

Research on integrated security management system in design and construction

Hongyong Liu ^a, Fang Wu ^b and Yong Yu ^c

School of civil engineering and architecture, Southwest Petroleum University, Chengdu 610500, China

^ahy78512@163.com, ^b826809172@qq.com, ^c1101888713@qq.com

Abstract

Construction safety is a serious problem in the construction industry, combined with BIM technology integrated design and construction can effectively eliminate safety hazards in construction activities. This paper studies the design and construction safety management, security management and further promote the construction cycle integrated design, reduce the incidence of construction accidents.

Keywords

Integrated design and construction, BIM, Safety Management.

1. Introduction

BIM technology and traditional design methods of integration, three-dimensional visualization of construction, it can enhance the professional communication efficiency. Optimization of the original design, the integration of different professional models, reduce design changes through the model of performance analysis, the final implementation of the traditional design process optimization, will be fully integrated with the traditional advantages of BIM design, construction and design specifications to achieve security objectives. Further, a BIM model parameter properties, give full consideration to the application model, BIM design phase of planning and construction phase of the final results meet the construction phase of further deepening and application requirements.

2. Summary of BIM in construction activities Safety Management

BIM-based industry and related IT security management conducted a lot of research, mostly concentrated in the design and construction phases.

2.1 Design Phase Safety Management

In the structural design, reflecting a typical study design is safe Zhenzhong Hu proposed by SABIC, SABIC can exclude many potential hazards at the design stage, which will reduce rework and stable architecture, and to improve the efficiency of security management. UweRüppel and other models into VR (virtual reality) model, this model to design a fire evacuation "game", the "game" is in a virtual reality environment within a room to simulate the human body through a variety of hardware in the case of the main senses in case of fire.

2.2 Construction process safety management

F.Peterson etc. research project management training based on BIM technology. In the study they will be project management tools based on BIM technology into the 2 curriculum.

Survey results show that both the worker's age, educational background and how information literacy, appropriate training modules and training courses can improve the safety of construction workers behavior. Wenfa Hu proposed construction management system based on RFID technology and 4DCAD, RFID and 4DCAD model based on the existence of great potential in the construction management and automation. H. Yang put forward a RFID-based hazard identification system to be used for construction site safety management and accident avoidance. S. Chae and T. Yoshida

proposed RFID-based security management system for preventing heavy equipment collision accident.

3. The design phase safety management system envisaged

Although BIM technical conditions in safety management matured, but due to the many obstacles the design stage, the application of technology to be further promoted. This article will build a safety management system, the design process clear, a clear mandate to achieve cost-efficient, standardized security.

The establishment of a safety management system is to identify the main source of danger, to identify hazards present in the design phase, we must first determine the constraints set of control effect. Designers to standardize the design standards, should also be recognized by the system to regulate the foundation. Which will regulate the provisions relating to security screening out, sorting into various logical relationship, that each rule is a specific provision of various types of standard formulation, specification and re-carded data compiled language. Design errors are stored in a database, uploaded to the review center through the Internet platform and strict checks at a map, to ensure the quality of the drawings.

3.1 Design preparation

Pre-construction design major consideration environmental factors, including urban planning, allocation of resources and market demand and so a comprehensive evaluation, through the combination of BIM and GIS (geographic information system, referred to as GIS), and the presence on the ground of the site of the proposed building the data was processed by forming a virtual BIM technology, can quickly obtain design data to help new projects to make the best layout of the building, site planning, lay the foundation for later work. Designers take the building information model as a basis for constructing , began preliminary design.

3.2 Design of alarm

After building information models imported into safety inspection system, using safe formula to run programmed repeatedly scan the entire building structure, the safety factor structure was refined calculation, the member or the mechanical model is not within the security rules range from the overflow object, the use of extensible markup language (extensible markup language, XML) read, stored in the system database error. Using a lookup error primitive way to make a feedback model for non-compliant parts labeled. To distinguish between different colors, and with flash. Safety testing, while the same portion can be extracted, mechanical model, mechanical properties and the data corrected by parametric design window, the system will return the modified operating results and model construction unit back to the modified consent after the consent of the owners can use to modify the program ,until all issues are resolved.

3.2.1. BIM module

Building Information Modeling is not a simple digital information integration, it is the application of a digital information and can be used for digital approach design, construction, management, integrated management environment to support this method of construction projects, it is conducive to cost control, quality control, schedule control, contract management and coordination and communication . Building information modeling has the advantage of visualization, collision detection and structural analysis can remove obstacles to the further deepening of the design. The use of Internet technology to build the database, you can achieve integrated management. As shown in Figure 1, which will make the energy flow in the safety management model to achieve the dynamic management to ensure project safety.

