УДК 658.2
ББК 38.6

BIM INFORMATIZATION CONSTRUCTION ORGANIZATION MANAGEMENT-TAKING HAINAN LINGSHUI XIANGSHUIWAN APARTMENT CONSTRUCTION PROJECT AS AN EXAMPLE

Wang Xianpeng[1], Wei Mingkun[2]
[1]postgraduate of specialty 05.23.08 «Technology and organization in construction»
[2] master of specialty 1-70 80 01 «Construction building and structures»
Belarusian national technical University,
Minsk, Republic of Belarus

Abstract: This paper studies the BIM information construction organization management and BIM information management technology, and takes the Lingshui project in Hainan, China as an example to introduce how to use BIM to carry out information construction organization management, which is helpful for other construction projects under construction. Reference examples are provided.

Key words: BIM technology informatization, construction organization, construction management.

BIM-ТЕХНОЛОГИИ В УПРАВЛЕНИИ СТРОИТЕЛЬНОЙ ОРГАНИЗАЦИЕЙ НА ПРИМЕРЕ ПРОЕКТА СТРОИТЕЛЬСТВА МНОГОКВАРИТРНОГО ЖИЛОГО ДОМА

Ван Сяньпэн[1], Вэй Минкунь[2]
[1]аспирант специальности 05.23.08 «Технология и организация строительства»
[2]магистр специальности 1-70 80 01 «Строительство зданий и сооружений»
Белорусский национальный технический университет,
г. Минск, Республика Беларусь

Аннотация: В этой статье изучается информационное управление строительной организацией BIM и технология управления информацией BIM, а в качестве примера используется проект Линшуй на Хайнане, Китай, чтобы представить, как использовать BIM для информационного управления строительной организацией, что полезно для других строительных проектов. в разработке. Приведены справочные примеры.

Ключевые слова: информатизация BIM-технологий, организация строительства, управление строительством.

INTRODUCTION

Since the 21st century, with the rapid development of the construction industry and the continuous expansion of the scale of the construction industry, BIM technology can play an important role in the various stages of initial planning, drawing design, post-construction and operation and maintenance of construction projects. In order to realize the collaborative sharing among the various participants in the construction projects with complex information and many participants, as well as the informatization management of building data. BIM technology can carry out virtual construction and simulation simulation of buildings, realize the optimization of project plans and provide reference for decision-making in the construction process, improve the quality assurance of buildings, and reduce the waste of building resources in the whole life cycle of buildings. As an efficient construction mode, construction site organization management and BIM represent the future development direction of the construction industry.

On-site information management is the basis for the implementation and management of engineering projects, and is a bridge between various tasks in the process of project implementation.

However, complex engineering information cannot achieve the expected effect without the help of scientific equipment and manpower alone. The information management based on BIM can achieve this kind of management, and can achieve higher results. In 2009, a research team led by Ma Zhiliang from the Department of Civil Engineering of Tsinghua University proposed to develop a 4D dynamic management system based on BIM technology on the basis of the 4D construction resource information model based on IFC standards, and to refine the resource management in the construction stage to the WBS process node. , to achieve dynamic information query and related management in the construction process [1]; the team also analyzed the information flow of concrete parts management work and used IFC tools to build a BIM-based standard parts library management system, which improved the standardization of residential parts. Informatization development [2]. Peter Podbreznik and others proposed to use BIM technology to associate the resource planning information system (ERP) with relevant project information, so as to strengthen managers' supervision of project progress and materials [3]. By analyzing the impact of BIM technology on various elements of the project, Eastman proposes to use BIM technology to manage and control the cost, quality, materials, and personnel of the project in real time [4]. Therefore, in order to effectively promote the rapid development of construction industry informatization, the rapid penetration and wide application of BIM technology in the construction industry has become inevitable.

RESULTS AND THEIR DISCUSSION

1. Key technologies of BIM-based construction site organization, management and operation.

The BIM database engineering information management module in the BIM-based construction site information management system is the core processing module for the import, export, model display, and storage of BIM information and related engineering information based on IFC. With massive engineering information storage and high-speed data retrieval functions. Through the design of the database table, the project information can be effectively defined and the above functions can be realized. Through the analysis of construction site information, the engineering information of this module is mainly divided into six parts: labor management information, material and equipment management information, safety construction supervision information, site environmental management information, quality acceptance and contract management.

In the design process of the BIM database table, it is first necessary to create a project table to store the basic project information such as the type and attribute information of the building entity, numbering information, etc. Meanwhile, each functional application system should establish a relationship with the building entity through its own database table, and store the corresponding functional system information. The BIM database table of the functional application system includes labor personnel table, material equipment table, construction supervision table, on-site environment table, quality inspection and contract management table.

