Research on Construction Process and Strategy Optimization under BIM Technology Background

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Abstract. In recent years, the economy has developed rapidly and the construction industry is an important part of the development of the national economy. The construction of a building is one of the most important steps in the construction process. How to manage the progress of the project scientifically and effectively has become an urgent problem for the current construction industry. The traditional management models are mostly empirical and intuitive management, relying on artificial management planning for construction progress. As a kind of information visualization technology, BIM can simulate every stage of construction and arrange the construction process rationally and effectively. The establishment of a BIM platform enables intuitive and effective sharing of information at all stages. This article is based on BIM technology, and scientifically manages the construction progress of the building. It aims at information management of construction progress, reducing costs and shortening the construction period. It also provides a theoretical basis for building information and the application development of BIM in the construction industry.

Introduction

Building Information Modeling (BIM) is a digital information processing model for building project management based on various related information data of construction projects. BIM technology can be used for optimal management and control of construction progress. It has broad application prospects[1]. The completeness of information and management efficiency for construction project management of construction projects are not high. This paper proposes an optimization model for building construction progress based on BIM technology. The results show that using this model to plan the construction progress of the building can save expenses and reduce the construction period[2].

Traditional Construction Schedule Management

Traditional Construction Progress Management Method Classification

(1) Bar chart method

The bar chart is also called Gantt chart. In the table with time coordinates, a horizontal line is used to represent a job. Different colors represent different stages. The time coordinates corresponding to the starting and ending position of the horizontal line segment represent the beginning and ending time of the job.

(2) Network plan map

In the project schedule management work, the network plan diagram is usually used to represent the project schedule. The network plan diagram is a network graph composed of nodes and arrows, used to represent the logical relationship between the directions, orderly and sequential work. A task can be represented by a network diagram.

(3) Key chain method

The key chain method is a schedule analysis technique that considers both deterministic and random, and it can adjust project schedules with limited resources. First estimate the duration of
each activity in the project, draw the project schedule network diagram according to the given dependency and constraints, and then find out the key route. After finding the key line, take into account the availability of resources and the number of cases, draw a resource-constrained schedule.

**The Disadvantage of Traditional Schedule Management Methods**

(1) Network plans are abstract, often difficult to understand and enforce

Although the network plan diagram is currently the main tool for project schedule management, the project schedule management still has problems. First of all, the network plan diagram is computationally complex and difficult to understand[3]. It is only suitable for professional internal use. Secondly, the network plan diagram expresses abstraction, which cannot visually display the project's planned progress process, nor is it convenient to track the actual progress of the project. Thirdly, the network plan map requires that the project work breakdown be detailed and the logic relationship be accurate. These are all dependent on the subjective experience of the individual, and various problems often arise during actual operations.

(2) 2D drawings are inconvenient for coordination and communication among professionals

Due to the limited degree of visualization, two-dimensional drawings make the work between the majors relatively separate. Whether it is in the design stage or the construction stage, it is very difficult to express the project as a whole. It may be very smooth for each major to work alone, but once the various professions are combined to work collaboratively, there will be collisions and contradictions, which will bring difficulties to the successful completion of the entire project[4].

(3) Traditional methods focus on experience and cannot be standardized and refined

With the continuous development of project management technology, standardized and refined management will be the trend. However, the traditional schedule management method largely depends on the experience of project managers, and it is difficult to form a standardized management model. This kind of empirical management method is subject to subjective factors, so it is imperative to introduce new management techniques and update traditional management methods.

**Construction Progress Management Method Based on BIM**

**BIM and Construction Progress Control**

The construction progress management based on BIM aims at satisfying the owner's requirements for the construction period, deepens the design model provided by the design institute, integrates the demand information of the owner and related stakeholders, and based on the characteristics of the project, the construction capacity of the construction company is to perform the project decomposition, the construction of the construction schedule, the actual progress of the track record, the analysis of the progress, and the correction of the deviation.

