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On the Construction Technology of Mass Concrete Structure in Civil Engineering

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Abstract: In the context of the current global construction industry and the pursuit of sustainability of continuous innovation, the construction technology research of mass concrete structure in civil engineering is not only related to the safety and economy of the project, but also involves the overall problem of the urban sustainable development. This paper deeply studies the construction technology of mass concrete structure in civil engineering, and discusses its advantages, common problems and optimization measures in engineering practice. Through a systematic analysis of the field, it aims to provide in-depth insight and practical advice to engineers, designers and relevant decision makers.

Keywords: Mass Concrete; Construction Technology; Advantages; Problems; Optimization Measures

Introduction

With the continuous development of urban construction, the application of mass concrete structure in civil engineering is gradually increasing. This kind of structure is favored because of its high strength, thick structure and its remarkable effect in improving the quality of construction projects. However, compared with the ordinary concrete structure, the construction of mass concrete structure has a series of challenges, such as large volume, more cement dosage, easy to produce cracks. Therefore, it is of great significance to deeply study the construction technology of mass concrete structure in civil engineering to improve the engineering quality and ensure the safety of the structure.

1. Advantages of the construction technology of mass concrete structure in civil engineering

1.1 Advantages of high strength

The high strength of the mass concrete structure gives it excellent performance and reliability in the field of civil engineering. Using high performance concrete and advanced reinforcement technology, we enable the structure to show excellent compressive and bending strength when bearing huge loads. The advantages of this high strength not only enable mass concrete structures to cope with the complex mechanical environment, but also provides a solid foundation for them to play a key role in large engineering projects[1]. By improving the overall strength of the structure, the mass concrete structure shows excellent performance in civil engineering, ensuring the stability and reliability of the project.

1.2 Improve the durability of the thick structure

Compared with the general concrete structure, the design of mass concrete structure usually adopts a thicker structure form. The thick structure not only makes it can withstand the erosion of the external environment, prolong the overall service life, but also effectively improves the ability to resist climate change, acid rain and other harsh environmental conditions. This design concept focuses not only on the mechanical properties of the structure, but also on its long-term stability in different environments. The characteristic of thick structure makes the mass concrete structure more reliable in the face of extreme conditions such as fire and explosion, providing a more reliable structural foundation for civil engineering.

1.3 The improvement of the seismic performance

The solid structure of the mass concrete structure and the good connection mode of the structure work together to significantly improve the overall stability of the building, thus effectively enhancing its seismic performance. The design of this structure not only pays attention to the strength of a single member, but also focuses on the synergistic effect of the overall structure, so that the building can better disperse

and absorb the earthquake energy when the earthquake occurs, and slow down the speed of the force change of the structure. Especially in the areas with frequent earthquakes, the use of mass concrete structure has become a reliable choice, reducing the risk of damage caused by the earthquake, and effectively guaranteeing the safety of personnel and property. This improvement in seismic performance provides reliable shields for buildings in civil engineering in a complex natural environment.

2. Common problems in the construction of mass concrete structure in civil engineering

2.1 Increasing space demand and rising cost

In civil engineering, the construction process of mass concrete structure is often faced with the challenge of increasing space demand and rising cost. First of all, due to the large size of the structure and the corresponding increased demand for construction space, higher requirements are put forward for the selection of the construction site, which may involve the impact of land use and adjacent buildings. This brings complexity to the project schedule and the overall project planning. Secondly, due to the large volume, the amount of cement required for the mass concrete structure is also relatively large, resulting in a significant increase in construction costs. Cement, as one of the main components of concrete, accounts for a large proportion in the construction cost, so the reasonable control of the amount of cement is crucial to control the overall cost. Project managers need to seek the strategy of saving materials to reduce the construction cost. In the case of limited construction resources and limited budget, how to balance the space utilization and reduce the cost is a problem that needs to be carefully considered and solved in the construction of mass concrete structure. By rationally planning the construction process, optimizing the design and adopting advanced construction technology, these challenges can be better met to ensure the smooth progress of the project and cost control.