In the process of BIM database organization, management and design, each participant of the project assumes different roles, and they can only operate within the specified authority. This module divides the main body of organizational relationship in the project into four parts: enterprise, department, user, and construction site information. Among them, Enterprise is the main enterprise of information management, such as construction general contractor, supervision unit, owner company etc.; Department is a work group or department divided by specialty or category, such as labor management group, material equipment information management group in this system, etc. ;User is an individual who forms a working group, such as the labor management team leader, labor management team member, BIM maintenance administrator, etc. in this system; Information is the object managed by User, such as building components in the construction site, Relevant information generated by materials, machinery and equipment, labor personnel, etc. The design description of the main body relationship of each organization is shown in Figure 1:

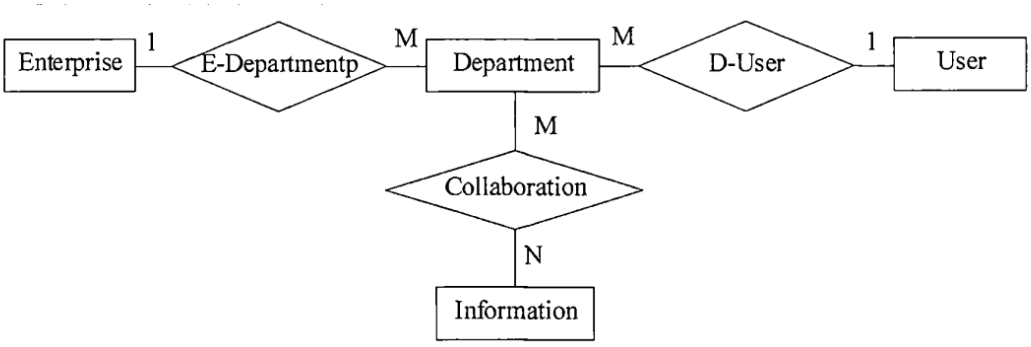

Fig1: The main body relationship design diagram of each organization

2. BIM construction site management system organization and management.

Although the owner in the BIM-based matrix organizational structure model is the highest commander in the whole life cycle of the project, it is not the direct decision maker of the construction site management. In the matrix organizational structure, the owner issues instructions to the BIM project manager, and manages the entire construction site through the BIM center. The BIM project manager sets up the subordinate functional application groups according to the management content and needs of the construction site, and at the same time issues instructions to the BIM center under the comprehensive consideration of the owner's requirements for the quality and duration of the project, so as to achieve effective implementation of the entire construction site. information management. The application team should generally include labor information management team, material equipment information management team, safety construction information supervision team, on-site environmental information management team, quality acceptance and contract management team, data management team, system maintenance team, etc.

The BIM-based matrix organizational structure model realizes the timely communication between the participants and the functional application groups under the BIM center in a virtual network environment through means based on the BIM database and information management application systems, so as to achieve real-time sharing of construction site information. with application. When there is an instruction conflict between the vertical and horizontal work departments under the BIM-based matrix organization model, the BIM-based construction site information management platform will collect the information, and the members of the BIM data management team will coordinate online, and the coordination results will be fed back to the BIM project Manager review.

Implementing a BIM-based construction site information management system requires not only the support of key technologies and various application systems, but also the clarification of the work powers of each information management personnel. The functional division of information management personnel in this system adopts the principle of "hierarchical configuration, classified management, and task orientation": "hierarchical configuration" means starting from the actual construction site information management, aiming at the construction site organizational structure, the construction site information management Personnel are divided into decision-makers, managers, and professional and technical operators; "classified management" means dividing roles according to the types of tasks undertaken by information management personnel, and implementing targeted classification management; "task-oriented" means according to the needs of the construction site. The types and characteristics of the information problems to be solved shall be uniformly deployed and managed for BIM information management personnel. As the highest decision-making department of the construction project department, the BIM center is also the core department of the centralized operation of the entire information management system. The setting of its functional departments and the distribution of personnel responsibilities and rights are very important. After the organizational structure model was established, the project department set up a BIM application group under the BIM center, and based on the above-mentioned principle of division of labor, the BIM project manager was divided into decision-makers, the leaders of the BIM application group were divided into managers, and the information of the BIM application group Management staff are divided into professional and technical operators.

The BIM project manager is the direct manager and top decision maker of the entire BIM center. He should have rich project management experience, good organizational and communication skills, and be familiar with BIM technology and software applications; the application team leader should be a professional with a serious work attitude. The technical operators are responsible. When the information management work is tense, the team leader also needs to undertake the technical operation tasks; the professional and technical operators are professional and technical personnel who are proficient in using relevant BIM software and have rich experience in construction site management.