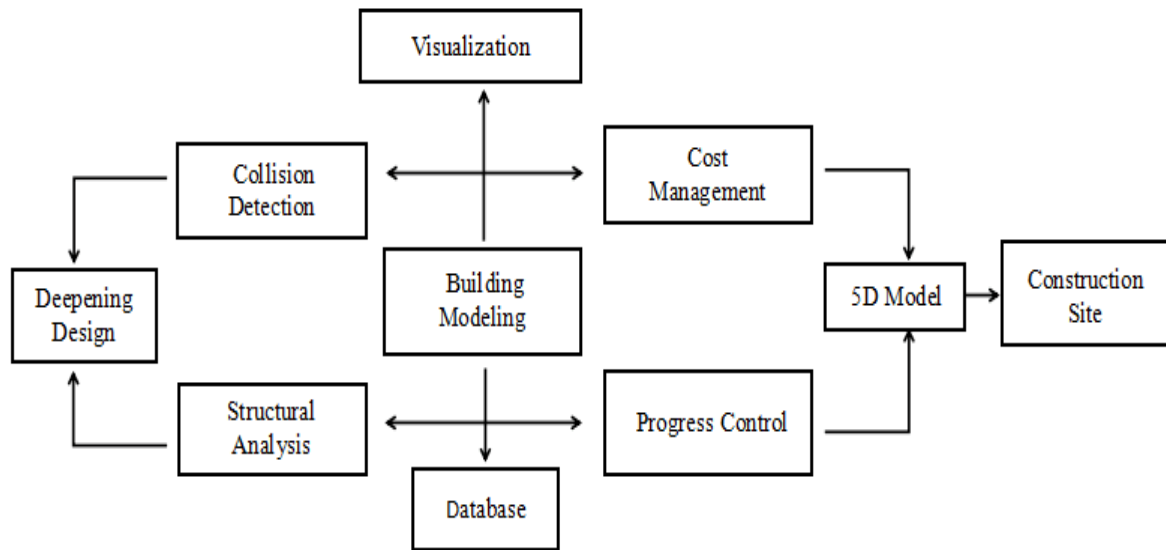


Fig 1. BIM module system of FIG

3.2.2. Structural Analysis

Current structure analysis software is the core modeling and BIM software integration relatively high degree of product, basically can achieve two-way exchange of information between the two, namely structural analysis software can be used BIM modeling software core information structure analysis and the results of structural adjustment and can be fed back to the core BIM modeling software to automatically update the BIM model.

3.2.3. Database

BIM technology and database technology has a different design philosophy: BIM emphasize visual building 3D geometry, while providing a wealth of property information; no database is mostly visual ability, but can handle 2D or 3D geometric data can be saved over the same time take a lot of good information and maintaining data consistency. According to news reports BIM, to allow more software applications can successfully access the BIM data, there are two approaches:(1) The BIM export the data to an open file format, such as IFC (Industry Foundation Classes) or COBie (Construction Operations Building Information Exchange); (2) API through BIM software applications provided by (Application Programming Interface) to access a variety of attribute information within BIM models. The information stored for the full life cycle of use, according to the attribute information will be divided into initial data and modify data, and error messages via the Internet will be uploaded to the audit system.

3.3 Review Center

The use of BIM technology for building coordination, simulation, optimized, integrated structure can make holes left diagram, integrated pipeline map, check collision investigation report and recommendations to improve the program. Review center design model scanned to specification by reference, there is beyond the specification allows deviation overflow error occurs that is, the error will be transmitted to the network monitoring platform, as the unit or individual design experience stored in the database by owner communication and design units, troubleshoot the error. If there is no overflow error, review center will inform the design unit of FIG. So the design units in the investigation and error before they can fully organized plot to obtain standardized BIM model, otherwise the model will not be approved. As shown in Figure 2.

