Research on Concrete Pouring Technology and Crack Control in Construction Engineering

Qin Wan

Tongling Construction Investment Holding Co., Ltd., Tongling, Anhui, 244000, China

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Abstract: With the continuous expansion of China's construction industry and the continuous improvement of economic levels, the construction technologies applied in construction projects show a trend of diversification. Currently, concrete pouring technology is relatively mature and has become one of the commonly used techniques in modern construction projects. However, overall, during concrete pouring construction, concrete cracking may occur, affecting the stability of the concrete structure and the overall project quality. Based on this, this paper specifically explores the concrete pouring technology and crack control techniques in construction engineering, hoping to provide some experiential reference for future modern construction projects.

1. Introduction

In modern construction projects, the application of concrete pouring technology continues to expand, and its techniques become more mature, making it a crucial part of construction. However, to ensure project quality during concrete pouring operations, high importance must be attached to controlling all aspects of the pouring process, especially considering crack control as a top priority. Considering factors such as project scale, construction cost, functional purpose, and site environmental conditions, a reasonable concrete pouring construction plan should be formulated to enhance the controllability of on-site operations. Therefore, effectively controlling cracks in modern construction engineering concrete can safeguard project quality and comprehensive benefits, as well as ensure the service life of the construction project. In summary, targeted research on concrete pouring technology and crack control techniques in construction engineering has practical significance.

2. Application Value of Concrete Pouring Technology in Modern Construction Engineering

2.1 Improving Building Structural Stability

Concrete material possesses high compressive strength. Using it as the main building material significantly enhances the overall structural strength of the building. Construction technicians need to form a sturdy and durable structural system through reasonable mix design, raw material selection, and construction process setup, thereby ensuring the stability and safety of the building under various loads. Traditional building structures often have poor seismic resistance, risking structural cracks or even collapse during natural disasters like earthquakes. Utilizing concrete pouring technology, due to its outstanding stability and durability, can effectively reduce the impact of natural disasters on building structural stability. Additionally, concrete has excellent waterproofing and fire resistance properties, primarily due to its dense structure, which effectively blocks external moisture penetration, and its low flammability, reducing the risks of leakage and fire. These are key factors in improving building structural stability.

2.2 Aligning with Green Environmental Concepts

From the current development of China's modern construction engineering sector, energy conservation and environmental protection concepts are widely implemented in engineering construction, emphasizing the importance of reducing pollutants and waste generation to promote the sustainable development of the industry. Concrete is a recyclable and reusable material. Its application in construction projects aligns well with the green environmental concept upheld within

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the industry[1]. Simultaneously, the production and processing of concrete materials demonstrate energy-saving and environmentally friendly characteristics. For instance, low-energy consumption equipment can be used for production, and industrial waste slag can be used as concrete admixtures. This significantly reduces the negative environmental impact of construction projects.

3. Analysis of Key Points in Concrete Pouring Technology for Construction Engineering

3.1 Key Points of Formwork Construction Technology

When applying concrete pouring technology in modern construction projects, formwork construction is a key preliminary step. As an essential facility for concrete forming, the quality of formwork construction directly affects the pouring outcome. Specifically, during formwork construction, requirements for formwork strength, structure, and dimensions must be detailed, and operations should strictly follow standards to ensure all parameters meet the project's needs. Additionally, during formwork assembly, joints must be tight, and potential grout leakage at joints should be inspected and confirmed to meet requirements before proceeding with subsequent work[2]. Some formwork surfaces may be dirty and require thorough cleaning to ensure a clean and smooth contact surface with concrete. Before officially starting pouring, the formwork should be soaked and moistened to significantly improve concrete adhesion and ensure smooth subsequent pouring operations.

3.2 Key Points of Concrete Mix Proportioning Technology

Concrete mix design is one of the most critical steps in modern construction pouring. To ensure pouring quality, national regulations and industry technical standards must be strictly followed during mix design to ensure scientific proportioning. Particular attention should be paid to setting reasonable proportions of various raw materials to ensure the stability of the concrete structure[3]. After preliminary mix design, samples of the prepared concrete should be tested using specific instruments selected based on project requirements. The concrete can only be used in subsequent construction stages after confirming that all indicators and parameters of the raw materials comply with industry standards and national regulations. Furthermore, thorough mixing is essential. Concrete strength should be set according to the grade requirements of raw materials to ensure targeted mixing and avoid rework.

