

## RESEARCH ANALYSIS OF FACILITY CONSTRUCTION MANAGEMENT AND BIM TECHNOLOGY

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*In recent years, the scale of construction facilities has expanded rapidly, and with it there have been problems in facility construction management. Traditional facility construction management has problems such as low human-machine efficiency, poor coordination and organization capabilities, long working hours and high costs. BIM technology can use information model technology to carry out collision detection, design optimization, and error reduction throughout the entire life cycle of a construction project. It can realize collaboration and communication among construction personnel through information models, thereby assisting facility construction management to improve human-machine efficiency and reduce construction risks. , the effect of reducing construction costs. Therefore, studying the fields of facility construction management and BIM technology is of great significance to promoting the development of construction projects and improving the level of construction management. This article studies the application, advantages and results of BIM technology in facility construction management, provides effective management methods and technical support for the combination of industry facility construction management and BIM technology, and further promotes the modernization and intelligence of facility construction management.*

Keywords: Facility construction management, BIM.

## INTRODUCTION

By analyzing the applications of researchers such as Huang Minzhi and Wen Zhuqian in actual engineering cases, found BIM technology can be used in facility management to solve complex construction problems, conduct collision detection on key construction parts, and ultimately improve the efficiency of collaboration and communication among construction personnel. Optimize construction design plans, improve human-machine efficiency, reduce construction risks, and reduce construction costs. Through BIM technology three-dimensional model: construction technology briefing, 4D construction simulation and construction rehearsal, construction layout, in-depth design of steel structure nodes, pipeline synthesis, combination with VR engine technology and other technical methods to manage facility construction, and can use new technologies to manage facility construction. Technology proposes more complete solutions to further promote the development of the construction industry.

## DEVELOPMENT STAGE OF BIM TECHNOLOGY

BIM (Building Information Modeling) is a building information modeling technology based on three-dimensional models. This technology models the components of an engineering project, and the model covers engineering project information such as size, materials, schedule, and cost. The development of BIM technology can be divided into three stages, as shown in table 1:

Table 1. Development stages of BIM technology

Key features and applications of BIM technology		
BIM technology phase	specificities	appliance
2D CAD stage	Computer-aided design based on 2D graphics	Only plan and elevation drawings can be realised.
3D modelling phase	3D model-based design with physical and logical information	Optimisation of parameters such as spatial arrangement, material selection, component sizes, etc.
4D/5D BIM Phase	Construction planning and cost estimation by adding information such as time and cost to the 3D model	Allows construction progress and cost control for full life-cycle management

### ADVANTAGES OF BIM TECHNOLOGY

BIM technology can design, construct, manage, and perform dynamic visual management of facility construction. The advantages of BIM technology are shown in tabulation 2:

Table 2 Embodiment of the superiority of BIM technology

Project cycle	vantage	analysed
design phase	Professional coordination, information sharing	Integrate the design results of different disciplines (e.g. plumbing, architecture, electromechanical, etc.) into the 3D collaborative design environment to maximise the sharing of information, adjust collisions in a timely manner, and avoid wasting resources.
	3D visualisation	From 2D design to 3D design, the abstract and professional 2D drawing information is presented in 3D visualisation form, which enables the relevant people to understand the project more intuitively.
	Design simulation	Construction of display scenarios in virtual worlds, thereby reducing the potential for future physical defects
construction phase	produce a chart	Forming various drawings based on BIM design results saves time in drafting and documentation and ensures the accuracy of drawings.
	four-dimensional simulation	3D+TIME model can simulate the whole construction process intuitively and accurately, helping construction personnel to reasonably formulate and implement the construction plan, master the construction progress, and optimise the use of resources to improve the quality and efficiency of the project.
Management phase	Provision of information	BIM technology can provide information on building quality, cost, schedule, bill of quantities, material preparation, etc. for the construction phase of a project
	programme adjustment	BIM technology generates up-to-date project plans and construction schedules for the engineering and estimating engineers, and the construction crews can update the plans according to the owner's requirements, thus minimising the impact of the construction process.

