Research on BIM Technology in Smart City

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Abstract. With the vigorous development of green and intelligent concepts and technologies in China's urban construction, BIM can no longer meet the tasks of data processing and management of a large number of information flows in green ecological urban areas. CIM (Urban Information Model), as an information means, has gradually become the engine power of future urban construction. Through the application of information technology and communication technology, smart cities can collect, analyze and integrate the key information of the core system of urban operation, and then make intelligent response to the needs of people's livelihood, environmental protection, public safety and urban services, create a better life and promote the harmonious and sustainable development of cities. CIM refines the granularity of data to an electromechanical accessory and a door inside a single building in a city, and upgrades the traditional static digital city into a digital twin city with perceptibility, dynamic online and virtual-real interaction, providing a data foundation for agile management and fine governance of the city.

1. Introduction

With the continuous advancement of China's reform and opening-up process, China's socialist economy has developed at a high speed, and driven by the rapid growth of China's social economy, various products and industries in society, especially the construction industry, have made great progress. As China is gradually in the stage of rapid growth, the market demand of various types of building infrastructure is increasing day by day, and accordingly the construction task will become more arduous, which is not only a new opportunity but also a new challenge for the whole building construction product industry. At present, the enterprises in the field of construction in our country should fully grasp some important opportunities for their development, and constantly improve and improve the technology they have mastered in design and construction and other construction project management.

2. BIM and smart city status

With the continuous improvement of modern science and technology in China, BIM technology has become more and more valuable, and it has been effectively applied in the field of building construction, which has greatly improved the level and quality of building construction and promoted the improvement of building construction level, and has great practical value. In the constant changes of construction fields and industries in China, this paper focuses on the value and utility of new construction technology, which can improve the level and quality of construction management to a certain extent, and has great impetus and guiding significance for the scientific and technological progress and development of the whole construction fields and industries in China. However, the application of BIM technology in current construction engineering management is not mature enough, and there are still many problems in concrete practice.
In 2013, the National Bureau of Surveying, Mapping and Geographic Information jointly organized experts to implement and plan the pilot project construction and application of the national spatio-temporal geographic information sharing cloud data service platform, which is called building a smart large city. Every year, about 10 smart city projects were selected to jointly carry out the pilot construction. The essential significance of building a smart large city is a large data sharing city. Based on the full opening and integration of urban data and information resources in various fields of smart cities and rational utilization of urban conditions, the higher the degree of open urban data, the higher the "intelligence" of cities, and the easier it is to realize. Without open urban big data, there may be no city with great intelligence. Premier Li Keqiang pointed out that "the government's data is drilling ore". The government can play a basic and supporting role in the construction of smart cities, promote the comprehensive utilization and reuse of big data, realize the value-added development and innovative application of big data, and fully release the functions of big data sets. Finally, the problems existing in urban development will be solved, and the goals of improving the efficiency of urban operation, improving the quality of urban development and building a livable environment will be achieved, so that the vision of a smart city will become a reality.

3. Application of 3.BIM technology in smart cities

3.1. Combination of BIM and Smart City

3.1.1. Comprehensive perception. To build a smart city information system, we also need to make full use of intelligent information processing technology and data sensing processing technology for real-time intelligent information identification and comprehensive information perception of the urban environment, master the important information such as the geographical location and state of the city, master the urban development trend comprehensively, dynamically and in real time, integrate, analyze and reasonably comprehensively utilize and process a large amount of urban data, and realize the efficient, safe, stable and reliable normal operation of all important core information systems of the city by using intelligence. BIM is an optimal integrated infrastructure big data analysis platform which is widely suitable for various basic applications in the construction of smart home cities in China.

3.1.2. Information Sharing. Building a smart city requires Internet connectivity, information integration and sharing. Its main purpose is to establish a system of complete intercommunication, succession and interconnection among things, people, machines and nature. BIM can provide powerful data support for intelligent services all the time.

3.1.3. Intelligent Convergence
BIM integrates, calculates and analyzes a large amount of urban data, which constitute the core brain of smart city system, and BIM is also an important basis for people to make correct decisions. BIM can ensure the necessary data decision and application whenever and wherever the data is wanted.

