Research on Construction Engineering Management based on Modern Engineering Technology

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Abstract. Engineering technology plays an important role in ensuring the construction quality of construction projects. Under the background of the new era, this paper takes construction engineering as the main research object, studies and analyzes the modern engineering technology applied in construction engineering, defines the role of the application of modern engineering technology in ensuring the management effect of construction engineering, and discusses the application and development trend of modern engineering technology in construction engineering management by case analysis and other methods in combination with actual engineering cases.

Keywords: Modern engineering technology; construction engineering; project management

1 Introduction

Modern engineering technology is developed on the basis of architectural engineering concepts and advanced technical levels in the new era, and can reflect the characteristics of flexibility, comprehensiveness and practicability in the actual construction and development of architectural engineering. Under the background of increasing construction requirements and increasing number of projects, the types of modern engineering technology are also increasing, and the scope of engineering is not short of expansion. From the perspective of construction management, this paper analyzes the measures of applying modern engineering technology to promote construction management, which has positive significance to promote the construction and development of construction engineering.

2 Modern engineering technology in construction engineering management

2.1 Modern group technology

Group technology is a typical modern engineering technology, which can use the nature of the specific construction content in the construction project, divide the

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whole construction project into several groups, and then carry out the construction method, so as to improve the production efficiency of the construction project. In order to give full play to the role of group technology in construction engineering management, the most important thing is to solve the processing and sorting problem in the application of group technology. Combined to the actual construction situation of the construction project, the group sorting problem of the n construction content of the construction project can be described as dividing the construction content into m group, and the group i is recorded as Gi, then the construction content in Gi is Ji1, Ji2, Ji3, ..., Jin; i=1, 2, ..., mm; n1+n2+n3+...+ nm=n. Under this premise, when n construction projects are started, only after a specific construction content can another construction content be carried out for another construction content. And this steering process also requires an independent adjustment time. Considering the adjustment time is related to the specific construction content type, so it is necessary to determine the process [1] between different construction contents. Under the requirements of group technology, the three-parameter representation can be applied to record the construction engineering group problem as:

$$l\,|r,S,GT|f(C)$$

In the above formula, r represents the preparation time vector of the construction content; S represents the vector of the construction adjustment time; GT represents the sequential construction of the construction content of the same group; f(C) represents a given objective function; l representative derivative.

Practical application of the technology for engineering management, combined with engineering planning management system, around the construction unit, construction unit and supervision unit, and other subjects, from the arrangement of multiple construction content and planning to find out the optimal solution, in order to realize the completion time and completion content between reasonable planning and arrangement (as shown in Fig. 1).

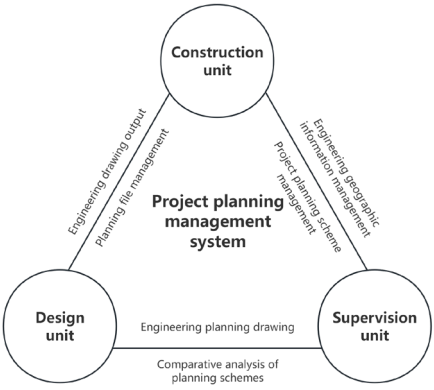

Fig. 1. Multiplexed network model

2.2 Building information model technology

Combined with the general development trend and background of the current construction industry, building information modeling technology [2], as a typical modern engineering technology, has played an important role in promoting construction management. The idea and form of building information model applied in architectural engineering are gradually mature. At present, in the aspect of supporting construction project management with building information model technology, more emphasis is placed on implementing the concept of sustainable development and green building through effective construction project management [3]. From this point of view, based on the purpose of reducing building energy consumption and improving building comprehensive benefits, the application of building information model technology can strengthen the standardized management of building projects from the construction stage.

