

# Analysis on Construction Technology of Concrete Structure in Civil Engineering

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**Abstract:** The rapid development of science and technology puts forward higher requirements for new building construction, especially in civil engineering construction. The construction quality of construction engineering is the core management and the testing link. The Concrete structure is an important safety and quality guarantee in the project and is the top priority in the civil engineering. In civil engineering, the concrete structure has an important social impact on the continuous research and development, and application of construction technology. This paper, discuss the advantage and disadvantage of using concrete in building construction.

**Keywords:** Civil engineering construction; Concrete structure; Crack phenomenon; Construction technology

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## 1. Introduction

The state attaches great importance to the civil engineering industry, strengthens its development, and has invested economic support to build buildings with good quality to meet the high-level demands of the people. With the development of civil engineering construction, it brings new opportunities where the relevant industries placed a higher requirement for civil engineering progress and standardization<sup>[1,2]</sup>. The concrete structure is an important basic part in the civil engineering construction. Additionally, when concrete is used in construction, it has a good transportation capacity, fire resistance, anti-corrosion, and destruction. However, there are many technical issues and management factors involved in the concrete construction, which may affect the project quality. Therefore, it is very important to strengthen the construction technology and quality management of construction engineering.

## 2. Advantages of concrete structure in civil engineering construction

The requirements of construction engineering industry for design scheme and construction quality have been more optimized. The concrete structures, mainly include the reinforced and plain concrete structures, and the performance of the concrete materials is closely dependent on its internal structure, where the performance of the concrete material can be changed by changing the concrete structure. The concrete structure is widely used in the civil engineering construction, and is an important part of the civil engineering building structure. The internal structure of concrete is the internal influencing factors and variation law of the concrete. The main features of concrete structure are described below.

### **2.1. Plasticity, compression resistance, and fire resistance**

The main components of concretes are water and sand, and the concrete material is soft and plastic in the wet state, and can be designed into various complex structures according to the needs, therefore it is beneficial for building pouring. Drying the concretes will be hard, thereby enhancing its compression resistance, make the building structure stronger, and the reinforced concrete is not easy to rust, can isolate the fire source, and improve the safety performance of the building.

### **2.2. High rigidity, strength, and durability**

The strength of reinforcement and concrete materials is conducive to the deformation control of the structure, especially the Reinforced concrete structure has a high level of durability.

### **2.3. Good integrity, earthquake and riot resistance**

The concrete material has good ductility, and gives people an overall feeling of integration. Additionally, it has anti-seismic, anti-explosion, and anti-radiation properties, which can be used as a protective structure in buildings.

### **2.4. Local materials and low maintenance cost**

It is easy and convenient to obtain concrete materials. For example, some industrial wastes and other substances can also be used to make the concrete aggregates. The materials are simple and cost-effective, the performance of the concrete will not be greatly affected, thereby can reduce the maintenance cost.

### **2.5. Save steel and reduce construction cost**

The concrete structure can decrease usage of steel in the building construction, which can reduce the overall construction cost.

## **3. Problems in the use of concrete structures**

### **3.1. Concrete regulation**

Concrete is an important material in the construction engineering. Concrete is complex in the production, construction, and its hardening process; therefore, it is important to focus on the concrete production technology. Controlling the mobilization of raw materials is the premise of ensuring the quality, for example by controlling the reasonable allocation of concrete materials, therefore the construction unit's delivery inspection and other production links should standardize the pouring, vibration, surface finishing, and other processes during construction, and taking maintenance measures as required.

### **3.2. The cement lacks heat dissipation and has cracks**

Relevant measures should be taken to release heat during the concrete mixing, otherwise it will have a serious impact on construction quality. In addition, self-shrinkage of concrete and hydration heat of cement will have an impact on the safety and stability of building structure. Therefore, reasonable pouring technology and binding force of the concrete is the key factors to ensure the construction quality.

### **3.3. Quality problems of the concrete materials**

Concrete is a kind of artificial stone, therefore before the concrete production, the quality of various materials should be strictly measured and inspected. For example, the particle size and composition of sand and gravel, conformity of cement source, manufacturer and production date, quality, and safety, and construction quality should be initially analyzed and reviewed before the concrete production.

