Research on Computer BIM Technology in Whole Process Dynamic Control of Construction Cost

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Abstract. BIM has become an important resource in construction engineering, which has a single engineering data source. Through BIM, we can solve the compatibility problem between distributed and heterogeneous engineering data. Through BIM, we can make the whole life cycle management of construction engineering, which will better realize the creation, management and sharing of dynamic engineering information. Through BIM, we can complete the Whole process (hereinafter referred to as WP) management of planning, design, construction and maintenance. Using BIM, we can update the calculation and evaluation of engineering quantity in real time, which will evaluate the design change more accurately. Therefore, BIM plays an important role in the WP dynamic control (hereinafter referred to as DC) of construction cost (hereinafter referred to as CC). Through BIM, we can carry out complex structural calculation, which will simplify the steps of project cost. BIM Technology has integrated two-dimensional, three-dimensional, four-dimensional and even n-dimensional models. BIM model has integrated all kinds of information of building life cycle, which can break the original separate cost management (hereinafter referred to as CM) mode. Through BIM, we have realized the integration of project CM of various specialties and stages, which is the WP CM mode of construction engineering.

Keywords: Construction Engineering, Whole Process of Cost, Dynamic Control, BIM

1. Introduction

BIM is the abbreviation of building information modeling, which can realize the management of all stages of the whole construction project (hereinafter referred to as CP) life cycle [1]. With the development of urbanization, the scale of infrastructure construction will increase greatly, which increases the difficulty of information management of construction engineering. Therefore, BIM is a parametric and modeling tool, which can store all data information in the database [2]. Through cloud computing, we can form a digital model, which will realize the dynamic comparison with various conditions of the construction site. Model calculation has many characteristics, such as accuracy, comprehensiveness and scalability, which can realize the visualization, sharing and Simulation of CP [3-5]. Through BIM, we can make decisions quickly, which will ensure the project management.
objectives. Through the WP of cost control, we can improve the efficiency of the project, which will help the construction personnel intuitive construction completion settlement. At the same time, designers can find the defects in the design through the three-dimensional model, which will reduce the later risk of the project [6-7].

2. Application advantages of BIM in project CM

Through BIM model, we can control the WP of CC dynamically, which has many advantages, as shown in Figure 1.

![Figure 1](image)

Figure 1. The advantages of BIM in project CM.

2.1. Helpful to control the change of design

In the early stage of construction engineering, people did not pay enough attention to the design work. Therefore, design changes are often encountered in CP management, which will affect the actual construction of CP. Design change is the most difficult work in the process of management and control. Through BIM, designers can input the changes into the relevant models [8]. Through the collision checking tool, designers can get the automatic change of engineering quantity, which can effectively reduce the impact of design changes. By controlling the design change effectively, we can calculate the error repeatedly [9].

2.2. Improve the timeliness of project cost data

Through BIM model, stakeholders can know the project progress in real time, including product quantity, price, manufacturer, size specification, design change, etc. BIM is a dynamic and real-time communication platform, which can strengthen the communication between stakeholders. Through BIM, we can get the latest developments of CP, which will reduce the loss in the process of information transmission. Through BIM, stakeholders can obtain business data timely and accurately, which will be more convenient to call the information in the database. Through BIM 5D model, stakeholders can quickly refresh the information base, which will improve the quality of information. Through BIM, we can avoid the information ossification of the traditional cost model, which will be better for the WP of dynamic control [10].

2.3. Improve the ability of project cost analysis

Traditional project CM has many problems, such as heavy calculation, large amount of calculation and so on. BIM model has rich parameter information, which can help cost analysis in each stage. Construction activities consume a lot of natural resources, which will directly affect our living
environment. Through BIM, we can simulate the simulation technology, which will better predict the changes of various kinds of energy. Through BIM, we can develop effective energy solutions, which will improve energy efficiency. Through BIM, we can improve the cost control ability, which ensures the accuracy of cost analysis [11].

3. Application in the stage of project investment decision

3.1. Investment estimation

In the CP investment decision-making stage, in order to form a scientific and reasonable decision, the relevant personnel need to complete a large number of comprehensive information collection. In BIM, BIM itself has data information of construction engineering, which provides sufficient data information for reasonable investment estimation. BIM Technology plays an important role in the investment estimation of project decision-making stage. In practice, we can extract the historical data information of BIM database. Combined with the actual situation of the corresponding CP, we can implement the adjustment, which will form the required new project data. By referring to the new project information, we can fully complete the calculation of project quantities. By comparing the market price information of materials, personnel and equipment in BIM database, we can estimate the investment of new projects.

