

# Study of BIM5D Technology on Construction Cost Control Application

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**Abstract:** This article describes the development of BIM5D technology in the construction industry. The emergence of BIM5D technology has led to a huge shift in the traditional cost control methods and has effectively solved various problems in this area. We will analyze the problems encountered in traditional cost control, and discuss the advantages of BIM5D and its application value in light of the actual situation here.

**Keywords** Construction Cost, Cost control, BIM5D, Application value

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## INTRODUCTION

As China's national economy develops rapidly, information technology in the construction industry continues to improve.[Ye, 2018] The application of BIM technology in the construction industry has become more and more widespread, and it has also forced BIM technology to continuously improve, from the previous BIM3D to today's BIM5D. As well as BIM6D that may be involved in the future, BIM technology is increasingly important in the construction industry. BIM5D technology plays an important role in the construction cost control. BIM5D increases the two dimensions of time and cost on the basis of 3d information model and improves the efficiency of cost control and cost management, as well as avoids the waste of manpower, material force, mechanical and other resources.[Zhou, *et. al.*, 2018] Daniel really thinks BIM5D technology will staff out of the statistics of heavy and complicated quantities, engaged in cost control and cost management, and other more valuable work.[Xie, *et. al.*, 2018] In this way, the cost control of the construction stage can be better realized and the economic objectives of the construction project can be achieved.

## OVERVIEW OF BIM5D

BIM (Building Information Modeling): the digital representation of facilities on physical and functional characteristics. BIM is a kind of shared knowledge resource. It is also a process of sharing information about facilities and providing a reliable basis for all decisions during the entire life cycle from the concept to the demolition of the project. At different stages of the project, different stakeholders support and reflect the collaborative work of their respective responsibilities by inserting, extracting, updating and

modifying information in the BIM system.[Yin, *et. al.*, 2018] BIM5D integrates project progress, project cost, 3D model, attribute information and relevant contract information into a model, providing data basis for project cost management and schedule management. With the aid of BIM platform to BIM5D model as the carrier, we can see the project before construction by the three dimensional animation and monitor the progress and cost at any time to real-time, so as to reduce the construction change, shorten the construction period, control the cost and improve the quality of purpose.[Lv, *et. al.*, 2017] Thanks to the coordination characteristics of BIM technology, we can make the communication between all parties more smoothly through simulating the construction process, avoiding problems caused by poor coordination. By establishing the BIM database, project managers can quickly and accurately obtain various engineering data and also carry out fine management of construction site.

In China, we began to introduce BIM technology to engineering construction industry in 2003. The current application is mainly for design companies. Various consulting companies, training institutions, industry associations and governments have also begun to pay more attention to the application value and significance of BIM. [Wu, *et. al.*, 2017] The national "Eleventh Five-Year Plan" technology support plan and the "Twelfth Five-Year Plan" development plan for building information also include BIM technology in the research content. Our country promoted BIM into the Twelfth Five-Year Plan in 2011 .In the following year, China Construction Research Institute jointly will initiate the establishment of the BIM Development Alliance, actively develop and build China's mainland BIM technology and standards, and software development and innovation platform as well.

## **RELATED ISSUES OF CONSTRUCTION COST CONTROL**

### **Not harmonious and unified**

In the traditional cost management, the project budget should be prepared in both the design and the end stage, and cost information is not updated in time due to the lag of information or the error of staff. When claims occur in the later stage, it will consume a large amount of manpower and financial resources.

### **Overlook beforehand and the matter controls**

In traditional cost control, construction units generally attach great importance to control after the event and despise beforehand and the matter controls. Construction enterprises lack relative intensification of budget in advance and matter can only appear in the excessive or lack phenomenon, so we are unable to effectively control the cost. The risk that increases construction enterprise is invisible, brings about construction cost to increase finally.

### **Failure to obtain cost data timely**

Cost control is the premise of mastering the timely and effective information, and the traditional way of collecting data process is slow. Information is scattered, low efficiency, processing data and partial information timeliness are strong and they are not easy to get, most late to engineering to get and hard to make the cost information sharing. Therefore they cause the late dispute unceasingly.

### **Lack of fine management**

The cost control of construction process is not paid enough attention to, and it lacks fine management. In the traditional construction process, construction is often carried out through the experience of the project manager. The rough estimation often lacks data support, which increases the risk. In today's construction industry information, only the adoption of fine management can be competitive in the market. Refinement requires more detailed and comprehensive analysis and control from short-term time dimension, component level dimension and process dimension.