#### **4. Causes of cracks in concrete structures**

The quality problems of concrete cracks will also occur due to the self-shrinkage reaction or objective environment. Additionally, concrete cracks are also caused by some microstructure, and cracks in the buildings can occur under special external environment or under different temperatures. This is the thermal effect force contributes by the temperature differences during construction. Further, under the physical action of concrete structure, local structure shrinks or expands will results in concrete cracks [3].

##### **4.1. Cracks caused by hydration heat of cement in concrete**

Concrete that is used in civil engineering construction should have a good physical property with load-bearing capacity. During the concrete production process, the heat generated during the concrete mixing will accumulate in the concrete, and when the surface temperature cannot be released on time and with the extension of time there will be a certain temperature difference between the inside and outside of the concrete. After some time, the temperature in the concrete will begins to decrease gradually and cool down. This action caused the thermal expansion and cold contraction, subsequently the cement hydration occurs, resulting in concrete cracks.

##### **4.2. Cracks caused by concrete self-shrinkage reaction**

When the concrete is placed, some water unable to evaporate or eliminated, which can lead to self-shrinkage, resulting in cracks, and subsequently affecting the construction quality. The interior of the concrete becomes dry due to the loss of water, thereby the volume of the shrink can be seen microscopically, and the concrete will solidify and harden after pouring [4].

##### **4.3. Cracks caused by objective environment**

The objective environment during construction will also lead to cracks, such as non-standard material selection, improper treatment of cold joints during construction, lack of scientific rationality in structural design and construction process, formwork removal factors, insufficient maintenance conditions and strength, improper setting of construction joints, too fast pouring speed, improper sequence, serious reinforcement stepping by constructors, lack of supervision and other factors, can also lead to cracks [5].

#### **5. Key points for improvement in civil engineering construction**

The application of concrete in civil engineering construction has the advantages of low cost and simple proportion, however the concrete structure has quality problems which are affected by some factors. Effective measures should be taken to improve the construction quality.

##### **5.1. Scientifically allocate the amount of concrete, and control the temperature stress of concrete**

Cement is a commonly used building material in concrete structure construction. The performance and dosage of cement have a direct impact on the functionality and structural stability of the concrete. Scientifically one should allocate a dosage of concrete, and select the cement with less hydration heat and higher strength as the engineering material, and also select cement that has lower hydration heat to avoid cracks. Additionally, the concrete pouring temperature should be strictly controlled to avoid high-temperature environment and large-area pouring. In the high-temperature environment, cooling or sun shading and other treatment measures should be taken. When necessary, the temperature can also be forcibly reduced to control the temperature stress of the concrete.

## **5.2. Key points of concrete transportation technology**

The transportation route and time shall be planned in advance. The construction personnel should strictly detect the concrete quality. In case if there is a problem with the quality, the concrete should be replaced immediately, to avoid interference in the subsequent construction.

## **5.3. Improving the crack resistance of concrete**

In order to reduce the hydration heat of concrete during construction, high-quality materials with good stability should be used maximally when selecting raw materials. The construction unit should strengthen the professional skills of construction personnel to reasonably use the amount of cementitious materials, improve the performance of the mixture, reduce the possibility of shrinkage, reduce the temperature stress caused by concrete hardening, and be able to perform construction activity with a strict attitude accordance with the design, further use scientific material ratio. In addition, adding retarding superplasticizer and mineral admixture can reduce the probability of cracks in concrete structure.

## **5.4. Select reasonable pouring technology**

The selection of construction scheme is very important. It is not only essential to optimize the proportioning design, but also the pouring should follow the requirements of engineering design before construction. Continuous pouring can avoid or reduce the occurrence of construction joints. In additional, controlling the temperature difference between inside and outside of the concrete is the most influential factor. Once there is a large temperature difference, it is easy to lead to large-area cracks. Therefore, pouring in high temperature or cold environment should be avoided as much as possible. Sand can be used for covering, low temperature method can be used as temperature control, the pouring speed should be minimized to achieve the thin-layer pouring goal, and the pouring work should be highly professional. Therefore, it is necessary to improve the literacy and ability of constructors, thereby they can fully grasp the key points of pouring.