Tabulation 2: Advantages of BIM technology

## CASES OF COMBINING FACILITY CONSTRUCTION MANAGEMENT WITH BIM TECHNOLOGY

Huang Minzhi combined BIM technology for facility construction management in the J2-5 plot of Zhujiang New Town in Guangzhou, and used BIM technology to efficiently complete the renovation plan, three-dimensional technical construction briefing, and eliminate construction collisions [1]; Wen Zhuqian was at Shenyang Shengjing Financial Plaza During the project, the internal site model library was drawn, BIM technology was used for construction layout, in-depth design of steel structure nodes, and pipeline synthesis, which provided important decision-making basis for the optimization of the construction plan [2]; The tower anchor bolts are prone to rust and corrosion. BIM technology is used to simulate and optimize the installation effect, ensuring the service life of the bolts and the safety of the tower foundation [3]. Wang Longfei and others used BIM technology to deepen the electromechanical installation design in a certain subway electromechanical installation project in China. They input the BIM model into the VR engine and simulated it through the VR engine to ensure that the model conforms to the design [4]. Niu Muqing used BIM technology in a hospital construction project to solve the problem of complex pipelines in the basement that needed to be resolved in advance [5]. The BIM technology used in the project case and the related construction problems solved are shown in tabulation 3.

Serial number	Project name	BIM technology applications	Sort
1	Lot J2-5	Deepening design of electromechanical pipelines, 2D code and 3D model for construction technical briefing, 4D construction simulation and construction preview, coding of equipment and pipelines.	Rapidly formed 36 renovation programmes, completed 18 three-dimensional construction technical briefings, eliminated 320 collisions in key areas, formed two on-site streaming prefabrication production lines, and assisted in the management of hidden engineering facilities, improving property efficiency and management.
2	Shengjing Plaza	Construction layout, deepening design of steel structure nodes, pipeline integration	Collision of air ducts and sprinkler short risers in the basement plant room, collision of bridge and air-conditioning water pipes and sprinkler pipes in the ground floor, no space between low-voltage distribution bridge and the bottom of the beam, bridge cover cannot be laid, collision of smoke exhaust pipe and air-conditioning water pipe, smoke exhaust outlet is too small from the edge of the door, collision of steel structure and electromechanical pipelines, and numbering, cutting, drilling, welding and other works on the steel structure.
3	High-speed rail four-electricity	Simulation of tower installation effect	Use (VR) technology for experiential delivery of installation effect. Use BIM software to stratify the planning in different reference planes to achieve three-dimensional intersection of cable placement design, effectively isolate the strong and weak power cables, reduce cable electromagnetic interference, so that the pre-planning effect of the three-dimensional three-dimensional presentation of the shortest path to achieve the minimisation of material consumption. Simulation of the construction environment, the position of the cabinet and static electricity floor in the machine room, according to the static electricity floor of the family documents to determine the direction of the wire rack, set the reference line to ensure that the outdoor introduction of pipelines into the machine room and the location of the manhole in the same straight line, through the pipeline model and structural model can be derived from the location of the holes intuitively.

Serial number	Project name	BIM technology applications	Sort
4	Metro Project	The BIM model is input into the VR engine and simulated through the VR engine	In this project, the BIM+VR technology platform was used to detect 31 structural collision problems of metro E&M pipelines and 15 line collision problems.
5	Hospital projects	Early resolution of complex collisions with basement pipe-work	Through the application of BIM technology, 12 major problems and 866 general problems were found in the drawings, and the problems were avoided before construction, reducing on-site dismantling and alteration and saving at least 45 days of the construction period. Conducted BIM research on earth excavation simulation, internal support removal, sub-division of block construction, etc., and determined the construction plan that best meets the site, saving costs of 550,000 yuan. The project has been completed 156 times of 3D delivery, which is a good promotion for on-site construction quality management and safety management. Design modeling construction model review, the project found 2286 collision problems in various disciplines, and the statistical economic benefits reached 6 million yuan.

