Exploring the Design and Construction of Aluminum Formwork Based on BIM Technology

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Abstract: Aluminum formwork is a new type of formwork system. It is easy to install and disassemble, can be turned over many times, has good forming effect, and has the advantages of green environmental protection. The application of aluminum formwork construction in construction projects can improve engineering construction efficiency and ensure project quality. BIM technology has the advantages of visualization, simulation and synergy. Combining the design and construction of aluminum formwork with BIM technology can give full play to the advantages of both, and use BIM technology to design, mold and construct aluminum formwork, effectively improving the design efficiency, optimization of the model. And in order to improve the level of aluminum formwork management, we can standardize the operation of construction personnel through the three-dimensional cross, so as to improve the level of construction technology. In view of this, this paper will summarize the application of BIM technology in the design and construction of aluminum formwork. The matters needing attention in the light of the BIM technology and the concept of aluminum template, combined with the principle and characteristics of BIM technology, and briefly analyze its economic benefits.

1. BIM Technology and Aluminum Formwork Construction Overview

1.1 BIM Technology Overview
BIM technology is a building information model and a digital technology based on 3D virtual technology. It has the characteristics of visualization, simulation and synergy. At present, this technology is widely used in various types of construction due to its outstanding application advantages. Applying BIM technology to the design and construction of aluminum formwork in construction engineering can realize the management and optimization of engineering project planning and design. At present, there is no unified concept definition for BIM technology, but its essence is a digital model based on computer technology. It utilizes the characteristics of information technology to realize the management of engineering design and construction, realize intelligent project management, and ultimately can be effective. Finally, it can improve management level, reduce construction costs, ensure the quality of overall construction projects, and promote the sustainable development of the construction industry.

1.2 Aluminum Template Overview
The aluminum formwork consists of a formwork system, fastening system, support structure and accessories. It has high strength and thickness and can ensure rapid forming during concrete pouring. The application of aluminum formwork technology in construction engineering can take advantage of its own small weight, convenient support system, simple operation control, short construction period, high strength, stability and carrying capacity, which is beneficial to the improvement of the overall
building. quality. Specifically, at first the weight of the aluminum template is small, which can improve the operation efficiency of the construction. When it is applied to the pin of the connection system, the utility model has the advantages of convenient disassembly and assembly, and only requires manual transportation during actual operation, thereby eliminating mechanical expenses. Secondly, the convenience effect of the support system is very obvious. There are not many support rods but the maximum independent support spacing range is large, which can provide favorable construction space for construction projects. Once again, the aluminum formwork has a short construction period and is easy to assemble and disassemble. Only one set of templates is needed for the entire project, which effectively reduces the construction cost. At the same time, the aluminum formwork also has high strength and stability, and the overall structure is stable after installation, and its bearing capacity is large. In addition, the effect can be maintained after the template is removed, and the connection is tight when the connection is made, the gap is small, the effect is obvious after the construction, and the smooth surface effect can be ensured. Certainly, the application of aluminum formwork in construction engineering can also effectively reduce the construction cost. This is because the aluminum formwork can be used for many times, the environmental protection effect is good, and the overall cost is reduced.

2. Analysis of Principles and Characteristics of BIM Technology Applied in Aluminum Formwork Construction and Construction

Use BIM technology to establish a three-dimensional model, and then optimize the design of the main structure of the aluminum formwork construction, the external wall decoration nodes according to the design drawing requirements and construction specifications. And conduct collision inspection on the water and electricity pipelines, pipelines, reserved holes, etc., and further optimize the design in order to ensure the uniformity of the aluminum template specifications and models, and facilitates the construction of aluminum formwork. In the later construction, BIM technology is used to realize the dynamic monitoring of the on-site construction of the aluminum formwork, timely discovering the problems existing in the construction and correcting them in time, improving the management efficiency and quality, and ensuring the construction progress and construction quality. The characteristics of aluminum template design and construction using BIM technology are as follows:

2.1 Information Application Effect

BIM technology uses a unified standard to describe building information and exchange effective information, which can reduce early design errors and reduce information security risks and costs. Secondly, BIM technology has the characteristics of visualization and intuition, which makes the building description popular and three-dimensional and intuitive, which can help the construction personnel to intuitively understand the construction molding method and expected effect. Secondly, BIM technology has the characteristics of three-dimensional presentation, which can accurately represent the structure and content of the building. In addition, BIM technology is used to make information communication more accurate. Every link of the construction project needs to manage a lot of content, and the application hardware and software facilities are different. In order to make the information transmission accurate and convenient, the model can be effectively transmitted, processed and saved by using BIM technology to avoid the software. Different hardware and software facilities bring information transfer and conversion problems. At the same time, the use of BIM technology can not only achieve the effective transmission of information, but also help the construction unit to express the demand to the design unit.

