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Discussion on Common Problems of Housing Structure Design in Civil Engineering Construction

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Abstract: This article discusses some common problems in the structural design of housing structure in civil engineering construction. To start with, we analyzed the basic principles of housing structure design, including safety, economy, practicality and so forth. Furthermore, we discussed common problems in structural design, such as improper selection of structural systems and inappropriate selection of structural materials. Last but not least, we proposed an optimization design method for housing structures in civil engineering construction, including optimizing the structural layout of the building, optimizing the material selection of the building, etc., to improve the safety and durability of the house building structure.

Keywords: Civil engineering construction; Housing structure design; Common problems; Countermeasures

Introduction

Structural design of housing buildings is an important part of civil engineering construction, the quality of which directly affects the safety, durability and comfort of buildings. However, in the virtual design process, due to various reasons, there are often some problems, such as unreasonable design, miscalculation, improper material selection, etc., which will not only affect the application outcome of the building, but may even lead to serious safety accidents. Therefore, it is of great significance to discuss the common problems of housing structure design for improvement of design quality and insurance of project safety.

1. Basic Principles of Structural Design of Housing Buildings

The basic principles of house building structure design mainly consists of safety, economy, practicality and aesthetics. These principles not only are the basis of the security of buildings, content of people's living and demands, but also are what architects need to follow when designing buildings. First of all, safety principle comes the priority of housing structure design. Designers must fully consider the structural stability and earthquake resistance of the building when designing to ensure that the building can remain

stable and will not collapse or cause casualties in the event of various natural disasters and man-made destruction. This requires designers to strictly abide by relevant building codes and standards when designing, employ qualified building materials, and carry out scientific structural design and reasonable construction. In addition, economy is an important principle in the structural design of house buildings as well. Designers need to consider the costs of the building construction and property management when designing, and reduce construction and maintenance costs to the utmost. This requires designers to fully consider the selection of materials, construction methods and technologies, equipment selection and other factors when designing, and strive to maximize economic benefits while satisfying the use functions. Moreover, practicality is the elemental principle of housing structure design. Designers need to take the building's using functions and people's living needs into account when designing, so that the building is both beautiful and practical. This requires designers to ponder the spatial layout, functional zoning, equipment configuration and other factors of the building while designing, and strive to make the experience of residents more convenient and comfortable [1]. At last, aesthetics is an important principle in the structural design of house buildings. Designers need to take account of the appearance effect and interior decoration of the building when designing, so that the building is both beautiful yet able to meets people's aesthetic needs. This requires designers to fully consider the color matching, shape design, material selection and other factors of the building when designing, and strive to bring the ultimate appearance of the building out.

2. Common Questions of Housing Structural Design in Civil Engineering Construction

As structural design of housing construction is an critical part of civil engineering construction, and its quality is directly related to the safety, durability and functionality of the building. In the actual engineering design process, due to various reasons, there are some common problems that affect the rationality and reliability of the structural design.

(1) The design load value is unreasonable.

In the design of house building structures, the rationality of load values is crucial. However, the unreasonable load values, such as inappropriate load combinations, over-low or over-high load standards, etc., sometimes occur in practical design progress. These unreasonable load values will lead to structural design that does not meet actual engineering needs, thus affecting the safety and reliability of the structure.

(2) Improper selection of structural system.

The choice of structural system directly affects the structural performance, construction process and engineering cost of the building. In the actual design process, this situation sometimes occurs: the structural system is improperly selected. For example, in the design of a combination of frame structure and shear wall structure, the arrangement of frame columns and shear walls is unreasonable, thus resulting in the load-bearing capacity and insufficient earthquake resistance of the structural system. Therefore, a reasonable selection should be made based on the building's purpose, geological conditions, climate conditions and other factors when selecting a structural system.

(3) The structural design is unreasonable.