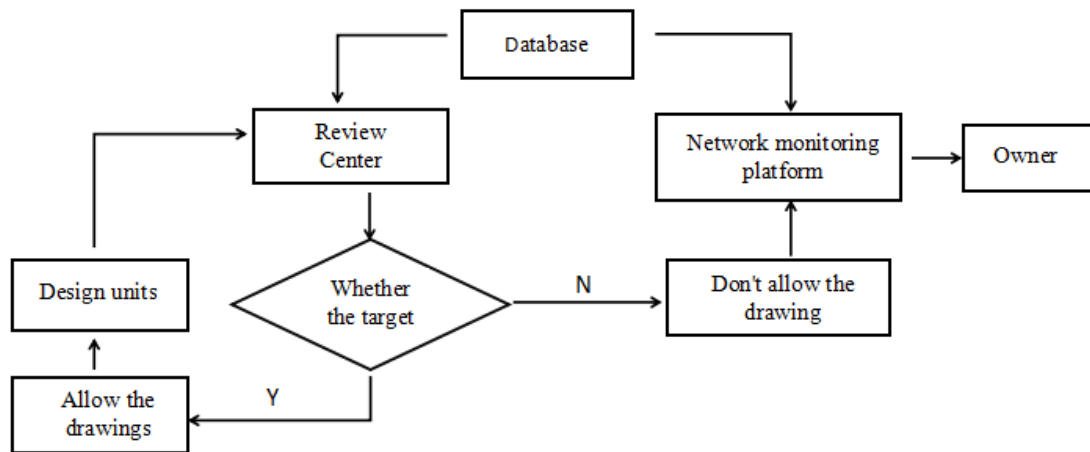


Fig 2. drawing quality control system of FIG

3.4 . Construction Supervision Platform

For large-scale, complex construction projects, the audit departments spend a lot of manpower and financial resources to complete the audit work to build network monitoring platform .It can reduce the workload of auditors to some extent, greatly reducing preparation time and payback period .In addition ,review the design center units will supervise implementation of the network, which means that security detection systems and review center can achieve two-way transmission of information, and the design units must accept supervision by the safety monitoring system, not approved. Then the project will not be showing.

3.5 Qualifications

Since the engineering and design phase is closely related to the accident, the designer should bear corresponding responsibility, the designer's level of qualification and sense of responsibility and safety engineering accidents and therefore indirectly linked. On the one hand, the study level designers can refer to the database in case; on the other hand, in order to cultivate the sense of responsibility of the designer, you can create a rule, the implementation of rewards and penalties.

4. The safety management system envisaged the construction phase

The first step in risk management is to identify risks, safety management is no exception. The first step is the construction units should be able to identify the possible cause accidents of all sources of risk, usually divided into uncertainty analysis, risk source list, the results predict that may occur and control planning of four parts. Only by establishing a sound safety management system can we lay the foundation for risk assessment and risk response. Thus, by analyzing the various construction safety cause of the accident, a variety of security incidents to be divided, to identify and establish contact, and the first time an important role in controlling hazards.

4.1 signal acquisition module

The module is through the adoption of "labeling" in order to workers in hard hats and construction machinery on real-time location, type of work in the hazardous area of the construction site is not allowed within a distance of construction machinery or dangerous radius personnel will be detected. Monitored construction workers promptly conveyed to signal its associated safety supervision center and further processing.

4.2 Warning module

When the construction site accidents, safety management system derived from the construction site safety information is processed and sent information officer to take appropriate emergency measures; at the same time via remote dial-up alarm, notify the person in charge of the project security incident handling. Site construction can also press the alarm button has been placed to notify management personnel in a timely manner to deal with accidents. In the form of alarm to sound and light alarm

main use of warning lights, buzzer, etc. Signal acquisition hazardous to personnel information feedback early warning systems, the security group immediately sent to the scene of the accident isolation of personnel, and accountability in accordance with the accident accountability system.

4.3 Work Safety Center

In order to take timely measures in case of emergency to ensure the safety of the construction site. Security administrators feedback received signal to a situation information acquisition dynamic monitoring of the data processing . Furthermore, the information center safety supervision departments will dock with the financial department, as a basis for rewards and punishments. BIM model can greatly improve the safety management chain and standardized integration of safety management system after management efficiency, reduce the probability of accidents. Transmission structure shown in Figure 3.

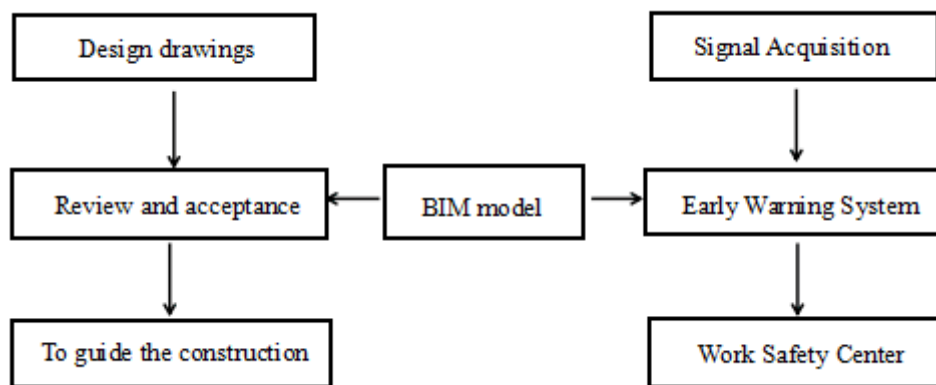


Fig 3. transport structure

The use of integrated design and construction philosophy can solve the problem caliber inconsistent information, the information model as the design phase of the construction phase carrier safety supervision, ensuring the smooth flow of information, designed to improve efficiency and construction safety. Of course, the real problem is often more complex. In order to realize implement intelligent security management ,the system also needs to continue to improve.

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