3.1.4. Sustainable Development
The construction of smart city highlights people-oriented, and pays attention to the independent development and creation of the space for economic, social and technological innovation activities and the maximization of urban value resources. As a carrier of urban information system, BIM technology can continuously and automatically carry out various types of multi-dimensional urban data collection, diffusion and function expansion, which can lay a solid foundation for its future expansion of the whole urban system engineering.

3.2. Application of BIM in Smart City Construction

3.2.1. Application of BIM Technology in Smart City Buildings. As one of the main core supporting
infrastructures in modern cities, the intelligentization of buildings will be the most important point in the intellectualization of modern cities in the future. In the process of design and actual construction of large-scale complex buildings, people can first capture all kinds of static information and data from buildings by applying digitalization, and then adopt visualization and simulation techniques to design the best spatial structure layout, classified evacuation roads and energy consumption analysis scheme, and improve the engineering quality of buildings to a certain extent.

Under the background that the concept of green building is recognized by more and more people, BIM has been applied to smart city buildings more and more. In the residential housing project, BIM is embodied in each stage:

- Engineering design stage. By building a three-dimensional model through BIM, Party A, Party B and the supervisor can more intuitively recognize the building structure they need, avoid the contradiction with the design, and at the same time, let us find some shortcomings and loopholes in time, so as to better rectify the design scheme.

- Engineering construction stage. Through BIM technology, architectural designers can better define the responsibilities and purposes of designers and constructors, so that they can carry out construction work more smoothly, reduce the loss of construction materials, and make them more optimized in terms of manpower, material resources and financial resources, thus better reducing housing costs.

3.2.2. Application of BIM in Smart City Planning and Management. In the process of urban planning and development, many departments are involved, and there are overlapping work among them. In traditional urban planning, if the work of urban planning management department is not in place, the development among many departments will be uncoordinated, which will have an adverse impact on urban planning. Considering the various factors in urban development, it is necessary to strengthen the application of big data technology in the planning of smart cities, and collect, analyze and process the data among different departments through big data system, so as to provide a scientific theoretical basis for the development of multi-regulation coordination system, and make the coordination among various departments more efficient. Thus, it can be seen that big data can help the coordinated development of smart cities in various aspects.

4. Application of BIM technology in construction

4.1. Schedule management of construction project

The traditional construction schedule control method is based on 2D CAD software, and the problems such as poor visual design project, abstract network plan, unreasonable construction schedule planning, and unsound communication and connection among all participants are the disadvantages of traditional 2D CAD, which will make the construction schedule differ greatly from the planned schedule in the actual management of engineering projects.

According to the construction progress budget of the project, the whole construction process is simulated by correlating the specific construction progress budget with the BIM model through BIM technical software. The network progress plan of each work should be associated with the corresponding construction component or construction section, so that the planned progress can be compared with the actual progress, showing the construction ahead or behind in the model. During the construction simulation, the construction technology can be displayed more intuitively by using the association between the model and the schedule. Through the analysis and comparison of the actual project progress and the simulated project progress data, it reflects the specific situation of the project progress, analyzes and evaluates the construction situation more timely and quickly, analyzes the impact of the progress and changes, and evaluates whether the changes will have a significant impact on the construction period, which provides a basis for the next project task adjustment, ensures the reasonable progress of the construction period and ensures the smooth completion of the project as planned.
Table 1. Deviation analysis report

| Serial number | name                | unit of measurement | Cost budget     | Actual amount     | Volume difference |
|---------------|---------------------|---------------------|-----------------|-------------------|-------------------|
| Artificial   | Integrated working day | working day           | 80908.46233703  | 56048.098128      | -14853.22         |
| material     | Concrete grade mortar | M3                  | 77.0527255665   | 30.2289525        | -40.05            |
|              | Masonry             | M3                  | 1088.53401265   | 456.53382015      | -1270.30          |
|              | Composite wood template | M2                | 9988.57857      | 74.519066         | -12.45            |
|              | Anti-slip brick     | M2                  | 272.216278      | 131.140788        | -120.17           |
|              | Water-resistant     | kg                  | 98311.1313      | 8809.9276         | -9372.03          |