Structural design is an important part of the housing structural design, and its quality is directly related to the building's functionality and safety. In the actual design process, this situation sometimes occurs: the structural design is unreasonable, such as insufficient reinforcement at the joints of beams and columns, improper structural processing of wall openings, etc. These unreasonable structural designs will lead to insufficient seismic resistance, deformation performance and durability of the structure, thus affecting the service life of the building.

(4) The material selection is inappropriate.

Material selection is the basis for structural design of house buildings, and its quality directly takes effects on the reliability and safety of the structure. In the actual design process, this situation sometimes appears: the material selection is inappropriate, such as the steel bars, concrete and other materials which strength grade doesn't meet requirement, or the selected materials don't meet the practical needs of the project. These problems will lead to insufficient load-bearing capacity and seismic resistance of the structure, thus affecting the safety performance of the building.

(5) The calculation model and analysis method are inaccurate.

In the process of structural design of housing

buildings, calculation models and analysis methods are the kernel to ensure the rationality of structural design. However, sometimes the calculation models and analysis methods are inaccurate, such as improper software selection, unreasonable parameter settings, miscalculation process, etc. These problems will give rise to large deviation in structural design, thus reflecting badly on the safety and reliability of the structure.

3. Design Optimizing Method of Housing Structure in Civil Engineering Construction

In civil engineering construction, the optimizing method of housing structure design is a complex yet important topic. It involves knowledge in multiple fields, including structural mechanics, building materials science, architectural design theory, and so forth. In actual operation, we need to adopt scientific methods and means to optimize the design of the building structure according to the function, geographical environment, economic benefits and other factors of the building, so as to improve the safety, economy and aesthetics of the building.

3.1 Selection of the Structural Pattern of the Building

The selection of a building structure is a complex process that requires consideration of a variety of factors, including its size, purpose, geographical location, economic conditions, etc. Different structural forms show different advantages and disadvantages, and need to be selected in accord with particular demands and conditions. For example, for high-rise buildings, we usually employ frame structure or frame-shear structure. The frame structure is composed of beams, columns, plates and other components, with the advantages of clear structure, convenient construction and good seismic performance. The wall of the frame structure is not load-bearing, and thus can be flexibly arranged, and the space layout is more free. The frame-shear structure is to add a shear wall on the basis of the frame structure, with the advantages of large structural rigidity and better seismic performance. Therefore, for high-rise buildings, we usually choose these two structures. And for residential buildings, we can choose brick-concrete structure or reinforced concrete frame structure. The brick-concrete structure is composed of masonry and concrete, with the advantages of low cost and simple construction. However, the seismic performance of brick-concrete structures is poor and is not suitable for areas with frequent earthquakes. The reinforced concrete frame structure is to add reinforced concrete walls on the basis of the frame structure, and its advantages are good seismic performance and high comfort. Therefore, for residential buildings, these two structures were usually chosen[2]. In general, the choice of building structure needs to take a variety of factors into account, not only to meet the needs of use, but also to consider economy and comfort. Only in this way can a building that is both safe and comfortable be built.

3.2 Optimization of the Structural Layout of the Building

The layout of the structure is one of the key factors that determine the overall performance of a building. In the process of building design and construction, we need to reasonably determine the structural size and position relationship of each part based on the functionalities and using requirements of the building to meet the transmission and distribution requirements of various loads. At the same time, we also need to consider the stiffness and strength distribution of the structure to prevent unfavorable deformation and damage. First of all, we need to fully understand the function and purpose of the building in order to choose the appropriate structural form for each part. For example, residential buildings often require good sound insulation and thermal insulation, so reinforced concrete frame structures can be adopted; Commercial buildings require high space utilization, and steel structures or long-span space structures can be considered. Secondly, we need to think of the rationality of the structural layout. Reasonable structural layout can improve the stability and seismic performance of the building, and reduce the project cost. In addition, we also need to pay attention to the material selection of the structure. Different building materials have different mechanical properties and durability, so it is necessary to comprehensively consider factors such as strength, toughness, and fire resistance of materials in the design process [3]. For example, steel structure possesses high bearing capacity and good ductility, which is suitable for large-span and heavy-duty buildings; Concrete structures, on the other hand, have high compressive performance and are suitable for important parts such as load-bearing walls. In

the actual construction process, we also need to pay attention to the construction process and quality control of the structure. Reasonable construction process can ensure the stability and safety of the structure and avoid quality problems caused by improper construction. For example, we can adopt construction methods such as prefabricated elements, cast-in-place floor slabs to improve construction efficiency and quality; At the same time, we need to strengthen on-site monitoring and management to ensure the safe use of the structure.

