat conditions of various indoor heat sources, and indoor and outdoor ventilation conditions. Some sample buildings began to apply the civil engineering building energy consumption monitoring platform. Figure 1 shows the benefit-cost curve for BIM.

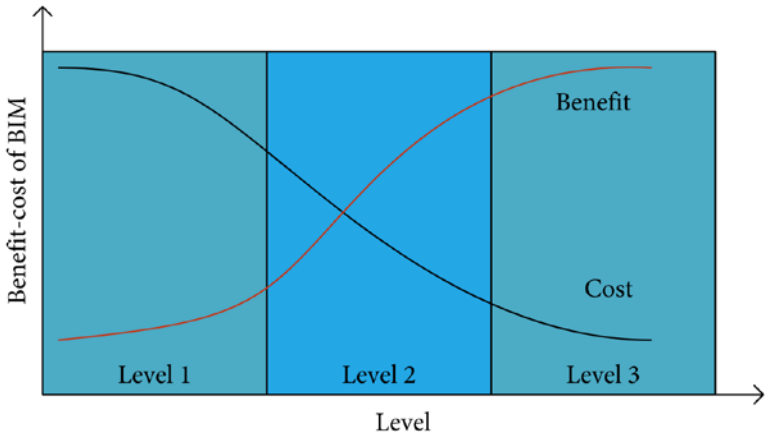

Fig.1. Benefit-cost curve of BIM

Building energy-saving design based on BIM technology can obtain building orientation, component geometry, building materials, functional zoning and other building information through architect's building information model. In recent years, the requirement of urban construction is not much improved, and the design of civil engineering architecture pays more attention to the facade design. On the basis of information model, information is extracted and quantified when needed to meet the needs of specific function. It is one of the aims of information standardization of ancient constructions. Due to the complexity and diversity of the deformation mechanism of the deformed body, an effective model must be used to approximate, simulate and reveal the deformation law and dynamic characteristics of the deformed body [9]. If the impact of the gross error is taken into account, the robust BIM model analysis method can be introduced and the model construction

completed. BIM technology has the characteristics of information integration, so the BIM model can be regarded as a database, including 3D entity information and non-geometric attribute information.

3. Deformation Analysis and Prediction Technology of Civil Engineering

The carbon emission measurement range of public buildings should include the whole process of the construction life cycle, and the boundary and preparation list should be clearly defined according to the life cycle. The back analysis method can also be applied in the application of the hybrid model for building deformation analysis and forecasting. This kind of back analysis is based on the system identification theory, and the positive analysis results are the evidence [10]. If the deformed body is regarded as a dynamic system, the state of the system can be described by the Kalman filter model, ie, the state equation and the observation equation. Building facilities and equipment are two different concepts. Equipment management is the foundation of building facilities management, and facility management is the system upgrade and integration of equipment management. With the development of science and technology, the level of monitoring technology, data communication technology and computer application has been improved. Deformation analysis has developed from single-point analysis to multi-point analysis. The thicker the insulation layer is, the lower the building energy consumption is not necessarily. Therefore, the determination of the thickness of the insulation layer of the external wall should be based on the concrete simulation results, and the experience can not be copied.

Building information database based on computer is the core content of BIM technology. Architectural information model includes various geometric information, such as the spatial relationship of building structure, the size of some components and so on. With the support of BIM technology, problems can be found as early as possible, thus avoiding the occurrence of quality problems. Analytic Hierarchy Process (AHP) is used to judge the impact of each sub-project on the cost importance of the two-storey underground project. As shown in Table 1, the budgetary amount of materials for the project is presented.

Table 1 Project material budget

Entry name	Budget (10,000 yuan)
Civil Engineering	908.1
Plumbing	128.3
Decoration Engineering	96.5
Electrical Installation Engineering	115.2

The use of different building materials, determined by the structural form of the civil engineering building, can also lead to differences in the deformation of the building and the building. The urban civil construction model created by the information-based design task can be used to advance the design problems and quality problems that may occur in the project through collision detection and other forms. The topology reliability optimization simulation comparison is shown in Figure 2.

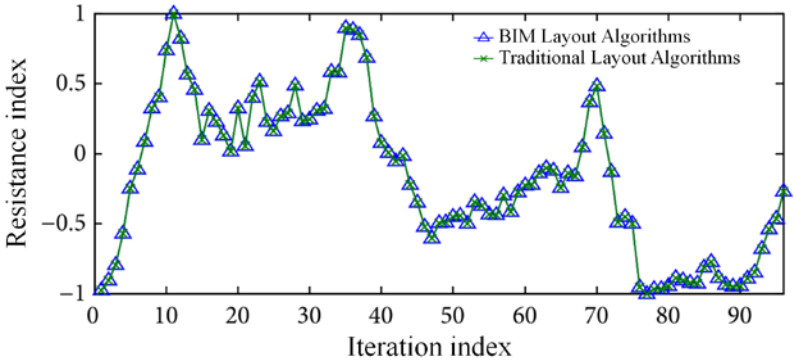

Fig.2. Comparison of civil construction layout optimization simulation

From linear analysis to nonlinear analysis, from static analysis to more and more sophisticated

dynamic analysis, the model of deformation analysis has gradually diversified. The success of BIM applications requires a suiTable standard, a mature information platform, and a complete family library. The difference between a facility and a device is that a system differs from a specific component, and the device emphasizes the specific production component itself. The information platform established under the appropriate standards is easy to manage and easy to call to view information and facilitate application. Using BIM information and system data, combined with building rational performance analysis software, various physical properties of the building can be analyzed, and the analysis results are finally fed back to the original BIM model. Because of the uncertainty and complexity of deformation, new ways of thinking and methods will be gradually involved. The development of deformation monitoring system software will not be limited to a fixed mode. With the development of deformation monitoring technology, the research of new deformation methods will continue to emerge.

4. Conclusion

It is a rather complex system engineering to analyze and forecast the deformation of civil engineering buildings. Based on information reuse technology of BIM, the key information in information model is extracted, and the method of building component information platform is established and perfected through related function. The implementation of BIM cloud-based building facilities management model can not only effectively promote the overall promotion of BIM technology, but also greatly realize the transformation of facility management model. With the deepening of BIM application and the continuous improvement of analytical tools, it can provide some reference for the practice of building physical performance analysis. The comprehensive research on geometric deformation analysis and physical interpretation will be further developed. The establishment of a security monitoring expert system with knowledge base, method library, database and multimedia library as the main body is the future development direction. Further research and summary of the civil engineering building deformation analysis and forecasting technology will play an extremely important role in ensuring the safety of various civil buildings in China and promoting the sustainable and sTable development of China's construction industry.

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