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The whole process cost management based on BIM

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Abstract: The-whole-process cost management is the overall process of engineering construction from feasibility study through preliminary design, construction preparation, contracting, construction, completion and post-evaluation. All organizational activities and business behaviors centering on engineering cost can ensure the investment benefits of construction projects. this paper introduces how the cost management of BIM technology plays a role in the project construction.

1. Introduction

At present, China's construction project is in the whole process cost management mode, engineering cost control is divided into decision-making stage, implementation stage (design, construction) and operation stage according to the stage of engineering formation; corresponding to it is estimation, budget estimate, contract price, construction budget, payment of progress payment, completion settlement, etc.

Engineering cost management every link data volume is quite large, the calculation procedure is also very complicated; with the development of market economy, the large scale complex projects in large and medium-sized cities have also increased significantly, and the cost management has become more and more difficult. The traditional manual calculation and the software budget of the single machine have fallen far behind the needs of the times; There has been no breakthrough in cost management software. The present cost management technology mainly has the following limitations:

The cost analysis data is not accurate enough, the function is relatively weak; the cost of the current mainstream software method to the set price or form, can only analyze a list of the total data, data granularity cannot achieve project management process requirements, it just meet the bidding budget and settlement; it cannot satisfy the floor according to the construction area according to component analysis; it cannot achieve more based on the analysis of the time dimension, either.

Cost is difficult to achieve process management .Detailed cost management needs to be detailed to different time, different components, different processes and so on. The construction enterprise only knows the end of the project at one end of the price, The construction enterprise only knows the price of the project beginning and ending, the process cost management completely abandoned. It was only after the project was done that the actual cost is largely different from the budget, and it was too late to take action. In the case of developer, budget over expenditure phenomenon is very common. The important reason for cost overruns is the inability to make accurate estimates, followed by the lack of reliable cost data



Building Information model (BIM), namely the implementation of construction engineering design, construction and management of engineering Information models and parameterization, BIM also has been described by many domestic and foreign designers as the second "revolutionary" technology in the construction industry after CAD technology [1]. The following is based on BIM technology cost management how to play a role in various stages of project construction.

2. Application analysis of BIM in the whole process cost management

BIM technology can be applied to the decision-making phase of the project to estimate design phase of the initial estimate and the revised estimate and construction drawing budget, to the bill of quantities of bidding and tendering, pre-tender estimate, bid price quotations, and then to the construction process of engineering measurement, the construction claim, progress payment, change visa payment, funds plan and deviation analysis, finally to project completion of data compilation and completion settlement to handle the whole process of construction project cost.

2.1 Decision making stage

In each stage of project construction, the decision-making stage is very important to the project cost. the decision-making stage is the basic stage of determining the project cost; Only in the decision-making stage, the actual control of the project cost can ensure the realization of the project cost goal; in the stage of project investment decision, the data of the previous BIM model can be utilized [2], and the cost of similar projects per square meter is estimated, and the cost of such a project is estimated; according to the historical engineering model of BIM library, make simple adjustment, estimate the total investment of the project and improve the accuracy.

2.2 The design phase

The design fee of the project is only 1% to 3% of the cost of the project, but the design determines more than 70% of the cost of the project; the design stage is the key to control the cost of the project; the design quota indicator is proposed by the developer independently, The aim of the current quota design is to change the project cost from "control" to "reduce" project cost; the BIM model is used to measure the cost data. On the one hand, it can improve the accuracy of calculation, and on the other hand, it can improve the measurement depth; After the design is completed, the BIM model is used to quickly make the budget estimate, and check whether the design indicators meet the requirements, control the total investment, and give play to the value of the limit design.

2.3 Bidding stage

With the gradual application of the bill of quantities bidding in the domestic construction market, the developer can provide the quantities required for the bidding quickly and accurately according to the BIM model; and then, they can avoid disputes arising from engineering quantity problems during construction. It is reasonable for the general project personnel to calculate the engineering quantity error in the case of plus or minus 3%. If a large project is encountered, the result of complex engineering and irregular engineering is more difficult to say.

As for the Construction enterprises, due to the tight bidding time and relying on manual calculation, it is difficult for most projects to check the bill of quantities, and only part of the engineering department and subhead can be checked, which will inevitably lead to mistakes. The BIM model can be used to quickly check the amount of project, so as to avoid the loss caused by the volume problem, such as China railway.

