Application Research of Campus Operation and Maintenance Management Based on BIM

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Abstract. Firstly, the article expounds the basic concepts of BIM (Building Information Model) technology, and then analyses the current status and outstanding problems of campus operation and maintenance management. This paper puts forward the concept of applying BIM technology to the campus operation and maintenance management stage from the aspects of security management, energy management and asset management, and analyses the practical application value of BIM in campus operation and maintenance management.

1. Introduction

The entire life cycle of a building is usually divided into four phases, the planning and design phase, the construction phase, the operation and maintenance phase, and the abolition phase. During the entire life cycle of the building, the operation and maintenance phase accounts for the vast majority of the entire life cycle of the building. It takes 3-5 years from the planning and design to the construction phase to the completion of the project. The operation and maintenance management phase of the project when it put into use usually lasts for several decades, and the cost of the operation and maintenance phase accounts for 82.5% of the total phase costs [1]. It can be seen that the management of the operation and maintenance phase is an important stage in controlling the construction cost. However, the management mode of China's construction industry is extensive management. In the whole life cycle of the building, the information asymmetry in the design and construction to operation and maintenance stage leads to the increase of management risk. Therefore, the integration and linkage of information is the key to improve the operation and maintenance management.

In recent years, under the guidance and support of national policies for BIM, BIM has been widely used in the planning and construction of China's architecture [2]. However, the value of BIM is not only reflected in the design and construction stage, but its information collection and 3D visualization advantages can fully integrate the information contained in the whole life cycle of the building, which makes the construction project communicate with the management organization in decision-making and management. At the same time, it can reduce management costs and increase project value.

2. Existing Problems in Campus Operation and Maintenance Management in China

2.1. Existing problems in campus security management
First of all, the school's technical defense awareness is weak, and the security system is not perfect. Throughout the current state of school security, most schools have relatively weak technical defense awareness. The enhancement of security capabilities is mainly concentrated on the control of civil air defense and physical defense forces, and the construction of technical defense is basically in its infancy. Secondly, the school's security systems are relatively independent, and emergency command is difficult [3]. As the security construction of the school is constantly improving, in this process, the replacement of new and old security monitoring equipment has increased the difficulty of the integration of security systems. The expansion of the campus has caused the unified management of the monitoring system of the old and new campuses to encounter bottlenecks. Then, at present, most campus security systems are still based on real-time monitoring and post-mortem access, and the processing capacity in advance is insufficient. Finally, due to the expansion of the school scale and the relatively openness of the university, the management of outsiders and vehicles is more difficult. Although the vehicle speed warning is limited in the school district, the management of its speeding is still based on personnel management, which is difficult to control in time. It has greatly threatened the safety of the lives of school personnel.

2.2. Existing problems in campus energy management

With the rapid development of the school discipline and the continuous improvement of school conditions, the demand for water, electricity, gas and other resources and energy is increasing. Under the impetus of building a sustainable and sustainable campus policy, energy conservation and consumption reduction will be an important task in achieving sustainable development of schools.

As for the existing problems in campus energy management, first of all, the school currently lacks energy-saving management departments. The energy conservation management department under the leadership of the management has not been formally established, and the deployment, coordination, implementation, and supervision of energy work have not yet been planned; technical positions such as energy measurement, energy supervision, and energy analysis have not yet been established, so the school's energy audit has no basic operational procedures. The goal of energy saving and consumption reduction cannot be effectively realized [4].

Secondly, there are many work links involved in school energy management, covering school infrastructure construction, scientific research teaching experiment, administrative office, logistics operation, industrial energy consumption, etc., which increases the difficulty of defining specific energy consumption collection and allocation standards. This brings new challenges to energy management [5].

Then, due to the imperfect update of the energy metering equipment, such as the incomplete configuration of the energy meter below the second level, the basic energy data is missing or distorted, and the energy flow and loss are not clear. Therefore, the decomposition of energy-saving targets is not supported by an effective and complete energy audit report, and cannot contribute to the goal of energy conservation and consumption reduction.

Finally, at present, the energy conservation and consumption reduction of the campus mainly focuses on the cultivation of energy-saving awareness of the school's personnel. The financial resources injected on the technical level of energy saving and consumption reduction are not sufficient. Although the energy-conscious and energy-using habits of the energy users are the decisive factors in the energy level, those who have good conservation awareness and habits will not only actively reduce waste, improve energy efficiency, but also actively seek opportunities for further savings. However, cultivating good conservation awareness and habits requires education and restraint on the energy users. The implementation of education and restraint is based on long-term observation and analysis of the energy use behaviour of energy users, and it requires a large amount of energy for a long time. The accumulation of information is difficult to achieve only by manpower, and it is also inseparable from the management means of informationization.
2.3. Existing problems in campus asset management

Campus asset management is primarily to manage and maintain all equipment and office facilities on the campus. As the standards of building construction continue to increase, it brings new challenges to the operation and management of campus buildings. Most school departments pay more attention to the purchase of instruments, and the daily management and maintenance of the equipment after purchase is not put on the agenda. The equipment management account, the use of the ledger and the maintenance ledger of the equipment use department are almost no or not perfect. In addition, due to the isolated state of each system, the entire life cycle of fixed assets from purchase, use, maintenance to scrapping is separated from energy management, financial systems, and logistics OA systems. Therefore, school administrators cannot consider the work efficiency and management level of equipment assets from all aspects, and data sharing and exchange cannot be realized between departments.