Under the background of implementing the whole life cycle theory of buildings, building information model technology is applied to realize effective monitoring of carbon emissions [4] of construction projects based on various engineering data collected from on-site inspection of construction projects, and then the results are reflected in the engineering model to provide a more scientific and reliable basis for engineering optimization design. In this process, taking the carbon emissions consumed in the production and transportation stage of building materials as an example, it is required to set the system algorithm program in the building information model based on the following formula in advance:

Building materials production stage: $E_{Mat}=\sum Q_{Mat,i}\alpha_i$

Construction material transportation phase: $E_{Trans}=\sum Q_{Mat,i}L_i\eta$

In the above formula, E_{Mat} represents the carbon emission of the building materials production stage; $Q_{Mat,i}$ represents the amount of the i building materials; α_i represents the carbon emission factor of the I building materials; E_{Trans} representing the transportation stage of building materials; L_i represents the transportation distance of the ith building materials; η represents the carbon emission coefficient of the corresponding transportation vehicle.

2.3 Automatic control technology

The application of automatic control technology also plays an important role in ensuring the management effect of construction projects. Based on the detection and analysis of seismic performance, stability, bearing capacity and other data indicators in the construction of construction projects, combined with the application of drones, photography equipment, etc., the comprehensive inspection of construction projects is realized, so as to provide more accurate inspection results for site managers. Thus, the potential quality problems in the construction of construction projects can be found in time. In the context of the new era, automatic control technology has been able to combine with intelligent technology, according to the results obtained by detection, to achieve intelligent judgment and analysis of abnormal changes in building related parameters. In this process, automatic control technology can also be combined with

BIM technology [5]. For example, in the management system based on building engineering, Pushover analysis method is applied to build an elastic-plastic model based on building structural design requirements combined with the construction site situation, and then the force is applied to the building model by simulating earthquake action, and then the quality effect of building construction is analyzed according to the deformation of the building model. In this process, the displacement of the building structure is mainly calculated and analyzed according to the following formula:

$$\delta_t=C_0C_1C_2C_3S_aT_e^2/4\pi^2g$$

In this formula, δ_t is the target displacement of the building structure, S_a is the spectral acceleration, T_e is the effective basic period of the building structure, C_0 is the correction coefficient between the peak displacement of the building structure, C_1 is the correction coefficient between the actual maximum elastic displacement and the expected value of the building structure. C_2 is the correction coefficient of the maximum displacement reaction character, C_3 is the correction coefficient after the yield of the building structure member, and g is the gravity acceleration.

After calculating the displacement change of the building in the building model, it is combined with the building in the actual construction, and the problems existing in the building structure model in the actual construction are clarified through automatic comparative analysis, so as to better strengthen the management of the construction project and ensure the construction effect of the construction project.

2.4 Virtual reality technology

Virtual reality technology [6] is mainly based on information technology, combining information technology and system software technology to achieve effective management of construction progress and quality in the way of real simulation of construction site. From this perspective, virtual reality technology is the optimal development of BIM technology. In the actual construction of the construction project, Revit software can play a role to display the results of the construction project in a 360° panoramic way. At the same time, with the function of the system software, the original data of the construction project can be analyzed, and then the overall structure of the building can be restored as the main basis for the management of the construction project. In this process, Revit software can also be used as an effective tool for planning and displaying construction projects, so that all units involved in construction projects can understand and master the operation and construction of the project, so as to provide a basis for construction project management [7].

3 Application analysis of modern engineering technology based on examples

3.1 Project Overview

The total building area of an intelligent project reaches 40322m 2, among which the building area of the library is 28770m 2, the building area of the archive is 11552m 2, and the height of the building is 40m, including one floor underground, and six floors above ground, which belongs to a typical multi-storey public building. In the actual construction, the construction project mainly follows the development requirements of low-carbon and green buildings in the new era. On the basis of combining the value range of low-carbon building design parameters, the reasonable planning of the building project is realized (as shown in Table 1).