The extraction of engineering quantity from BIM model data is simple and efficient, which avoids the tedious calculation work of cost engineers; however, this part of work will not disappear, but the designer will finish the building model in advance by defining various component properties of the building model when applying the BIM series software modeling; since the software adopts 3d modeling, all the input models can be displayed in 3d and calculated quickly. if there is any doubt about the calculation result, it can be visually checked through 3d display;. Since the designer replaced

the cost engineer to complete the work calculated, the corresponding reward should also be sent to the designer; therefore, in each project, the cost engineer's remuneration will gradually reduce.

2.4 The construction phase

After the completion of bidding and the determination of the general contractor, there will be a maximum range of design disclosure and drawing review meeting led by the construction unit and attended by the design, construction and other units, this meeting most can only increase the project cost to resolve the problem, but can be settled before the formal construction, can reduce visa, reduce rework cost and the contractor's construction claim, and with the intervention of the contractor and construction control company, it can review from the Angle of construction and supervision of the drawings, find errors and unreasonable factors; however, the traditional drawing review is based on two dimensional plane drawings, and each professional drawing is designed separately. It is difficult to detect problems by artificial inspection. using BIM technology, we can integrate the majors into the unified platform and carry out three-dimensional collision inspection. We can find a large number of design mistakes and unreasonable places to provide effective support for project cost management; when the work amount of the whole project is calculated, the BIM software can use the "cloud model check" function based on the Internet function to intelligently judge the errors of graphs and attributes, the missing calculation and errors of work amount, and some errors can be repaired with one key, which can save the construction unit time and avoid economic losses.; of course, Collision check is not only used in the construction stage, the blue prints .the design in the project plan design, preliminary design and construction drawing design, and construction units can take advantage of and design company has dozens of times and can make use of BIM technology of drawing review.

In addition, the construction unit can use BIM technology to arrange funds reasonably and review the payment of the progress payment. especially, for design changes, the project cost can be adjusted quickly, and relevant components are related to facilitate settlement; construction unit can use BIM model to press the time, according to the process, according to the area project cost, convenient cost control, make the detailed management, such as control material dosage, reasonably determine the material price.

2.5 Settlement stage

There are several areas where problems can arise in settlement

2.5.1 If there is any deviation in the understanding of the construction contract and site visa, only the explanation in favor of the construction party shall be made, which is easy to make mistakes in the understanding.

2.5.2 Due to lack of investigation and reliable first hand data, the budget quota, meter or supplementary quota is not reasonable, so the actual cost is far from the norm.

2.5.3,Some construction units have overestimated the cost by using multiple project quantities and high set quotas in order to obtain more income unilaterally.

2.5.4 Due to the uneven level of engineering cost staff, the settlement becomes unreal.

The BIM model ensures the accuracy of settlement. Most of the verification work of settlement is completed in the construction stage, so as to reduce disputes between both parties and accelerate the settlement speed.

3.Suitability of BIM in construction engineering cost management

*3.1*BIM database information is updated rapidly.

BIM technology can be parameterized construction in all kinds of information can be converted to 3 d model, when the construction project change or material market price changes, you just need to adjust the corresponding information in the BIM model, the entire database will change accordingly, in the project database in a constantly changing throughout the lifespan[2], the information in the database contains the quantity of construction components, the market price of construction materials and the design change of construction projects.

3.2 Effectively improve the accuracy of engineering quantity calculation

Based on the BIM parameterized model, according to spatial topological relation and 3D Boolean algorithm the cost staff only needs to adjust deductive calculation rules in the BIM software according to the local calculation rules of engineering quantity; the system will automatically calculate the component deduction, and calculate the engineering quantity information more quickly and accurately .this not only reduces the human error, but also facilitates the fine management.

3.3 Realized dynamic management of engineering cost

A 5D building model is built with the help of the BIM 3d model and the time and cost dimensions to realize dynamic real-time monitoring, which can make personnel plan, material plan and mechanical plan more reasonable; in the BIM model, each component is given parameterized information, such as schedule, materials, process arrangement, etc., and each component information can be combined at will, which provides technical support for the research of engineering projects.

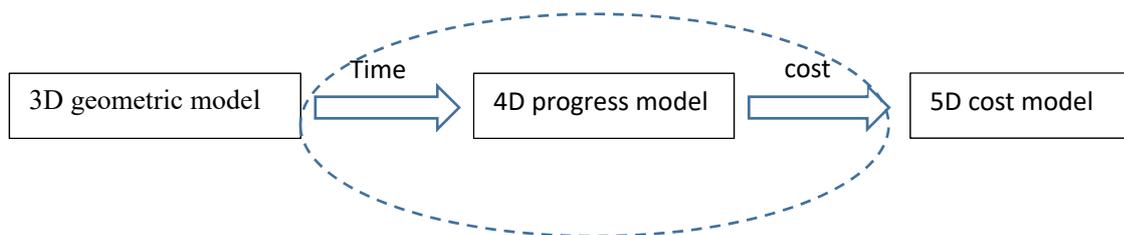


Figure 1. 5D building model of BIM.