1. The actual construction efficiency is improved, and the pile is shortened.
2. Due to the midway change construction plan, the organization is weak, resulting in an increase in the construction period
3. When the foundation is backflip, the labor force is increased, and the construction period is shortened.
4. Waterproof insulation materials are not in time, causing increased construction period
5. In this stage, the input computer machine is as shown below:

Construction safety monitoring is carried out based on camera equipment and unmanned aerial vehicles, and state recording and video sampling are carried out on construction conditions (generally, camera equipment or unmanned aerial vehicles are arranged at high angles). Compare the construction status of the simulated time node with the actual construction status through UAV photos or videos. Compare the construction status of the simulated time node with the actual construction status through UAV photos or videos. Through the building intelligence platform, all architectural design units, construction units, supervision units, construction engineering departments, etc. can know and control the dynamic progress of the construction site of each project in real time and anywhere through the two mobile terminals APP and PC, so as to achieve transparent monitoring and transparent construction, realize the "green, intelligent, lean and intensive" construction and engineering management of the refined building, and realize the creation of green, intelligent and livable modern intelligent residential buildings.

4.2. Cost control of construction project

Using BIM model data, reasonable allocation of management personnel, machinery, materials. According to the simulation of the construction schedule, optimize the distribution of labor personnel, ensure that under the premise of normal construction, effectively save labor costs and avoid periodic idling. Reasonably arrange the transportation and in and out time of all kinds of machinery and equipment, and manage the use, loss and damage of all kinds of machinery and equipment. Understand the mobilization and use of materials. Manage the usage, loss and damage of mechanical equipment. Understand the mobilization and use of materials.
In order to realize the pre assembly of steel structure, some changes will occur in the construction process of large-scale steel structure. Therefore, the traditional construction technology of steel structure should first carry out the pre assembly of steel structure, and then disassemble and transport it to the site. After using BIM Technology, we can compare all the steel structure materials that have been installed on the site with the model which is completely consistent with the actual situation in the computer. Through virtual pre assembly, based on the design and model of BIM, we can collect and decompose the component data. After the processing and scheduling of each component, a two-dimensional code is made for all information of each component, and a QR code label is pasted on its surface. The QR code information platform system of each component is centralized and dynamically managed with the model link system. At the same time, the two-dimensional code can be further associated with the engineering acceptance report, component properties, video and other picture data, PDF documents, CAD drawings, etc., and integrate these data into the platform.

4.3. Analysis of construction project model
BIM 3D construction design process is a continuous transformation and continuous improvement process from 2D construction drawing model to 3D construction model. It is a continuous transformation and continuous improvement process from traditional passive "encounter problems, solve problems" to active "find problems, solve problems". Therefore, the wide application of BIM model is particularly important in the construction of "smart city". BIM model is far more than a model in the early or late stage of project construction. Through the interpretation of the model, various factors of the project are analyzed, such as: the overall quantities of various raw materials in each construction flow section; through the decomposition of each detail point of the model, the construction can be directly processed one by one according to the model.

4.4. Comprehensive utilization in construction project
In the stage of construction site layout, the layout software used by buildings on the construction site is used, and the corresponding scientific and technical measures are taken. The specific situation of buildings in the construction site is fully considered as a whole. The layout of various functional areas of buildings in the construction site, the layout of site roads and the positioning of tower cranes are reasonably arranged. For example: the layout of water supply and power supply facilities and the placement of equipment, as well as the stacking of building materials and mechanical equipment to ensure the safety of the construction team; the coverage of tower crane, including anti-collision measures between tower cranes, reinforcement shed, mixing station and the engineering surface of each floor, should be selected as far as possible within the coverage required by the tower crane; The construction site has been reasonably arranged and divided into various job areas, auxiliary work areas, raw material stacking and processing areas and office and living areas.
By using the visual characteristics of BIM, the construction process is simulated by software, and audio explanation is provided to show some technical problems in the construction process more intuitively. Carry out technical disclosure and training for all operators participating in the site construction, restore the site construction situation and scene, facilitate the scientific and reasonable organization of construction, study and discuss various problems before construction, correct the conflicts in the field construction, avoid rework, avoid technical quality problems and other accidents. Thus the construction efficiency is improved and the construction risk is reduced.