2.2 Improve Calculation Speed and Calculation Accuracy

The BIM model has the functions of information storage and information calculation. All components in the model contain different information data such as component type, performance and price. In the decision-making of the enterprise, based on the actual situation of the project at the time, all the data of the project should be placed in the BIM model and saved in the cost plan, and the cost of the final
project can be obtained. Secondly, the properties of the components in the BIM model can be changed, the engineering dynamics can be updated in time, and all valid data can be guaranteed to not change. In addition, the behavior of the change is also controlled. The use of BIM in the whole project can improve the speed of information calculation, and at the same time adjust the cost more reasonably and better control the project construction.

2.3 BIM Can be Used to Modify Drawings
BIM technology has the characteristics of visualization and simulation, which makes it possible to use the function of drawing modification in the design of building structure. For example, by modifying the model, the related functions can be automatically reflected in the drawing, so that the designer does not need to spend other time and energy on the modification of the construction drawings.

2.4 Collaborative Design Using BIM Technology
There are many people, materials and equipment involved in the design and construction of aluminum formwork, and the technical requirements are getting higher and higher. At this time, in order to ensure the good cooperation between various professions and systems, it is necessary to do a good job among the members of the profession. The three-dimensional collaborative design work between multiple professions and between systems can effectively reduce drawing errors and improve the efficiency and quality of design work.

3. Design and Construction Application of Aluminum Formwork for Construction Engineering Based on BIM Technology

3.1 General Application of BIM Technology
When the BIM technology is designed and applied in the early stage of the aluminum formwork, it mainly clarifies the contents of the design plan, including the main contents and technical requirements of the construction, the construction process, and the response to the emergency. Combine all these parameters to simulate and simulate the construction effect, analyze the problems that may occur during construction and correct them in time. After initial design, BIM technology is used for auditing. The visual function helps designers visually discover the unreasonable support in the design and optimize it to reduce post-design changes and a series of problems. In addition, BIM technology can be used to complete the comprehensive simulation of the construction site, various construction stages and costs, to ensure that the project can be completed on schedule, and to achieve economic benefits while ensuring quality. When BIM technology is applied in the mid-term design of aluminum formwork, it mainly determines and perfects some detailed problems in the design of building structure, such as structural performance design and correlation design between structures. In the application of BIM technology, it is first necessary to clarify the connection method of beam-column connection, beam-beam hinge and beam-beam connection, and check the parameters. In addition, a database can be built based on these data, and database simulation can be used to ensure the accuracy and rationality of the aluminum template design. The application in the design of aluminum formwork performance is mainly to use BIM technology to complete the comprehensive analysis of the seismic performance and thermal insulation performance of the building structure. And to select the construction materials according to the analysis results, to determine the load factor, and to find out the existence of the design in time. Inadequacies and corrections. In the aspect of correlation structure analysis, BIM technology is used to simulate the building structure, which reflects the relationship between the various links of the construction and coordinates. After completing the design of the aluminum template, it is necessary to check and review all the details of the design, and try to avoid the unreasonableness in the design, so as to reduce the design changes in the later stage. This not only ensures quality but also controls engineering costs. When using BIM technology for post-design inspection and inspection, it is necessary to closely combine the design schemes, integrate the various parameters to form a database. And use BIM technology to do the inspection of hidden projects,
difficult points and complex node design, and judge whether the choice of construction materials is reasonable as construction technology.

3.2 Aluminum Template Design
Select ArchiCAD 3D design software and build a basic database of aluminum formwork components. This dataization is not a simple combination of drawings and texts, but a collection of parametric components, which can effectively reduce the time for designers to design the mold, reduce the problem of mismatch between the component information and the template frame, and reduce the matching of the template. The inspection workload, the designer will check the hole position matching and the standard rate of the components. After the database is built, the structural model is created, and the thickness of the plate, the beam section, etc. are marked, so that the cross-section information of the component is intuitively recognized, and unnecessary errors are frequently avoided by frequently changing the model data. After the overall structural model is built, the aluminum formwork design of the sub-project begins, including the floor aluminum formwork design, the beam aluminum formwork design, and the stair aluminum formwork design.