3.3 Key Points of Concrete Vibration Technology

The concrete vibration process is closely related to the final pouring quality. Construction managers and technicians must effectively control this stage by selecting vibrators that meet engineering requirements and vibration needs, setting vibration intensity according to parameter standards, and then conducting vibration operations. During vibration, air bubbles may remain and must be promptly removed to avoid negatively impacting the final concrete strength[4]. Throughout the vibration process, the basic principle of "first top then bottom, first difficult then easy" should be strictly followed. After initial vibration, layered vibration is necessary. During layered vibration, the vibration height and time for each layer must be strictly controlled to ensure strength meets engineering requirements. Currently, insertion-type vibrators are predominantly used in modern construction concrete pouring. When using such vibrators, vibration should be performed through up-and-down oscillation, which can effectively control surface bubble formation and ensure concrete strength[5].

4. Exploration of Crack Control Strategies for Concrete Pouring in Construction Engineering

Crack control has always been a focus within the industry during concrete pouring. Improper construction practices or the lack of targeted crack control plans can significantly reduce concrete structural strength and stability, directly impacting the service life of modern buildings. Therefore, crack control should be treated as a top priority, specifically from the following aspects:

4.1 Implementing Early-Stage Curing of Concrete

Generally, cracks in concrete structures often occur during the solidification process due to environmental temperature influences. Frequent temperature changes or significant differences between internal and external concrete temperatures can generate internal stresses, leading to cracking and affecting construction quality. To reduce the likelihood of cracking, early-stage curing of concrete is essential. Specifically, concrete should be placed in an environment with appropriate temperature and humidity. Sunshade curing can be used for early-stage maintenance[6]. Construction units need to reasonably select the placement location and space for concrete materials, avoiding direct sunlight to reduce the possibility of cracking due to drying. Sunshades or nets can be used to maintain constant internal temperature and humidity, ensuring effective early curing. Moist curing can also be employed to keep concrete moist, effectively reducing the likelihood of cracking[7]. Various moist curing methods exist, typically involving spraying water or mist, allowing concrete to maintain performance through hydration during storage, thus preventing crack formation.

4.2 Implementing Foundation Settlement Prevention Measures

Foundation settlement in construction projects can directly cause concrete cracks, severely affecting structural stability and service life. Therefore, completing concrete pouring does not mean the construction is entirely finished; preventive foundation settlement measures are also necessary. Actually, preventive foundation settlement techniques can be applied during early-stage foundation and concrete construction to control crack generation. For example, foundation reinforcement techniques can be used. This requires first assessing the specific conditions of the building foundation, summarizing its parameters, and determining the stability and specific bearing capacity of the foundation structure[8]. After assessment, foundation reinforcement should be carried out considering factors like project scale, surrounding geographical environment, and building purpose. For instance, grouting reinforcement can be used, injecting specific slurries into the soil around the foundation structure to optimize its mechanical properties, increase its bearing capacity, and enhance its overall impermeability and reinforcement effect. Another method is groundwater level control for preventive foundation settlement maintenance. Currently, high groundwater levels are also a major cause of concrete cracking in modern construction. Therefore, to reduce the likelihood of cracking, reasonably controlling the groundwater level should be a priority in early maintenance to avoid settlement[9]. Construction units should monitor groundwater levels in real-time, record specific water level parameters after each monitoring session, and adjust levels promptly according to project needs to ensure appropriate groundwater levels, effectively reducing the possibility of settlement and thus preventing concrete cracks.

Furthermore, the rational use of admixtures can also effectively prevent foundation settlement issues. Primarily because admixtures can extend/shorten concrete setting time, making it more controllable and reducing the likelihood of cracks caused by improper formwork removal or unreasonable construction sequencing. When selecting admixtures, accelerators or retarders can be chosen. Accelerators are typically used to shorten setting time, while retarders extend it. The rational use of these admixtures can meet the specific needs of concrete pouring operations, making the hardening speed more controllable.

5. Conclusion

In summary, the application of pouring technology in modern construction engineering is increasingly widespread, ensuring main structural strength and facilitating quality control. However, to achieve the desired results with concrete pouring technology, the issue of cracking must be addressed. Considering the specific influences of environmental factors and technicians on site, the key points of concrete pouring construction must be clarified, and targeted crack control plans must be established. Currently, effective crack control can be achieved through early-stage concrete curing and foundation settlement prevention measures, ensuring the comprehensive quality of concrete pouring construction. In the future, the pouring technology system should be continuously

improved, focusing on key aspects such as raw material selection, mix design, and vibration. Green and environmentally friendly construction concepts should be actively introduced, highlighting the energy-saving and environmental attributes of concrete pouring technology. This will safeguard the quality and benefits of modern construction projects and provide more ideas for the subsequent development of the construction engineering field.

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