3 Case analysis of apartment construction in Lingshui Xiangshui Bay, Hainan

Hainan Lingshui Xiangshuiwan Apartment Construction Labor Information Management System conducts performance appraisals for on-site labor subcontractors and project managers. Its system is mainly divided into labor subcontracting personnel client and project management personnel client; labor personnel BIM information management includes: labor personnel basic information management, labor personnel attendance management, labor personnel salary management, labor personnel types and types of work. Cooperative instruction delivery between them. Project management personnel BIM information management includes: management personnel's practice certificate information, post certificate information, responsible positions and job responsibilities, academic information, management personnel attendance management, salary management and administrative function transfer, etc. Before the construction of the project, the administrative staff of the project department shall be responsible for the information sorting and review of the overall personnel and labor service personnel of the project department. First, log in to the construction project management system, and be responsible for entering the BIM labor service system and the BIM project management personnel system. The BIM management system generates a QR code label for each person based on the second-generation ID number. Scanning the QR code label network link can directly display the personnel's identity information, education information, type of work information, practice certificate information and job information, the area in charge, etc. Then confirm and check whether the information of everyone is accurate, and then provide the QR code label to the supervisor for review. Then, according to the data of the basic management module provided by BIM labor information management, use BIM software to analyze the supply and demand of human resources, and combine the BIM progress analysis technology to determine the time and number of labor personnel. Before the laborers take up their jobs, they will carry out unified safety training, and allocate all relevant salary cards, safety helmets and other series of equipment. As shown in Figure 2.

Figure 2 project management system

The management function of the construction materials and equipment of Lingshui Xiangshuiwan Apartment in Hainan Province shall be centered on the convenience of supply, and shall be set according to the construction plan of the project. The main functions of the material and equipment information

management function include basic information management, entry and storage, storage, inventory management, order management and other functions. In the project preparation stage, use the material and equipment information in the BIM database, combined with Glodon's BIM-5D progress analysis function, to determine the entry time and quantity of materials and equipment. Before materials and equipment are transported, add tracking events through the interface set on the mobile client by the information management system, and edit the required tracking status. And through the combination of BIM technology and RFID, the corresponding two-dimensional code is generated, so that the information can be checked and checked when the material equipment enters the site. When the material equipment arrives at the construction site and is about to be put into storage, by scanning the QR code of the material equipment on the transportation vehicle, the type, quantity, model and other information of the vehicle and material on the construction site are collected, and the information on the tracking event page added before transportation is collected. Check, confirm whether it is in the warehouse, and store the information in the BIM database. When inventorying materials and equipment, the BIM report statistics function is used to realize the intelligent inventory record of inventory, which reduces information errors. In the construction of the project, the material out of the warehouse should record the relevant filling records in time, and use the scan and read generation function in the BIM information management to generate the used report in time. And use the BIM material report to carry out the inventory work of quantity, delivery period, specifications, models, and use parts, etc., and collect and store the information in the BIM database for inspection by relevant parties, so as to grasp the current equipment and material status in a timely and accurate manner.

Before the construction of the Xiangshuiwan apartment building project in Lingshui, Hainan, the civil engineer provided relevant construction guidance to the construction personnel who implemented the process plan according to the BIM software simulation model diagram. The construction process simulation based on BIM technology is easy to understand, and all construction personnel can quickly understand and master the construction process, which improves the efficiency of information exchange on the construction site.

During the construction process, the civil engineer collects data from the data sensors installed on the structural safety and edge protection, four holes and one opening, and lifting and hoisting facilities arranged on the construction site, and transmits it to the BIM database in real time. Import BIM-based structural safety professional software for simulation analysis to judge the status of construction site safety management.

The construction site information management functions of Hainan Lingshui Xiangshuiwan Apartment construction mainly include site layout management, construction environmental protection, etc. BIM-based environmental monitoring collects environmental protection information, such as on-site temperature and humidity, wind speed, wind direction and other ； meteorological signals, dust concentration, particle concentration and other air pollution, noise index, water pollution and other information collected by the environmental protection information monitor installed on the construction site. After the construction site network system is transmitted to the BIM database, the corresponding environmental protection management plan is made after the analysis and comparison of the BIM series software.

The BIM-based on-site environmental information management system of Hainan Lingshui Xiangshuiwan Apartment Construction Project firstly involves the relevant personnel to conduct on-site measurements on the construction site, collect site information, and extract the engineering quantity information, material demand plan, labor demand, progress plan and other basic information from the system. The project information is used to make overall arrangements; then the BIM model of the building to be built is placed in the site, and an appropriate combination of vertical transportation machinery is selected; then according to the material consumption information and mechanical equipment required information provided by the system, the processing plant and the Determination of the type and location of temporary facilities for material storage; after determining the type, input the relevant parameters, and after the specific parameters are determined, the 3D building model can be placed in the construction site; After the layout of the building models such as the mixing station is

completed, the entrance and exit are selected according to the location of the road outside the site, and the width is set in the graphic element component to draw it into the designated position; after the road layout is completed, the entrance and exit gates, The guard delivery booth is drawn at the set position; the layout of the temporary housing for administrative management and living rooms follows the principle that the office area is close to the construction site and the living area is far away from the construction site, and the corresponding temporary housing components are drawn according to the needs of the number of workers. in eligible regions. Finally, other types of components can be selected and placed into the BIM model of the construction site to complete the establishment of the model. The temporary water and electricity pipeline network can be arranged by using the intelligent arrangement function of the relevant software, and finally the site layout management of the construction site can be completed.