3.4 Facilitate the accumulation and sharing of data

Take advantage of the BIM model and Internet technology, these data can be saved and summarized in detail through the database. when it is necessary to analyze and find, it can be found quickly, making the exchange and sharing of data more convenient, the BIM database formed in the continuous accumulation of the historical data related to the project can combine the relevant reference historical data to enable the enterprise to form the BIM model of the proposed project in the process of cost management; BIM - based unified cost information management platform can achieve better data sharing and communication[3]

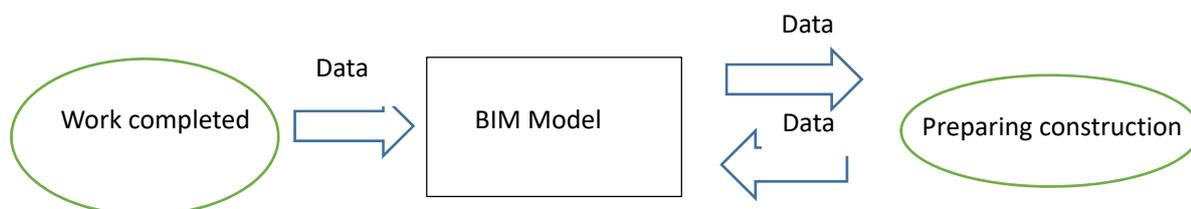


Figure 2. Accumulation and sharing of data.

4. Cloud cost technology contributes to BIM data accumulation

In terms of the whole process of project cycle or cost, BIM model will be produced at each stage, namely the model is the carrier.; Corresponding data will be added and produced at each stage. On top of these data, the model is the carrier, which is conducive to the accumulation and precipitation of data.

At the same time, these data can be processed and deepened through cloud cost system, and the key indexes can be extracted to our cost database; especially for the cost consulting industry, data is our core competitiveness, in the past, due to limited resources and energy, it was difficult to form a good habit of accumulation. now cloud computing technology provides us with favorable conditions and lays a foundation for sustainable development, cloud cost data, as the carrier of cost data, and BIM as the carrier of cloud cost, are closely connected and cannot be separated. This explains the relationship between cloud cost and BIM [4].at present, a series of measures, such as big data development, cloud cost application and BIM software launch, are making continuous efforts for the development of the construction industry.

BIM has incomparable advantages in informatization of cost management, which is of great significance for improving construction project cost management informatization level, improving efficiency and even improving cost management process.

5. Problems and Suggestions for realizing the functions of BIM

5.1 system Problems and Suggestions of inconsistent data transmission standards

At present, the different functions of software of informatization obstacles still exist in the data transfer and sharing; it is usually a design department to do a set of model,, cost unit and make a model, construction management and even need to build a data model, which affect the level of vertical integration, integration of construction industry, also lead to repeated work, higher costs; one of the key reasons is that there is no unified data transmission standard, which reduces the level of data sharing [5].

Therefore, it is necessary for the Chinese government to establish more systematic standards for the transmission of architectural data, and unify the information data transmission mode of the construction industry in the form of law; this is conducive to the application and popularization of BIM technology in China.

5.2 Problems and Suggestions on the inconsistency of BIM information classification system

At present, different agencies or project cost at different stages of the participants on the same project, we will write a different elements and at this point, if the data transmission have matters, data can be efficient and enjoyment, but transmit to reference project cost data and proposed model artifacts can't automatic recognition and matching, it will seriously affect the efficiency of BIM data call.; to realize the efficient cost information sharing of BIM technology, a complete construction industry information classification system is indispensable. A unified building information classification system can enable different regions and organizations to share the data transmitted and realize rapid matching [6]

5.3 conclusion

With the deepening application of BIM technology in cost management, the construction engineering industry will become more transparent and orderly, relevant enterprises can earn reasonable profits, and the focus of enterprise development will be on internal management, cost control and technological innovation.

For the engineering cost consulting industry, BIM technology will be a subversive revolution, which will completely change the behavior mode of the engineering cost industry and bring new vitality and vitality to the industry.

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