3.2. Scheme comparison and selection

BIM has the functions of visualization and simulation. In the project investment decision-making stage, BIM can intuitively display the three-dimensional model of the building. Decision makers can directly compare the three-dimensional models of different schemes, which can make better scheme selection. In the process of scheme comparison and selection, BIM Technology mainly relies on scheme features, which can separate, extract, change and combine the models of similar CP. Through a variety of implementation models, we can finally form a more diversified model of CP. Combined with the revised content, we can implement the sub calculation, which will urge the decision-makers to complete the screening of the optimal scheme.

4. Application in engineering design stage

4.1. Quota Design

In the process of DC of project cost, quota design is an important means to control project design cost. In the traditional cost control work, we mainly use the budget method, which is difficult to ensure the change of the design scheme. Through BIM, we can avoid the budget problem, which can strengthen the practical effect of limit design. In this process, BIM model database can complete the comprehensive and accurate acquisition of building basic data. By combining quota indicators, we can complete the design. With BIM Technology, we can simultaneously complete the analysis and calculation of unit CC in the design of CP, which can realize the design optimization. Through BIM, we can ensure the economy of the project, which can improve the rationality and operability of the design.

4.2. Collision check

Collision checking is an important function of BIM. In the actual construction engineering design stage, we can achieve the effect of reducing the probability of design changes, which will avoid rework, waste
of resources and other problems in the subsequent construction stage. Through BIM, we can realize the effective control of project cost. Through BIM Technology, we can reduce the change out of budget by about 40%. For the collision checking function, we can reduce rework and engineering changes. In the BIM 3D model, different specialties and components can be coordinated in the engineering design stage, which can determine the design loopholes. An example of collision check is shown in Figure 2.

![Figure 2. Example of collision check.](image)

5. Application in the project implementation stage

5.1. Bidding stage

The CM work in the bidding stage is mainly to do well in every step of the bidding work, which will select the best construction unit. The most important thing for the construction unit at this stage is to do a good job in the bidding documents, the target and the block price, which can make the bidding work smoothly. The most important work of the construction unit in the bidding stage is to master all kinds of bidding skills and combine with the bidding documents, which can calculate the most suitable bidding price. Through the preparation of high-quality bidding documents, we can ensure that we can win the bid. Through BIM Technology, we can make the construction units and design units to apply BIM model, which can quickly get the information of engineering quantity. Through BIM, the bidding unit can work out more accurate block price and bidding quotation, which has changed the traditional construction unit to spend a lot of manpower on the audit of quantities. Through BIM, we can reduce all kinds of errors, which can make the CM achieve the best state.

5.2. Construction stage

The construction stage is the stage of the project from the design drawings to the construction entity, which has many factors affecting the cost. Construction quality directly determines the cost of maintenance and operation in the later stage of the project, which needs to strengthen the management of CP cost. In the first mock exam, BIM technology can help us integrate different professional contents such as civil engineering, hydropower, HVAC to the same model platform, which is convenient for all participants to conduct comprehensive drawings review. Through the collision inspection, we can find the pipeline collision problem of the CP in time. Through the visualization function of BIM Technology, we can check out the errors in the design, which can make the later construction more efficient. Through BIM, we can reduce claims, speed up progress and save cost, which can be used for 4D simulation construction. The cost personnel in the construction stage can directly import the BIM model into the corresponding cost software. Through the automatic summary function, we can quickly calculate the project cost. Through BIM, we can more easily query the progress payment audit and funds. In the
construction stage, material managers can skillfully use the database of BIM model, which can more accurately determine the consumption of building materials. Through BIM, we can avoid the shortage of materials, which will make the management of materials more convenient. Through BIM Technology, we can quickly calculate the completed quantities, which can achieve dynamic cost monitoring.

5.3. Project Acceptance

With the implementation of the project, the engineering information in the database is also increasing. After the construction stage, the data information in the database is more perfect, which can accurately express the project entity. BIM model information can ensure the integrity of information, which improves the efficiency and accuracy of settlement. At the same time, through BIM, we can reduce some dishonest behaviors in settlement, which can make the project participants complete the settlement quickly and accurately. Through BIM, we can strengthen the return of funds, which will save costs.

6. Conclusion

Through BIM, we can collect all-round information of project cost, which is the basic of DC of the WP of project cost. Through BIM, we can carry out scientific CM in the project investment decision-making stage, design stage and project implementation stage, which will improve the DC effect. BIM promotes the upgrading of the WP DC of project cost, which has become the key point to increase the economic benefits of CP.

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