The pipeline information system is constructed by using BIM Technology. Through BIM model and pipeline data, the pipeline layout is optimized, and the pipeline fight problem in the project is solved. Whether the pipeline inside the ground building or the underground hidden pipeline, the optimal layout can be obtained. Through the BIM related software for collision detection, not only can effectively eliminate the hard and soft collisions, optimize the architectural engineering design, reduce the probability of a large number of wrong material loss and rework that may occur in each period of urban construction, but also can effectively optimize the drainage clearance and optimize the drainage pipeline layout.

| Project Name: Tianjin University Ren'ai College Library | Item Number: 0004 |
|---|---|
| Conflict classification: structure vs structure | Reporting time: Sunday, October 27, 2019 |
Problem description: Wall and structural frame collision

Axis network position: II-14-II-R-2F

Figure 4. Collision detection comparison

In order to manage and monitor the progress of work more precisely, UAVs are used to take panoramic photos and videos every day in some places where the local weather and weather conditions permit. The progress data collection and data storage of various equipment such as the work progress, quality, personnel, machines and so on are routinely collected and saved. After uploading to the application platform, daily on-site progress data record can be made. The app on the mobile application terminal can also access the progress database at any time.

We use UAV low altitude flight, carpet scanning, and interior processing, we can get a nearly 100% in line with the construction site of the three-dimensional real model. By using this aerial survey technology, the management of construction progress, operation and surrounding environment of the project department is obviously enhanced. In the navigation survey model, we can input GIS data conveniently and quickly, such as distance, elevation, slope, area, volume, etc.

5. BIM construction helps smart city

One of the most important links in the planning and construction of modern smart livable cities in China is to promote the informationization of construction projects. In the process of building a modern smart city in China, the integration of construction informationization and construction industrialization in the field of construction engineering technology is one of the key points that needs to be paid attention to. BIM-related technical products can run through the whole life cycle of collaborative construction from beginning to end, support all stages of collaborative construction, and realize the whole information and intelligent engineering collaborative construction mode.

- The new professional intelligent building operation management system based on BIM technology is not only a large-scale specialized building management service system that can serve all large-scale building design, property management and government departments, but also a brand-new intelligent building service management system that can serve all large-scale building operation users. It is believed that in the near future, with the new generation mobile Internet of information technologies such as IOT, cloud computing and big data, and the technology innovation development
and application management mode in the mobile information age as the engine of urban development and innovation, the development of a new urban intelligent transformation building system based on technologies such as BIM is expected to completely break the management boundary between traditional professions, departments, products and service industries, and make common development for local governments, state-owned enterprises and asset owners. To provide a new intelligent building system operation and operation management mode which is more suitable for the rapid development of mobile Internet and mobile information age, to provide more comfortable and convenient public life and daily work rest space for the general public, and finally realize building data conversion and recovery, big data processing, new intelligent building design, intelligent transformation and urbanization construction, and provide a sustainable information node for the development, construction and application of new intelligent transformation cities in China in the future.

6. Summary
In how to realize the intelligent urban planning and construction, how to scientifically, effectively and correctly handle the close relationship between the natural ecology, resources and environment of a smart city and the development of a smart city, all of which are an important academic topic that we are facing in smart city planning and environmental management. Based on the big data analysis platform, integrating a number of relevant professional data of natural resources operation and management, a number of cross-sectoral, horizontal and cross-industry natural resources management elements are expanded and optimized, including comprehensive statistics of geographical location distribution and comprehensive analysis of ecological pattern of spatial resources development. The wide application and expansion of BIM technology will greatly improve the management efficiency of urban planning. With the continuous improvement of BIM automation integrated management, the continuous optimization of big data cloud platform and the improvement of data information model will create greater value for smart cities.

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