Tabulation 3: Actual project analysis using BIM cases

It can be seen from the analysis that BIM technology can help solve more complex construction difficulties, collision detection of key construction parts, optimized construction design plans, underground construction and subsequent property management through visual three-dimensional models in the process of facility construction management, effectively improving construction efficiency and engineering effectiveness. And BIM technology can be combined with VR engine technology, which shows that BIM models can be used in conjunction with other new technologies to manage and control construction sites through dynamic simulation modes.

## DEVELOPMENT TRENDS OF FACILITY CONSTRUCTION MANAGEMENT AND BIM TECHNOLOGY

BIM technology combined with the concept of BLM (project life cycle management) is a new model of facility construction management. BIM technology is applied to various stages of facility construction such as design, construction, operation, and maintenance to help facility construction achieve dynamic management and is also the future Trends in facility construction management. And the combined use of BIM technology and VR technology in actual engineering cases proves that new technologies and BIM technology are related. Virtual reality VR technology and augmented reality AR technology can bring a new management model to facility construction management. New data platforms or data software can be developed based on the BIM information model to assist intelligent building on-site construction management, realize virtual environment construction, and discover and solve potential construction problems in advance. In the context of sustainable development throughout the world, BIM technology can effectively reduce the loss of construction materials and improve resource utilization, which is of great significance to deepening sustainable development. Based on the current construction technology, it can be seen that the application of facility construction management and BIM technology can be used in smart city construction, digital twin modeling, interdisciplinary cooperation and innovation, etc. to achieve higher-level comprehensive solutions and ultimately promote the construction industry develop.

## IMPROVEMENT SUGGESTIONS FOR BIM TECHNOLOGY AND BUILDING CONSTRUCTION MANAGEMENT

In order to popularize BIM application technology in actual construction, further improvement is still needed. First of all, we must ensure the accuracy of the BIM model. The BIM model is the basis for management. Once the accuracy of the BIM model is inaccurate, it will bring great hidden dangers to construction quality and construction safety. Moreover, there is a problem that workers cannot understand the application of new technologies during construction. BIM technology should be popularized and construction personnel should be trained. Secondly, as a new technology, BIM technology is in a stage of rapid development. The corresponding construction standards and technical specifications have not yet been formulated, and there are great differences between different countries and regions. Finally, it is necessary to supervise BIM technology-assisted construction management and establish a corresponding supervision and management mechanism to ensure that BIM technology plays its due role.

### CONCLUSION

Five cases of BIM facilities and construction management have been reviewed and it was found that BIM can improve the level of construction management in many aspects. The following suggestions are made: 1) Progress control: Use BIM combined with Project software to create a construction project schedule, supervise and manage the project progress in real time, adjust the construction plan in a timely manner, and ensure that the construction cycle can be completed on time. 2) Cost control: Use the visualization advantages of BIM technology to avoid problems before construction and reduce demolition and modification; combine with Autodesk Navisworks for model synthesis and collision inspection, and adjust the construction design in a timely manner; combine with VR engine for construction simulation to ensure that the model conforms to the design. 3) Safety control: Use the construction visualization and precision features of BIM technology to reduce the probability of safety accidents. 4) Quality control: Construction zoning modeling through simulation. BIM technology plays a role in helping to solve construction problems in different types of construction. BIM technology is also an indispensable new technology for future on-site construction. The combined application of new technologies and BIM technology also reflects its potential and application prospects in building construction management. The education, popularization and improvement of BIM technology should be strengthened, supervision mechanisms and construction specifications should be established to further promote the application of BIM technology in construction management, and ultimately achieve more efficient, safe and low-cost construction.

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