3. BIM-based campus operation and maintenance management

Based on BIM technology, it can collect all relevant information during the whole life cycle of the integrated building, and build a more complete building information database to provide powerful data support for the management of the later operation and maintenance phases of the building. Therefore, the advantage of BIM is not only from the establishment of 3D visualization model, but its integration of data is an important support for the development of operation and maintenance management system. Therefore, the application of BIM technology in campus operation and maintenance management system is mainly embodied in the construction of smart campus. This paper mainly reflects BIM intelligent operation and maintenance from three aspects of security management, energy management and asset management.

3.1. Application of BIM in campus security management

This paper introduces the application value of BIM in campus security management in three aspects: pre-security deployment, security control when the incident happens and post-case analysis.

First, security deployment before the incident. The BIM model can use its 3D visualization advantages to visually display the spatial information inside and outside the campus building. The administrator can learn more about the internal functional area of the campus building and the inside and outside of the classroom through the free combination, cutting, measurement and roaming of the BIM building information model. These can accurately restore the actual space situation on the scene. Schools can do security deployment and control during campus activities or important leadership receptions. At the same time, the BIM model can be used to plan the movement of personnel in advance, effectively improve the efficiency of traffic and work, and avoid the use of channels when there are many people, thus effectively ensuring normal traffic. The BIM model can also simulate different perspectives to view the inside and outside of the campus building, to achieve the orientation of the human eye and the conventional perspective, and to achieve 360-degree full coverage and seamless connection [6].

Second, security control when the incident happens. The BIM model can take advantage of its information integration and dynamically respond to the internal use of campus buildings through the connection with monitoring and communication facilities. Once there are too many people in the space causing congestion or excessive space use, and sudden disaster evacuation, alarms can be dispatched at the first time, personnel can be dispersed. Decision-making commanders, actors, and senior management can reach consensus based on a common model perspective to avoid language description and understanding of the asymmetry of the problem.

Finally, case analysis after the incident. Through the BIM model, it is possible to record, simulate, and re-execute the evacuation action plan. We can also establish an emergency evacuation database, summarize the experience, make a summary report, and continuously improve the emergency evacuation plan to ensure the safety of the school personnel.
3.2. Application of BIM in campus energy management
To reduce energy waste, it is first necessary to clarify when, where, who, and what equipment is wasted. Under the existing conditions, this information is scattered in different departments of the whole school. The visualization of energy management and the informationization of operation and maintenance work are the fundamental ways to solve this problem.

Building a BIM-based energy management platform is an important tool for building energy management. Through the BIM-based energy management platform, it is possible to integrate the building's spatial information, personnel information, equipment information and energy consumption information, and analyse the building energy consumption operation status from different dimensions. Managers can set assessment targets for building sub-item energy consumption data, and view building operating conditions and energy efficiency levels in real time. Through the three-dimensional visualization method, scientific analysis, diagnosis and evaluation of the consumption of classified energy are carried out, and the analysis results are visually expressed. Through the 3D visualization advantages of BIM, operation and maintenance managers can discover problems in the building and waste energy. At the same time, the operation and maintenance management personnel can find the construction operation problems and deal with them in the first time, which can ensure the safety of building operation and reduce energy consumption.

3.3. Application of BIM in Campus Asset Management
With BIM technology, you can create a device information database. Through the BIM 3D visualization model, managers can view basic information such as the number, name, type, acquisition cost, and acquisition time of the device in real time. By integrating the asset management system with other systems such as the energy system and the OA system, the administrator can view the operating status of the equipment in real time, understand the operating status of the equipment, and control the cost of the whole life cycle of the equipment. Based on this, it is proposed to improve the repairing plan, improve the operating efficiency of the equipment, and ensure the efficient operation of the building.

4. Conclusion
In recent years, under the guidance and support of national policies for BIM, BIM technology has been widely used in the planning, design and construction of China's buildings. However, its value has not been fully reflected in the management of building operation and maintenance. Its three-dimensional visualization advantages and information integration advantages will make it play its value in the operation and maintenance management of buildings. It will also reduce construction operation cost and achieve the purpose of efficient operation and maintenance. This paper makes a detailed analysis of the application value of BIM in campus operation and maintenance management, including security management, energy management and asset management, which can guarantee the safety of school personnel and efficiency of building operation to a certain extent. Generally speaking, the application of BIM technology in the operation and maintenance of buildings is still in the exploration stage, and its application value will be realized with the deep application of BIM in the construction industry and the large-scale application of similar systems.

References
[1] Sina blog .(2012)Understanding of the importance of facility equipment management in property management. http:///blog. sina. com. cn/s/blog_63a7b7c1010160np. html.
[2] Chen, P.H. (2016) The applied research of BIM technology in the architectural design. Master Degree. pp.1–3.
[3] Liu, H.L. (2015) Talking about the Status Quo and Trend of Campus Security Prevention in the Internet + Times. Telecom World. pp41–42.
[4] Zhou, H. (2014) Energy Management in Colleges and Universities: Current Situations and Strategies. China Population, Resources and Environment. 24:95-98.

[5] Zhang, J.M. (2017) Application Prospect of BIM Technology in Public Security Security and Anti-terrorism Work. Science & Technology Industry Parks. pp.3-5.