When designing the floor aluminum formwork, first determine the lower level of the floor corner. When assembling the mold, a standard type plate should be used and its parameters such as length, width and height should be set and placed in the correct position on the plan by copying and pasting. And laying flat. Set the length, width and height of the template in the plan view, copy and paste it to the correct position, and then switch to the 3D mode to check if the mold is correct. This method reduces the time required to match the mold and also reduces the error rate of the mold design. In the beam aluminum template design, under the determined beam bottom and beam side template width and height, the position of the template placed in the plane mode is confirmed in the 3D mode, and then the model is accurately matched. In the wall aluminum formwork design, under the height of the standard wall formwork that has been determined, the correct position of the wall form is placed in the plane mode, and the height is confirmed in the 3D mode and then accurately matched. In the aluminum stencil design of the stair, because the stair structure itself is complex, mistakes often occur in the traditional model design, and the three-dimensional software can be used to visually design the stair template, and to switch the plan, elevation and section at any time. And separate the stair space, then arrange the stair members in the plan, arrange the lateral members in the elevation, and finally check and export the drawings in the 3D map. As for the aluminum template design of complex nodes, because of the variety and quantity, it is necessary to consider the accuracy of aluminum template design and the difficulty of post-reinforcement and the difficulty of demoulding. Therefore, 3D design software can be used to visualize the image. These complex node matrices are displayed in the ground, and the real-time modification of the mating components can be found in advance and corrected in the traditional design mode.

3.3 Aluminum Template Design Matching Inspection and Optimization
Using the 3D design software, the length and size of the template can be changed through parameter setting, and the dimensioning is also modified in time, which reduces the time for proofreading. In addition, the visualization function helps the proofreader to intuitively understand whether the template splicing is correct, reduce the workload of repeated inspections, and also improve the accuracy and efficiency of proofreading, and minimize the error rate. For the problem that the template length is not enough, you can directly find the beam side template length problem directly in the 3D view and then drag the beam side template to the accurate stitching position in the 3D view. In addition, the missing template in the aluminum template can be visually found through the three-dimensional view, and the missing template can be directly filled by the linkage function of the three-dimensional design software.

3.4 Aluminum Formwork Application
First, a list of aluminum formwork members is generated, which is accurate to the number, weight, and
area of the components, and can be used to extract a list of each type of template. The number in the component list is linked with the template in the model, the size of the component is changed, the data in the list is automatically changed. And the component list is given to the aluminum template processor to produce the aluminum template according to the list, which is efficient and can control the production cost. Secondly, BIM technology is used to realize the three-dimensional cross-bottom work of aluminum formwork. The three-dimensional model has the characteristics of intuitive image and clear and detailed features. Under the visualization, the technical characteristics of aluminum formwork and the technical requirements of complex nodes can be fully introduced, and the technical work can be completed efficiently. In the aluminum template trial assembly, use the special software to read the super model drawings, help the workers to intuitively understand the shape and template information after the construction, and complete the assembly. The application of the aluminum template three-dimensional model reduces the workload, reduces the difficulty of work, and effectively ensures the quality and efficiency of the aluminum formwork construction.

4. Results and Benefit Analysis
The BIM technology is used to construct the 3D model of the aluminum formwork, and the collision of the 3D model is realized through the integration of the professional model, and the work of optimizing the wiring, the hole reservation, the top layer and the standard layer design, and the secondary structure design are optimized. Through the design optimization, the specification and model of the aluminum formwork are unified, the construction difficulty and construction cost are reduced, and the economic benefit of the design and construction of the aluminum formwork can be effectively improved. Secondly, using the research results of BIM technology, the three-dimensional collaborative design of aluminum formwork is carried out to improve the efficiency of design, and the work efficiency of design, fabrication and trial assembly of aluminum formwork is improved by the work of column sorting, partitioning, and three-dimensional technology. Accuracy reduces errors and reduces the cost of rework. Thirdly, the use of BIM technology results to carry out aluminum formwork construction, which has more turnover times, which reduces the use cost, facilitates the construction of aluminum formwork, reduces the dimensional deviation of the formwork. And reduces the construction of the plastering layer and the construction of the decoration and decoration project. Reduce the quantity and engineering costs, while also improving the appearance quality of the building structure.

5. Conclusion
In summary, the application of BIM technology in the design and construction of aluminum formwork in construction engineering can utilize the advantages of visualization, coordination and simulation of BIM technology, and combine the advantages of aluminum formwork construction to optimize the design, mold matching, processing and processing of aluminum formwork. The construction process, through three-dimensional cross-over and three-dimensional inspection, has greatly improved the use efficiency of the aluminum formwork and reduced the construction cost. In the future, BIM technology should be further studied in depth and its technical achievements should be applied to the design and construction of construction projects to promote the sustainable development of the construction industry.

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