Study on Safety and Economy of Civil Engineering Structural Design Based on Computer Model

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Abstract. Computer modeling is a favorite tool for building engineers. As a new productive force, it lays a solid foundation for the future development of model design. It can use computer 3D technology to design and make physical models of buildings, simulating the effects of digital space design that cannot be achieved by hand. Generally speaking, the application of computer three-dimensional model design in structural design of civil engineering is very outstanding. Based on the summary of the calculation model design, this paper analyzes the safety and economy of the structure design of civil engineering.

Keywords: Computational model, Civil engineering, Safety, Economy, Computer 3D

1. Introduction

As the expression of design concept, computational model can vividly express architecture and environment planning, design intention and effect. Nowadays, its application has become a necessary examination project for urban planning and constructional engineering approval. In addition, the real estate development and commercial housing sales industries use computational model, so that customers get a more intuitive visual effect. The digitization of computing model provides a lot of convenience for various industries[1].

For the structure of civil engineering, designers need to attach great importance to the safety and economy of structural design. In the construction process, it is easy to have safety accidents, which will bring a lot of troubles to the construction industry. The application of the computer model can help people predict the safety of the design of the building structure, and make the constructional scheme with high economy.

2. Model design of computer

2.1. The development of computational model design
The 3D modeling technology of computer was developed in 1960s. Until the 1990s, its technology gradually matured. There are more and more functions of computational modeling software. Modeling software allows designers to change the shape and parameters of the model in an interactive way until customer recognition. Partial 3D models can simulate lifelike animation, and their actions can be stored in the computer. People can extract the desired animation design from the computer at any time.

2.2. Advantages of computational modeling technology

The model can be built quickly, cheaply, easily modified and stored with computational modeling technology[2]. The technology can help designers to view and analyze the model from any angle on the computer screen. Generally speaking, computer model can make image, vivid and concrete architectural scheme. It can inspire designers and enhance their creativity of conception.

2.3. The significance of computational modeling application

In the construction industry, people use modeling technology to make building models, which has a very positive practical significance. When analyzing the feasibility of building models, designers need to consider the factors of brightness, sight, shadow and height. The expression of architectural environment effect in traditional architectural model is not satisfactory. However, today's computational modeling technology can study and control various environmental factors. In short, modeling technology can help people to intuitively study the relationship between buildings and environment on the computer screen, and help them make correct decisions. The 3D modeling of a building is shown in Fig 1.

Figure 1. 3D modeling of computer building
3. Safety analysis of civil engineering structural design under model design

3.1. It can effectively predict the security of the structure

In the traditional model design process, people sometimes cannot realize the safety of the building structure clearly\cite{3}. This situation will lead to lots of safety accidents in the process of construction, resulting in human and finance losses. However, the current computational model design can effectively predict the various safety problems of the building structure, and help people to prevent safety accidents.

3.2. It can make more reasonable structural design scheme

In order to catch up with the constructional period and reduce the cost of many civil engineering projects, some amateur designers often adopt some unreasonable or rough structural design schemes. These designs may not be seriously flawed. But there are still many loopholes, which will seriously damage the performance of buildings and the damage of users. Model design can help people to develop a sound structural design scheme and reduce the loopholes and hidden dangers of structural design.

3.3. It can fully improve the safety of the structure in theory

In the past structural design process, due to the technology limitations, people prefer to practice rather than theoretical analysis. This will increase the probability of safety accidents during construction. The constructional project is not good in quality and durability. Designers make full use of modeling software to carry out theoretical analysis and discussion on construction projects, which can solve many hidden problems.

4. Economic analysis of civil engineering structural design under model design

4.1. It can effectively control the cost

Civil engineering cost calculation has always been the focus of designers. The traditional model design does not calculate the material cost accurately, which leads to the cost exceeding the budget and unilateral economic loss\cite{4}. At present, computational modeling technology can accurately calculate the cost of various materials in civil engineering projects. In this way, the cost of structural design can be well controlled.

4.2. It can select standard drawings and reduce economic waste

In the past, structural design redundancy appeared in engineering drawing due to calculation deviation. This will not only increase the workload of constructors, and will cause economic waste. Computational modeling technology can help people choose more reasonable and standardized engineering drawings, reduce people's workload, speed up the construction of the project, so as to reducing unnecessary economic losses\cite{5}.

4.3. It can strengthen the effective control of design parameters

In the whole structural design process, each link will produce various parameters. Modeling
technology can increase the erroneous tolerance of designers' parameter settings. It can help people calculate the accurate parameters of each constructional link and control the parameters (as shown in Table 1). This can make the structural design more rigorous and ensure the economy and overall quality of the project.

Table 1. Parameters and modification of building materials design

| Structural system | Non seismic | VI  | VII  | VIII | IX  |
|-------------------|------------|-----|------|------|-----|
| Frame             | 60         | 60  | 55   | 45   | 25  |
| Modify parameters | 50         | 50  | 35   | 25   | None|
| Frame-shear wall  | 130        | 130 | 120  | 100  | 50  |
| Modify parameters | 100        | 100 | 90   | 70   | None|
| Cast-shear wall   | 140        | 140 | 120  | 100  | 60  |
| Modify parameters | 120        | 120 | 100  | 80   | None|
| Steel frame       | 110        | 110 | 110  | 90   | 55  |
| Modify parameters | 110        | 110 | 110  | 90   | 55  |
| Toughened frame   | 240        | 220 | 220  | 200  | 140 |
| Modify parameters | 240        | 220 | 220  | 200  | 140 |

5. Strengthen the attention to the safety and cost of civil engineering structural design

In order to fully reflect the characteristics and functions of civil engineering structure, these designers should attach great importance to the safety and cost in the structural design process, which can greatly reduce the loss of human and financial resources. This is essential for the constructional industry[6].

5.1. The importance of strengthening the safety of structural design

The safety of civil engineering is the guarantee of its quality. In order to ensure its quality, it is necessary to consider the selection of design units comprehensively. The contractor of the project shall establish the civil engineering project safely and effectively on the basis of years of experience and high-quality practice.

5.2. The importance of strengthening the economy of structural design

With the continuous progress of our society, the construction of highway bridge and projects has greatly consumed China's financial resources. It has a great influence on Chinese economy development. Therefore, the design unit should constantly improve its professional level. Designers should retrofit the plan and not waste too much money.
6. Conclusion

At present, civil engineering shows a very excellent development prospect, and the number of civil engineering projects is gradually increasing. The safety and economy of the project is very important in the process of construction. Obviously, the application of computational modeling technology in dealing with safety accidents and reducing costs in civil engineering plays an essential role in the whole project.

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