In the construction site information management work, the system first automatically generates quality check points and quality check plans related to relevant specifications and contract requirements. The quality inspection personnel of the construction unit can manually modify the inspection points, and the modification records are automatically saved in the BIM database. For concealed projects or projects that require side-site inspection, the construction personnel use the system's video and photo functions to record during the construction process, and will automatically obtain the time, location, photo angle and orientation of the photo and video recording through the construction site network system. Save to BIM database.

During the acceptance process of the construction sub-project or inspection batch of this project, the construction party logs into the system after passing the self-inspection and enters the acceptance application, and the system notifies the owner or the supervision engineer to organize the five parties responsible for the acceptance. During the acceptance process, the quality inspection engineer can specify the inspection and acceptance site, compare and verify the real photo and the BIM model rendering image, and save the real-time acceptance data to the BIM database in real time. Checkpoints that pass the acceptance are updated to green, and those that fail to pass are updated to red. Only the acceptance points that are fed back as qualified acceptance can continue to the next process. When there is any objection to the construction quality and needs to be re-examined, the supervisor and the quality inspection engineer will verify the quality information by calling the relevant engineering information and materials stored in the BIM database.

CONCLUSION

During the implementation of the BIM-based construction site information management system, the traditional project management organizational structure has been improved. Due to the independent contractual relationship between the project participants in the construction site, they lack effective trust and communication with each other in the traditional project management mode, and it is impossible to truly realize the full participation of all staff in the on-site information management. The BIM-based construction site information management system effectively improves the traditional construction site project management tasks with unclear division of labor and uneven distribution of responsibilities and rights by setting up a BIM-based matrix organizational structure model, and strengthens the construction site project participants. information exchange between them.

Improvements to traditional project management tools and systems. The traditional project management tools and methods such as work breakdown structure and network planning technology fail to share information in a timely manner, and the management plans and schemes formulated cannot fully consider the actual project situation, which affects the realization of project objectives. The application systems and series of BIM software in the BIM-based construction site information management system can provide corresponding operations in a relatively stable network environment, keep information updated in time, and effectively improve the backwardness of management tools and systems in the traditional project management mode.

Optimize the traditional project management process. The traditional construction site management process is not standardized, which often leads to low construction site management efficiency. BIM-based construction site project management, by using the advantages of BIM technology's high information creation capability and high information understanding efficiency, supports the automatic conversion of various types of data and models, making it easier for other participants to obtain the required information. Optimized construction site information management process and improved project management efficiency.

REFERENCES

1. Ma Zhiliang, Lou Ji. Discussion on the application of IFC standards in the cost budget of construction projects in my country [J]. Civil Engineering Information Technology, 2009, 1(02): 7.14. DOI:10.16670/j.cnki.cn11-5823/tu.2009.02.005(the date of visit: 01.03.2022).

2. Ma Zhiliang, Cai Shiyao. BIM-based standard parts library management system [A]. BIM Professional Committee of China Graphics Society. Proceedings of the Second National BIM Academic Conference [C]. BIM Professional Committee of China Graphics Society, 2016: 5.https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CPFD&dbname=CPFDLAST2016&filename=JGCB201611001030&uniplatform=NZKPT&v=Hd4k1Dg4_PD6kpjgDxGjQayXWXYwmiUbCmt8wiby2WoqJXOIHGqp8AMeY3eXsHeCFhKy20BXHqs%3d(the date of visit: 01.03.2022).

3. Nenad Cus Babic, Peter Podbreznik, Danijel Rebolj. Integrating resource production and construction using BIM[J]. Automation in Construction, 2009, 19(5). https://www.infona.pl/resource/bwmeta1.element.elsevier-b1a42a82-7fe9-3c12-8c66-73b9a13480e0 (the date of visit: 02.03.2022).

4. Eastman, Teicholz, Sackset, BIM handbook：a guide to building information modeling for owners, managers, designers, engineers and contractors[M]. Wiley：Hoboken, 2011293-295.https://www.academia.edu/3183272/BIM_handbook_A_guide_to_building_information_modeling_for_owners_managers_designers_engineers_and_contractors (the date of visit: 02.03.2022).