Table 1. Values of low-carbon building design parameters

Design value	Take value 1	Take value 2	Take value 3
Body coefficient	0.17365	0.21635	0.25261
Window wall than	0.2	0.4	0.6
Outer window K value / $W \cdot (m^2 \cdot k)^{-1}$	1.5	3.0	4
SC value of outer window	0.2	0.4	0.8
Outer wall K value / $W \cdot (m^2 \cdot k)^{-1}$	0.4	0.8	1.2
Roof K value /$W \cdot (m^2 k)^{-1}$	0.3	0.6	0.9
orientations	East-south 30°	South	Southwest 30°

3.2 Application analysis of modern engineering technology

In the actual construction of case engineering, based on the purpose of strengthening the management of construction engineering, the modern group technology, building information model technology, automatic control technology [8] and virtual reality technology are combined to continuously improve the management effect of construction engineering. In this process, the management personnel first according to the overall construction situation and requirements of the project, some similar characteristics, the same construction process and similar attributes of the content of the group, and then according to the specific management group, take targeted management measures and methods, standardize the specific construction behavior and process.

For example, in the processing management of steel bars, it is required to determine the specific location and number of steel bars processing sheds in combination with the site situation, and ensure that the on-site tower crane can cover all the scope of the project construction. In the preparation stage of steel bar engineering, it is necessary to carry out no-load test on all kinds of mechanical equipment involved in steel bar processing. During steel bar processing, the sequence flow of steel bar processing should be strictly followed to ensure that the changes in construction parameters involved in the process of steel bar processing meet the corresponding standard requirements; When protecting the semi-finished steel bars made on the construction

site, the steel bars are required to be stacked neatly according to the corresponding type and application of the floor, and corresponding protective measures need to be added to some steel bars that are easily damaged or deformed. In the reinforcement installation process, the reserved holes for hydropower pipeline construction should be embedded according to the results of measurement and pay-off, so as to ensure that the reinforcement installation and construction can be combined with the subsequent engineering concrete construction, and the construction quality of the project can be better guaranteed [9].

3.3 Project Overview

In order to give full play to the role of all kinds of modern engineering technologies in construction engineering management, it is required to start from the whole construction stage of construction engineering and provide complementary advantages between different engineering technologies to provide more favorable basis for engineering management. Specifically, in the architectural design stage, should be able to use building information model and virtual reality technology, simulation site model and scene, focus on the complex parts of the project construction, combining the construction plan and the construction drawings and requirements, realize the optimization of construction pipeline layout, avoid pipeline collision. In the actual construction of the engineering construction scheme need to change, but also can be directly based on modern engineering technology system, in the system software input before and after the relevant data, and directly implemented by the system program to adjust the relevant parameters, and can adjust the parameters of the building model presented in front of the relevant personnel, provide reference for the development of management work.

3.4 Project management evaluation

After the application of modern engineering technology in engineering management, the case project combined with the overall requirements of engineering construction and the site situation, through the comprehensive analysis of the performance of the building structure, the construction scheme more suitable for the project was selected from the listed schemes, which effectively guaranteed the mechanical performance, structural stability and quality effect of the building structure. From the perspective of construction engineering economy and low-carbon environmental protection, the loss rate of cast-in-place steel bars in the case project was reduced from 3% to 2%, green electricity was used instead of energy application, the green land rate was increased from the original 30 to 35%, and the assembly rate was increased from the original 40% to 50%, which not only effectively increased the construction cost of construction projects, but also implemented the concept of green building. Improve the quality of construction projects [10].

4 Conclusion

To sum up, the application of modern engineering technology to construction engineering management is of great significance to improving the management effect of construction engineering and ensuring the quality of construction engineering. Combined with the overall construction situation of the construction project, when carrying out the management work, we should be able to choose the appropriate type of modern engineering technology, so as to better play the role of modern engineering technology. However, this study also has some limitations. For example, this paper mainly discusses the application of several modern engineering technologies in construction project management, and the scope and depth of application of these technologies may be limited by actual engineering conditions, technical maturity and cost. And the case analysis in this paper is mainly based on a specific intelligent building project, although it has a certain representativeness, it may not cover all types of building projects, especially those with small scale or poor technical conditions.

In the future, we should further study and optimize the existing modern engineering technology, especially in the application of intelligence, automation and green building, and improve the maturity and applicability of technology. In the direction of case studies, more types of construction engineering case studies should be carried out, covering projects of different scales and different technical conditions, and verifying the applicability and effect of modern engineering technologies in different environments.

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