Whole Process Cost Management System Based on BIM 5D

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ABSTRACT

First of all, this paper analyzed the limitation of current technical methods of cost management, and gives a comprehensive exposition of the principles, technology and application of cost management system; Then, characteristics and functions of BIM 5D system was analyzed. The integrated operation of the system in the whole stage was analyzed. Revolutionary vision has been put forward at the end of this paper.

KEYWORDS

Building Information Modeling (BIM); Multi-dimension database; BIM 5D system; Cost management system;

INTRODUCTION

Low productivity and high waste is a problem for the global construction industry[1]. Statistical analysis shows that the proportion of non-value-added investment in the United States was 57% in the engineering construction industry and 26% in the manufacturing industry with high utilization rate of IT technology. The former was 31% higher than the latter. In 2008, the global construction industry was $4.8 trillion, and the U.S. construction industry was $1.288 trillion. If construction waste were reduced to the same level as manufacturing, the U.S. construction industry would save $400 billion a year, a figure that doesn't include operational and maintenance savings. America's bim-centric construction aim is to

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save $200 billion a year by 2020. The low application rate of IT in construction industry has become the bottleneck that restricts the development of construction industry.

Many countries at home and abroad have vigorously promoted the utilization rate of BIM in the construction industry [2-3]. From 2007, the BIM utilization rate of the construction industry in the United States and Canada increased year by year. So far, Western Europe has more than 20 years of BIM experience. In recent years, the south Korean government has made it compulsory for all participating units to use BIM technology for state-owned projects costing over 50 million yuan.

PROBLEMS OF CONSTRUCTION COST

With the development of social economy, the scale and complexity of the project are increasing and the difficulty of cost control is getting higher and higher. Traditional manual calculation, single computer software calculation, has been difficult to meet the requirements of information. There still existed problems in current cost management system:

(1) Isolated one-stage management

The whole-stage cost management needs to be detailed to different time and construction progress, etc. At present, enterprises usually only know the price of project investment estimate, project budget, budget and settlement. There is no cost management in all stages. For some construction companies, when a project ends, there is a big difference between the settlement and the budget. By this time, it is too late to take measures. For the construction unit, budget over expenditure phenomenon also occurs from time to time. The main reasons are low reliability of accumulated cost data and large deviation of project investment estimation.

(2) Poor management of project group at enterprise level

A large project usually involves many individual projects, and the cost management of a large enterprise involves hundreds or thousands of projects. Not only must each management department cooperates the application, moreover requests the enterprise to have the formidable cost analysis technology. Only then the cost analysis was carried on quickly and accurately. However, the cost analysis technology still remains at the level of single-machine software analysis monomer engineering at present.

(3) Difficult of data sharing and accumulation

Cost management personnel are difficult to share data with other departments [5-6], the ability of all departments to work together is weak. For example, the cost of a project and make multi-calculation comparisons was analyzed. To make multi-calculation comparison, it is not only necessary for the financial department to provide data, but also for the material department to provide data. This involves the coordination of multiple positions. Due to the equality between different
departments, the efficiency of communication and coordination is low, and the
timeliness and accuracy of data are difficult to be guaranteed. Technical
limitations also make it difficult for others to use shared data directly.

Data accumulation can enhance the core competitiveness of enterprises. At
present, the society has stepped into the era of big data information, and the
construction industry is also big data industry. Grassroots workers engaged in the
construction industry have mastered a lot of data. However, summary lack
systematic summary was lacked.

THE WHOLE PROCESS OF BIM 5D SYSTEM

Based on the development of BIM technology, the online real-time BIM
5D database of engineering project dimensions can be built. The pre-stage
preparation stage, scheme stage, design stage, construction stage and operation
and maintenance stage of the project cost management can be comprehensively
upgraded. Static cost management was improved to real-time dynamic cost
management. The ability of cost management was promoted[7-8]. The
management mode of quality over flight was achieved.

The realization method of the whole process of BIM 5D system of was shown
as Figure 1.

Preliminary stage

Engineering data was collected and sorted. BIM historical database was
established. Multidimensional data were extracted from databases, such as
engineering quantity, cost, construction schedule, time. Estimation model was
established.

(2)Scheme design stage

Firstly, a preliminary 3D BIM model was formed in the system based on the
design drawings.

The overall situation of the proposed project through the visual image of BIM
virtual reality technology was understand by engineering construction company,
design unit and other related units. Online real-time communication modification
was realized. Secondly, estimation model based on similar project information in
BIM historical database was selected. Finally, all aspects of the BIM virtual
model are simulated. The estimation model was used to carry out the full phase
cost analysis of the project and determine the equipment, materials, construction
process, etc. It was make sure that the quota design was carried out smoothly.

(3) Deepen design stage

A relatively complete BIM model based on the design drawing and BIM
technology was established. The two-dimensional design scheme was replaced
with the three-dimensional visual model of the project. A kind of three-
dimensional physical graph was used to show all the building components for
optimizing the building space reasonably. The design drawing was reviewed. The
missing design was found. The ability to work together in all disciplines was
enhanced. The virtual world of human beings in the three-dimensional space of buildings was simulated.

(4) Construction stage

In this stage, the construction unit coordinated all the participants of the project and reasonably conducted construction management. Engineering change and claim was performed well. Based digital and simulation advantages of BIM, engineering changes were known by automatic statistical. CNC production, materials and construction schedule during construction was managed. The project schedule was updated in real time and visual cost comparison chart was generated. And then, cost control was strengthened. Project completion settlement was convenient.

(5) Operation and maintenance stage

During the operation and maintenance of the engineering project, the problems of equipment failure and failure to find the relevant control system often occurred. For example, service pipe the corresponding valve was not found in repairing pipes. Original information was not found in replacement facilities. Based on BIM, seamless connection of data from construction period to operation and maintenance period can be realized. Preliminary detailed data required during operation and maintenance was accumulated.

Figure 1. Whole Process Cost Management System Based on BIM-5D.
CONCLUSIONS

The BIM-5D system can cover the whole process of project construction and operation. And then, it can coordinate all parties involved in the project. Comprehensive cost management can be carried out in longitudinal (life cycle) and transverse (each project). The BIM model was the DNA of the building, which eliminated design and construction problems before they actually occur. Project controllability and constructability can be improved. This BIM-5D system breaks the "unforeseeable" tradition of the construction industry. In addition, the information of project management requires the establishment of a full-stage cost management digital information system as soon as possible to ensure the smooth progress of cost management. However, the establishment of the BIM-5D system still faces many difficulties in terms of hardware, technology and personnel quality.

REFERENCES