

The application and development of reinforced concrete structure in building construction

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Abstract: With the acceleration of the current social development, more and more people's demand for life is also gradually improving. The quality of housing construction and environment also has higher requirements. The reinforced concrete structure is one of the main application structures in the current project. Its good performance is the basic support to strengthen the performance of housing construction, but there are also some problems. At the same time, due to the rapid development of the current construction industry, a large number of new materials and new technologies began to be applied to the market. Based on this, this paper analyzes the application of reinforced concrete structure technology in housing construction, makes full use of its advantages and avoids its disadvantages as far as possible, and finally puts forward the future development strategy of the structure in housing construction.

1. Introduction

Reinforced concrete structure refers to structures made of concrete embedded with configured reinforcing steel. Compared to other structures such as timber and masonry structures, the history of reinforced concrete is relatively short. However, it possesses a series of characteristics that other structures find hard to match, including high load-bearing capacity, durability, and excellent fire resistance. Moreover, this type of structure can be used not only for general building structures but also for civil engineering structures with large spans, high-rise, and even super-high-rise structures. Consequently, reinforced concrete structures can be regarded as the most widely applied in engineering. In contemporary society, reinforced concrete structures are commonly utilized in the construction of residential buildings[1].

2. Analysis of advantages of reinforced concrete structure

2.1 Easy material production

Reinforced concrete is a composite material consisting of two primary components: steel reinforcement and concrete. The composition of concrete mainly includes sand and aggregate materials, which are widely available and easily sourced locally. The material mixing and proportioning process for reinforced concrete are relatively simple, enabling quick completion of initial construction preparations. This reduces construction difficulties and steps, significantly

enhancing construction efficiency. Additionally, the construction of reinforced concrete causes relatively minimal environmental disruption to the surroundings of the building project. Based on the points mentioned above, reinforced concrete holds a vast potential for widespread applications in the field of construction.

2.2 Make full use of the characteristics of steel reinforcement and concrete

Concrete, as an extensively used material, possesses remarkable compressive strength but relatively lower tensile strength. To meet the tensile strength requirements in building construction, reinforced concrete components are commonly employed. The strategic placement of steel reinforcement within these components endows them with exceptional tensile capacity, effectively meeting the structural strength demands of building projects. Moreover, the concrete surrounding the steel reinforcement in reinforced concrete components forms a crucial protective layer, serving a vital role. This protective layer not only partially prevents steel corrosion but also safeguards the structure during fire incidents, preventing overall failure caused by the rapid softening of the steel. Through this structural design, reinforced concrete components provide not only tensile strength but also ensure structural durability and safety[2-3].

2.3 Good structural integrity

Cast-in-place reinforced concrete structures exhibit excellent overall integrity. The remarkable tensile and compressive strength of this type of structure is prominently showcased in building construction, simultaneously fulfilling seismic and blast resistance requirements, thereby ensuring the quality of the building. This characteristic allows for significant reduction of losses in the event of natural disasters, which sets it apart from many other structural types.

3. Application of reinforced concrete structure in building construction

To apply reinforced concrete structures in practical engineering, a step-by-step analysis of various factors affecting their application must be conducted. These factors include but are not limited to materials, formwork, and more. During the construction process, strict control over the quality, strength, and various indicators of these factors is essential.

3.1 The choice of materials

3.1.1 Selection of reinforcement

To ensure the quality of building construction, selecting appropriate reinforcing steel materials is fundamental. To guarantee the stability of the building, it is advisable to choose steel with good plasticity, i.e., high elongation and excellent cold bending properties. This type of steel exhibits noticeable warning signs before failure, and its failure is ductile. Considering the seismic requirements of the building, the application of steel stress should enter the strengthening phase, with the requirement for the ratio of tensile strength to yield strength not less than 1.25. Besides ensuring the performance indicators of the steel are up to standard, it is also crucial to provide proper storage space for the steel materials, preventing any deterioration or deformation caused by adverse storage conditions.