3.3 Optimization of the Material Selection of the Building

The performance of building materials directly affects the quality and performance of building structures, so it is important to choose the right building materials. When considering building materials, we need to choose the appropriate material according to the use environment and conditions of the building. For example, if the building is located in an earthquake-prone area, we need to choose materials with good seismic performance; If the building is located in a cold area, we need to choose materials with good thermal insulation properties. In addition to considering basic properties such as durability, crack resistance and thermal insulation of materials, we also need to consider the environmental protection and sustainability of materials. With the improvement of environmental awareness, more and more people are beginning to pay attention to the impact of building materials on the environment. Therefore, when choosing building materials, we should try to choose those materials that have a low environmental impact in the production process and can be recycled with waste. In addition, we should also pay attention to the life cycle cost of building materials, that is, the total cost incurred in the entire process from raw material extraction, production, transportation, use to disposal. Choosing building materials with low life cycle costs can reduce the overall operating costs of the building, while also benefiting the environment. In order to ensure the quality and safety of construction projects, we also need to strictly monitor the use of materials during construction. For example, we can regularly check the strength of concrete and the quality of steel bars to ensure the structural safety of buildings. At the same time, we also need to pay attention to the storage and transportation process of materials to prevent damage or contamination of materials. In short, the choice of building materials is of great significance to ensure the quality and performance of buildings. We need to choose the appropriate building materials according to the use environment and conditions of the building, and fully consider its durability, crack resistance, heat insulation and other properties. At the same time, we also need to pay attention to the environmental protection and sustainability of materials to reduce the environmental impact [4].

3.4 Optimization of the Structural Construction of Buildings

Structural construction is a vital part of construction engineering, which is directly related to the safety, stability and service life of buildings. Therefore, in the design stage, we need to fully consider the problem of structural optimization to achieve the rationality and scientificity of structural design. First of all, we need to develop a reasonable construction plan and process. The construction plan is the specific plan that guides the construction, including the construction sequence, construction method, construction equipment, etc. A reasonable construction plan can make the construction progress proceed in an orderly manner and avoid engineering quality problems caused by improper construction. At the same time, we also need to develop a suitable construction process given the main points and difficulties of the project to ensure the quality and safety of the structure. Secondly, the economics and efficiency of construction is what we also need to ponder. Constructive economy refers to reducing construction costs as much as possible under the premise of ensuring project quality. This requires us to select low-cost and efficient construction methods and equipment during the design and construction progress. At the same time, we also need to strictly manage and control the construction progress to reduce waste and improve resource utilization ratio. Finally, the environmental impact of construction should also be recognized. During the construction process, we need to minimize the impact on the environment, such as noise, dust, waste, etc. This is not only respect for the natural environment, but also responsibility for public health.

Conclusion

In a nutshell, the structural design of housing buildings

is an important step of civil engineering construction, which is closely linked to the safety, durability and service life of buildings. Through the discussion of common problems in the structural design of housing buildings in civil engineering construction, this paper aims to improve the level of design and quality awareness of designers and thus ensure the security and stability of buildings. In the design process, geological conditions, climatic conditions, material properties and other factors should be fully considered, and reasonable structural forms and structural measures should be adopted to meet the functional and safety requirements of the building. At the same time, designers should constantly learn new knowledge and technology, improve their professional literacy, and strive to make greater contributions to civil engineering construction.

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