2.2 Temperature change caused by the hydration heat inside the structure

In the construction of mass concrete structure, due to the huge volume of the structure, the hydration process of cement will produce a lot of heat, resulting in a significant increase in the internal temperature of the structure. This temperature change may cause stress concentration inside the concrete, especially when the structure is larger and the concrete is thicker. With the solidification and hardening of the concrete, the heat released by the cement hydration reaction accumulates in the structure, forming a high temperature area[2]. The volume of the concrete in this high temperature area may change greatly, while the surrounding concrete is still in a relatively low temperature state, resulting in a temperature gradient inside the structure. Such a temperature gradient may cause great internal stress inside the concrete, thus causing the concrete to crack. Especially in the process of concrete pouring, due to the inability to quickly heat dissipation, the temperature gradient is more significant, making the crack risk of heat caused by cement hydration is further increased.

3. Specific optimization measures of the construction technology of mass concrete structure in civil engineering buildings

3.1 Reasonable selection of cement materials and control dosage

In civil engineering construction, in the construction process of mass concrete structure, reasonable selection of cement material and controlling the use is an important step to ensure the quality of the structure. First, the choice of cement materials should focus on reducing the heat of hydration. The selection of high-performance cement with lower hydration heat can effectively slow down the temperature rise inside the concrete. This optimization measure not only helps to reduce the occurrence probability of cracks, but also improves the overall performance of concrete. At the same time, in the control of cement dosage, we need to make a reasonable ratio according to the specific requirements of the concrete structure. Excessive cement use may cause excessive hydration heat, so controlling the amount used helps to maintain the temperature balance inside the concrete. In addition, the moderate addition of fly ash and other admixtures is an effective measure, not only can optimize the performance of cement, improve the working performance of concrete, but also help to reduce the overall construction cost. Through this optimization measure, the risk of temperature increase of the concrete structure can be reduced from the source in

the early construction stage, and the release of hydration heat can be effectively controlled. Such a construction method is not only conducive to the overall stability of the structure, but also help to improve the durability of concrete, to ensure the reliability of the project quality.

3.2 Adopt a scientific and reasonable pouring method

In the early stage of construction, the joint review of the construction drawings should be strengthened to ensure that the drawing design is reasonable and in line with the engineering requirements. At this stage, scientific and reasonable pouring methods such as layered casting or inclined layered casting can be selected according to the specific situation. Layer pouring can effectively slow down the temperature rise speed of concrete, is conducive to reduce the internal temperature gradient, thus reducing the probability of concrete cracks. This method can make the temperature of the concrete more evenly distributed, slow down the hydration process of the cement, and help to control the temperature change inside the concrete. Especially in the mass concrete structure, the internal temperature can be better managed and the overall stability of the structure can be improved by layered pouring. In addition, the reasonable control of the pouring speed is also an important link. Too fast pouring speed is easy to cause the internal stress concentration of concrete and increase the risk of cracks. Through the scientific and reasonable pouring method and the moderate pouring speed, the construction quality of the mass concrete structure can be better guaranteed to ensure the durability and stability of the structure.

3.3 Adopt advanced technical means

In order to further improve the scientific and precision of mass concrete structure construction, it is very important to introduce advanced construction technology. Among them, computer simulation analysis and temperature monitoring system are particularly important tools. Through computer simulation analysis, the construction process of mass concrete structure can be comprehensively predicted. This includes the simulation of key parameters such as temperature, stress and deformation, which helps to optimize the construction scheme and prevent the occurrence of problems. The simulation analysis provides a deep understanding of the structural performance, provides a scientific basis for the project, and ensures the controllability and reliability of the construction. On the other hand, the introduction of the temperature monitoring system can realize the real-time monitoring of the construction process of the concrete structure. These systems can timely capture temperature changes within the structure and alert them when anomalies are detected. Through the monitoring system, the construction personnel can take timely emergency measures before the problem occurs to reduce the potential risks and ensure the smooth progress of the construction process. In general, the use of computer simulation analysis and temperature monitoring system and other advanced technical means not only improves the scientificity and precision of the construction of mass concrete structure, but also provides strong support for the successful construction of the project. The application of this technical means is the inevitable choice of modern civil engineering in pursuing efficient, safe and sustainable development.

Conclusion

Through the detailed discussion of the advantages, problems and optimization measures of the construction technology of the mass concrete structure in civil engineering, we can see that in the practical engineering, scientific and reasonable construction technology and effective management measures are the key to ensure the construction quality of the mass concrete structure. By constantly summing up experience and introducing new technologies, we can better respond to the challenges, improve the efficiency and quality of mass concrete structure construction in civil engineering, and contribute to urban construction and sustainable development.

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