## **APPLICATION VALUE OF BIM5D TECHNOLOGY IN COST CONTROL**

In BIM5D platform, each major (such as steel, civil engineering, mechanical and electrical) of a 3D model contracts for connection with the construction progress plan and cost budget, the rest of the information such as each cooperated-building parties' information such as data entry to BIM5D platform, forming BIM5D information database, can help the related management personnel for effective decision-making and implementation construction stage of fine management.

### **Integration of all professional information**

The BIM5D model integrates all professional information to facilitate the browsing and management of professionals. The BIM5D model contains not only the attribute information of relevant majors, but also the progress information and cost information, which can be browsed by the professional model. Various professionals can work together on BIM platform, solve the problem of collision in the process of design, to realize precise reserved holes, prefabricated components, and 3 d models can be used to optimize the design improvement. Management personnel can enter to it at any construction or construction time to quickly obtain the relevant information (such as labor, materials, machines, costs and other information), according to the relevant data to reasonable allocation of resources to avoid waste of resources.

### **Update data in time**

In the BIM5D platform, data can be modified at any time, which improves the ability and efficiency of cost information processing, and then relevant information of the modified data can be modified accordingly. Compared with the traditional mode, it is easier, faster, and more convenient to modify the data. It also saves a lot of working time and does not waste resources. All professionals work together on the BIM5D platform which can also avoid problems caused by poor coordination.

### **Dynamic cost analysis**

At present time, all the projects in China are in the application of PDCA (plan, implementation, inspection, processing) dynamic principle to do the schedule, quality and cost control work, but the application is mostly manual accounting. However, PDCA can realize informatization by using BIM5D system. BIM5D can show up the actual number and the actual cost of each stage of the construction, and visualization to the actual investment estimate budget cost and actual cost of real-time contrast, such as establish a BIM actual cost database according to the BIM3D entity model which is set up at the early stage of the project. Actual cost data will be put into database in time to do real-time cost calculation, statistics and analysis, so that management can find problems in time in planning and actual deviation, timely solve the problems to better achieve the goal of the project.

### **Dynamic simulation realizing the fine management**

The dynamic simulation of the construction process realizes the fine management of the project. BIM5D platform can truly break through the traditional slick virtual building process, the simulation for BIM application to define and it can let

the project managers make prediction in advance before the construction site layout arrangement and heavy machinery and measures at each key node in the process of construction. It can also predict the use and change trend of funds and resources in the monthly and weekly cycles, and can identify problems and optimize them in advance through the use of funds and resources plan. The construction simulation of BIM5D is applied to the virtual simulation of construction stage to realize the prior management and control.

#### **Accurate and fast statistics of engineering quantity**

Accurate and fast statistics of engineering quantity will improve the ability of cost control. The processing quantity of construction and audit subcontractor quantities will be frequently reported to the owner of the project in the process of contract management, which involves a large number of completion confirmation, the statistics and calculation of quantities. But if we use the completion and on-site visa record in BIM5D model, business people can complete quickly the statistics part of the list of quantities, finish party a's review of progress payment application and subcontracting of quantities in a short time. In the BIM5D platform, components can be associated with budget documents, subcontracts, construction drawings, schedule plans, etc. It can also support major, floor, progress, flow, and other multidimensional screening statistics list of the amount of work, subcontracted work. Construction relevant personnel of the departments can obtain needed information in a timely and effective manner in BIM5D platform. For engineers, they can quickly provide accurate tap water section, floor materials requirements planning. For material department, the material staff can quickly review the accuracy of the material plan of the engineers in the engineering department, so as to make the audit process effective and reliable, which can truly achieve the limited amount of materials. For ministry of commerce, budget staff can make cost analysis, cost control and cost accounting according to the model data extraction. By this way, we can complete the monthly project review report to the owner quickly, and complete the actual subcontract project review very soon. For project manager, they can check the project cost control status at any time to support macro decisions. It will provide the real, accurate and shared actual project amount and the budget project amount updated automatically providing data and information support for material purchasing, cost analysis of cost personnel, and macro control for project managers.

#### **RESULTS AND CONCLUSIONS**

The BIM5D technology dynamically correlates the

BIM3D model with cost information and progress information, which has unparalleled advantages in cost forecast, schedule management and cost control of construction projects. Through the use of BIM technology, the problems of the isolation of information and management lag in traditional cost control have been solved, which contributes to fully grasping the implementation and progress of the project and implementing refined management, so as to improve the management level of construction and cost control ability.

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