3.1.2 Selection of concrete

Many factors such as cement, curing conditions, age, mix proportion, and the variety and

composition of aggregates can influence the compressive strength of concrete. Among these factors, cement has the most significant impact on concrete structures, as its quality affects the durability of concrete. The sand and aggregates contained in the cement also play a role in the quality of the structure.

Therefore, during construction, strict quality inspection of the chosen cement should be conducted, and it should be stored in a well-ventilated and dry area. In addition to controlling the quality of cement, the most suitable cement dosage should be determined based on the standards for reinforced concrete and building construction. This will avoid issues such as excessive water-cement ratio, which can lead to concrete shrinkage, creep, reduced strength and durability, or, conversely, poor workability.

Beyond cement, aggregates also have a significant impact on concrete performance. Well-graded aggregates with high density, high elastic modulus, and large particle size can reduce concrete shrinkage. The shape and surface characteristics of the particles also affect concrete strength. In building construction, the proportion of impurities in reinforced concrete should not be too high, so the proportion of impurities in aggregates should also be controlled within standard limits.

3.1.3 Ratio of material

Ensuring that all indicators of the reinforced concrete materials are up to standard is the foundation for ensuring the quality of building construction projects. While guaranteeing the quality of both steel reinforcement and concrete, it is also essential to properly allocate and proportion them. This can be achieved by calculating the load-bearing capacity of the building structure to prevent issues such as excessive or insufficient reinforcement, and even steel reinforcement exposure or inadequate concrete cover. These issues can significantly impact the quality of the building construction project[4-5].

3.2 Precautions for templates

The construction of formwork systems has a significant impact on the construction of reinforced concrete structures. Its role is to facilitate the pouring of concrete according to the designed dimensions and shapes, ensuring that the construction meets the requirements and objectives of the components. When planning the formwork, the shape and size of the poured concrete will affect the size and position of the formwork. If the shape is irregular, special attention should be given to ensuring tight connections between formwork elements to prevent concrete leakage during pouring.

Moreover, it is essential to fully consider the pressure that the structure will bear and use materials with sufficient strength to construct the formwork. This ensures that the formwork has appropriate stiffness and avoids excessive deformation. Additionally, selecting the most economical formwork system is crucial.

Furthermore, considering that the formwork may experience slight deflection during pouring, it is necessary to allow for appropriate allowances when installing the formwork. This accounts for any minor adjustments needed to achieve the desired dimensions and shapes of the finished concrete component.

3.3 Disadvantages and prospects of reinforced concrete

The use of reinforced concrete structures in high-rise buildings is limited due to their significant self-weight. Additionally, the low tensile strength of concrete often leads to cracking in reinforced concrete structures. Although some cracks may not compromise the structural load-bearing capacity, they can impact the overall aesthetics of the building and even create a sense of insecurity among residents. Improper handling of cracks may also expose steel reinforcement, which is susceptible to

corrosion, potentially affecting the overall quality and lifespan of the structure. To address this drawback, lightweight and high-strength materials or prestressed concrete can be employed to reduce the self-weight of the structure and improve its crack resistance.

Furthermore, reinforced concrete structures are labor-intensive, require extensive formwork, and have a longer on-site construction period. They are also susceptible to seasonal influences and involve numerous manual control processes, such as material mixing, pouring, and curing, all of which can affect the final quality. To overcome these challenges, future construction practices could consider the use of electronic machinery or artificial intelligence-controlled technologies to automate the process. This can reduce human-induced errors to some extent and enhance the efficiency and quality of construction projects.

4. Peroration

Indeed, despite the continuous development of technology and advancements in building materials, reinforced concrete structures remain an indispensable part of modern building construction. A well-designed reinforced concrete structure serves as the foundation for ensuring the quality of building construction, effectively reducing damage caused by natural disasters and external accidents, thereby providing a certain level of security for people's lives and property.

Due to its significance, it is essential to adopt new technologies or measures to enhance the construction techniques of reinforced concrete structures in building projects. By fully leveraging the strengths of reinforced concrete structures and effectively addressing their weaknesses, we can further promote the development of building construction projects. With ongoing improvements and innovations, reinforced concrete structures will continue to play a crucial role in the safe and reliable construction of modern buildings in the future.

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