## **6. Effective measures to improve the quality of concrete structure**

### **6.1. Strengthen the strength and defect detection of concrete materials**

Concrete strength and defect detection system can provide strong data support for concrete material ratio, for example, make the construction more systematic and quantitative, reduce the loss and the cost, and ensure high quality and high efficiency of construction. Additionally, during the construction process, problems such as damage or cavity cracks in the concrete structure can be detected timely, therefore corresponding measures for remedial treatment can be taken effectively. Further, the defect of the concrete materials can be determined, subsequently, improve the construction quality of the construction project as a whole <sup>[6]</sup>.

### **6.2. Improve the technical level of construction personnel**

The technical level of construction personnel is the core in building construction. The construction enterprise should formulate a perfect technical training scheme in the form of apprenticeship (master and apprentice) <sup>[7]</sup>. In addition, train the construction personnel to master the modern construction equipment, professional construction technology and quality standards, and boldly use new technologies, processes, equipment and materials. Further, the personnel should have an awareness of independent innovation, expand ideas, establish a high sense of professional responsibility of construction personnel, and improve own self to be in line with the rapid development of construction engineering.

### 6.3. Reduce the binding force of concrete, and take corresponding maintenance measures

The binding effect of components that cannot expand freely, such as reinforcement, will produce tensile stress, and the volume of the concrete structure will subsequently reduce when it hardens in the air after pouring, therefore, it is important to reduce the internal stress caused by the continuous decline of temperature during concrete solidification [8]. After construction, corresponding maintenance measures should be taken to improve its service life. There is a counterbalance between the internal and external binding force. In order to reduce the external binding force, layered pouring can be adopted to effectively control the stress caused by the internal and external temperature difference, or sliding layer can be added to reduce the internal binding force of concrete structure [9]. Further, it can effectively prevent cracks which are caused by dry shrinkage of concrete surface due to rapid evaporation of water, thereby, improve the service time and construction quality of the project.

### 7. Conclusion

Concrete is the main material in building construction. Its structure is of great significance for the overall building design scheme and construction, additionally it is widely used in civil engineering construction. The concrete construction also placed higher requirements for the overall quality and safety of building engineering. To ensure the overall integrity of concrete structure, the analyze and management of engineering construction should be effectively conducted, modern technology should be adopted, concrete construction technical problems should be reduced, and rapid development of construction industry should be enhanced [10]. Lastly provide favorable technical support and strong guarantee to improve the construction quality of civil engineering.

### Disclosure statement

The author declares no conflict of interest.

### References

- [1] Li Q, Wu L, 2016, Research and Thinking on Construction Technology of Mass Concrete Structure in Civil Engineering. *Jiangxi Building Materials*, 36(3): 96.
- [2] Hao J, 2018, On the Construction Technology of Mass Concrete Structure in Civil Engineering Buildings. *Building Materials and Decoration*, 14(47): 25-26.
- [3] Wang P, 2018, Application of Reinforced Concrete Structure Construction Technology in Building Construction. *Building Materials and Decoration*, 525(16): 11-12.
- [4] Li X, 2018, Research on Key Points of Construction Technology of Concrete Structure in Civil Engineering Buildings. *Building Materials Development Orientation*, 16(24): 46-48.
- [5] Liu K, 2020, Research on Construction Technology of Concrete Structure in Civil Engineering Buildings. *Journal of Jiamusi Vocational College*, 36(3):190-191, 193.
- [6] Wang H, 2016, Causes and Prevention Countermeasures of Concrete Floor Cracks in Civil Engineering Construction. *SME Management and Technology (Last Ten Days)*, 25(12): 171-172.
- [7] Li M, 2019, Discussion on Construction Technology of Mass Concrete Structure in Civil Engineering Buildings. *Contemporary Chemical Research*, 19(4): 193-194.
- [8] Analysis on construction technology of mass concrete structure in Civil Engineering Zhang Junchao. <https://wenku.baidu.com/view/b614f4fd31687e21af45b307e87101f69f31fb44.html>
- [9] Zhao X, 2020, Construction Technology of Concrete Structures in Civil Engineering Buildings.

[10] East China Technology, Academic Edition Sun Dongming-Analysis on Concrete Construction of Building Foundation Slab, 2013.

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