Based on BIM's project construction schedule management, accurate calculations can be made on the use of people, materials, and machines required at each stage of construction, and the accuracy of the construction schedule budget can be improved to ensure a reasonable allocation of resources[5]. Associate construction progress information and resource configuration information with related components of the BIM model, and repeatedly perform multi-dimensional construction simulation and dynamic analysis of the overall progress and partial progress of the construction project, continuously adjust the construction sequence, optimize resource allocation, and formulate more detailed and scientific The BIM-based project construction schedule management process is shown in Figure 1.
Using BIM to Construct Information Model

The traditional two-dimensional design of each major and each drawing is independent of each other, and there is no correlation. It is inevitable that there will be some problems with the inconsistency between drawings. In the BIM model, each individual building component is represented only once, building individuals such as shapes, attributes, and positions in the model[6]. All drawings, reports, and analysis information sets obtained in the same version of the BIM model are related to each other, and one is changed and updated everywhere. This function can solve the problem of inconsistency of each drawing. And in the process of building a three-dimensional model, an intuitive and comprehensive understanding of the project can be obtained, so that errors and defects in the design can be found before the construction of the project, and the quality of the engineering design can be improved. The speed of modeling and the accuracy of modeling directly affect the effectiveness of the application at the end of the project. In the initial modeling of a construction project, Autodesk's Revit 2015 software was selected. Revit has the powerful functions of architectural design, structural design, and electromechanical design modeling, and can accurately and flexibly represent the geometric and physical characteristics of components. In the Revit model, all drawings, plan views, 3D views, and schedules are built in the same database of building information models. There is a close relationship between 3D models and drawings. Therefore, one revision is made everywhere else. It will be automatically modified, saving a lot of manpower and time to adjust the drawings, to ensure coordination between the drawings. When you create a model, you can also adjust the parameters of the original component family to create the current model, which can greatly increase the modeling speed.

Project Planning and Duration Optimization

The preparation of BIM-based construction schedules is consistent with the content of traditional construction schedules, including the establishment of work breakdown structure, duration estimation, and the logical relationship between work and other steps. In the same way, the first step is to establish a work breakdown structure, which is usually done with related software. Linking construction schedules, resources, and other information with related components of the BIM model can complete the construction schedule.
BIM-based construction progress management can be implemented with a variety of software. This project mainly uses Autodesk Navisworks Management and Microsoft Project software to simulate. First, based on the project statistics, according to the requirements of the contract period and construction requirements of the pipeline construction in Microsoft Project construction schedule. Then the project's BIM model is imported into Navisworks Management, and the model is archived in Navisworks Management. Some fragmented components can be combined to create a component set. The component set contains components that are independent of each other and each has its own information. The set of components is the smallest unit of work during the construction simulation, and its name must be exactly the same as the name of the task in the construction schedule and it is a one-to-one correspondence.

**Construction Schedule Simulation**

The construction simulation based on BIM visualizes the construction process of the entire project in a 4D or even 5D visualization manner. The project management personnel can view the stages of the construction process in a visual environment and can more easily identify the problems in the construction organization plan. And then optimize the construction organization, realize the construction cost, quality, safety, resource allocation and visual management of site information, improve work efficiency, shorten the construction period, and save costs[7].

The dynamic simulation of the construction process is a very important function in the control of the schedule, and it is also a way that traditional schedule control does not have. The dynamic simulation function of the construction process refers to a three-dimensional simulation of the progress of the project after the project plan has been prepared, through a dynamic way, according to the time schedule, and the project management personnel can have a whole process of the project from the construction simulation of the project. A clearer understanding of the overall situation of the projects at different stages and the overlapping relationship between the processes. At the same time, the plans are adjusted according to the dynamic simulation process. In addition, during the construction process, after the schedule is adjusted, the modified model can also be observed in three dimensions through the dynamic simulation function of the construction process. On the one hand, it can assist the scheduler to verify the revised plan, find out the problems existing in the schedule through the 3D model, and make improvements, and on this basis, reasonably arrange the work surface of the project and the plans for the entry and exit of machinery and materials; On the one hand, the construction staff can be given a more comprehensive understanding, intuitive understanding of the process of the project, to help them complete the construction task more efficiently and accurately, reduce rework to avoid delays in the duration.

![Image 1](image1.png)
![Image 2](image2.png)

**Figure 3. Index bed construction simulation.**

In addition to the sequential dynamic simulation, the system also needs to have a reverse construction simulation function, that is, the entire construction process is reversed from the progress of the construction process in reverse order, this function can help managers to more clearly understand the overall process of project composition, and at the same time In the event of
progress problems, reverse tracking is used to find the work package in which the problem occurred and timely remedial measures are taken.

**Summary**

This article compares the traditional construction schedule management with the new construction schedule management model based on BIM technology, and based on practical examples, it concludes that the integration of BIM technology and construction schedule management can increase production efficiency, shorten construction period, and make construction more scientific and effective. At the same time, it also provides a theoretical basis for the construction procession and BIM application development in the construction industry.

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