

*Original Research Article*

# Application of New Concrete Materials in Civil Engineering

Keli Tong\*

Juyu New Material Co., Ltd. E-mail: tongkl@sina.com

**Abstract:** In recent years, the cement industry has made continuous development, while there are more and more varieties of concrete materials, and new concrete materials play an increasingly important role in the field of civil engineering. Compared with traditional concrete, it has higher durability and strength, which can be consistent with the service life, function and physical performance of civil engineering. On this basis, the application of new concrete materials in the field of civil engineering is analyzed in order to provide the corresponding reference for people in the same industry.

**Keywords:** New Concrete Materials; Civil Engineering Field; Application

It is generally known, materials are the foundation of civil engineering construction, and various properties of materials directly determine the safety and stability of the whole project. If there are certain problems in the materials themselves, it will directly affect the subsequent construction and the final construction quality of civil engineering. However, with the development of new technology and new material technology, various new materials are widely used in civil engineering, which greatly guarantees the safety of civil engineering. Compared with traditional concrete, the new concrete has been greatly optimized in many physical and chemical properties. Fiber reinforced concrete, for example, has great advantages in flexibility and can meet the design needs of some special projects. However, in the process of applying new materials, it is necessary to consider not only the technical problems of materials, but also the related problems of material management, and strengthen the management of materials from the aspects of material procurement, material use and material storage, so that materials can better meet various application requirements.

## 1. The basic concept of concrete

### 1.1 The concept of concrete

Concrete, refers to the collective name of engineering composite materials in which aggregates are glued into a whole by cementing materials. Generally, ordinary concrete used in civil engineering construction refers to a kind of artificial stone, which takes cement as the main cementing material, and is mixed with water, gravel, gravel and other materials (mineral admixture and chemical admixture added if necessary) in a proper proportion, and then is formed by stirring, compact molding, curing and hardening, etc., so it is often called three-stone soil. In addition, the strength grade of concrete is divided according to cube compressive strength standard. In China, the strength grade of ordinary concrete is divided into 14 grades, namely C15, C20, C25, C30, C35, C40, C50, C55, C60, C70, C75 and C80.

At present, concrete materials have been widely used in the field of civil engineering, which has the advantages of low cost, abundant raw materials, high strength, good durability and good plasticity. However,

its disadvantage lies in the fact that concrete is a brittle material because of its heavy weight. In recent years, in order to effectively improve the shortcomings of concrete materials, China has continuously studied and explored them, and made substantial breakthroughs. For example, various new concrete materials, such as high-performance concrete, reactive micro-powder concrete and fiber reinforced concrete, have appeared one after another and have been widely used in the field of civil engineering.

## **1.2 New concrete is widely used in the field of civil engineering inevitability**

Nowadays, with the rapid development of society, people's living standards are gradually rising, which puts forward stricter requirements for the quality of civil engineering construction. However, the performance and quality of traditional concrete materials can no longer meet the quality of engineering projects and the needs of users. Therefore, new concrete materials came into being, which can be said to be formed by upgrading on the basis of traditional concrete. However, compared with traditional concrete materials, they are more environmentally friendly and energy-saving, and greatly promote the development of enterprise benefits. Therefore, it is inevitable that new concrete materials will be widely used in civil engineering in the future.

## **2. The connotation of new concrete materials and the significance of their application in civil engineering**

Compared with the traditional concrete production process, the new concrete material refers to the general name of materials which are prepared by adding chemical or non-chemical substances and adding related fibers, minerals or coal particles according to a certain proportion in the traditional concrete production process.

One of the most commonly used materials in the field of civil engineering construction is concrete. The quality and performance of concrete materials affect the effectiveness of the whole civil engineering construction to a certain extent. Therefore, strengthening the research and development of concrete materials has become the focus of research in the field of construction. Introducing new concrete materials into the field of civil engineering

construction, on the one hand, can upgrade the traditional concrete construction technology and materials, better improve the performance of concrete materials, and ensure the quality of civil engineering construction. On the other hand, compared with traditional concrete materials, new concrete materials have higher strength, durability and environmental protection, so the application of new concrete materials can help reduce construction costs, improve construction efficiency, minimize adverse effects on the environment, etc., and achieve win-win results in ecological, economic and social benefits.

## **3. The types of new concrete**

### **3.1 Fiber concrete**

Although the traditional concrete has great advantages in hardness and strength, it has some disadvantages such as poor durability and low tensile strength. However, the application of fiber in concrete can effectively solve this problem. The biggest characteristic of fiber material is its strong flexibility, which can meet the defects of concrete itself. The application of fiber material in concrete can significantly improve the physical and chemical properties of concrete through a certain proportion. On the basis of meeting the hardness and strength of concrete, the crack resistance and compressive strength of concrete are further improved. Compared with other building materials, fiber materials can effectively improve the toughness of concrete because of their mechanical properties, easy adhesion and dispersion.

### **3.2 Active micropowder concrete**

Compared with traditional concrete, the biggest advantage of reactive micro-powder concrete lies in its high structural strength, which can reach 200 Mpa–800 Mpa in compressive strength and 25 MPa–150 MPa in tensile index. In order to meet the needs of some applications, ordinary concrete can be transformed into reactive micro-powder concrete under certain conditions. In the process of transformation, it is necessary to treat ordinary concrete uniformly first, so that the range of low particle size of micro-powder concrete can be reduced to a certain range, thus improving the uniformity between concrete structures. In addition, when using micro-powder or very tiny powder materials, it is necessary to ensure that the bulk density of concrete meets the optimal structural configuration during the conversion process. In the pro-

cess of concrete hardening, in order to better improve the physical and chemical indexes of concrete, pressure or heating can be used to enhance the strength performance of concrete.

### **3.3 High performance concrete**

At present, many countries are aware of the advantages of high performance concrete, which has become a hot issue in the construction industry. Compared with traditional concrete, high performance concrete has been optimized and improved in many performance indexes, mainly in the following three aspects. (1) High performance concrete has small density and lighter weight under the same volume, which can significantly reduce the structural volume of concrete and meet the construction requirements of some special projects. Applying this kind of concrete to the construction process of foundation or bridge project can effectively reduce the load and structural weight of foundation or bridge body, thus ensuring the stability and reliability of the structure. Moreover, the concrete can effectively reduce the consumption of materials, reduce the building space and improve the economy of the project. (2) High-performance concrete has more advantages in application, and is less affected by external temperature and pressure, which facilitates the application of concrete, better carries out the construction of civil projects and reduces the construction intensity. (3) High-performance concrete also has great advantages in durability performance index, which can be used in very bad working range for a long time and improve the service life of civil engineering projects. Moreover, there is no need to carry out corresponding maintenance and overhaul in the use process, which improves the social benefits of civil engineering projects.

### **3.4 Roller compacted concrete**

Roller compacted concrete (RCC) is generally suitable for the construction of large-volume projects, such as highway pavement. The biggest advantage of this concrete is that it can significantly improve the construction efficiency, and can improve the material utilization efficiency and turnover efficiency. The reason why the construction efficiency can be effectively improved is that large-scale construction equipment can be used in the construction process. Compared with ordinary con-

crete construction, rolling concrete can shorten construction time by half, reduce water consumption by 20%, and reduce cement consumption by 30%. At the same time, RCC has more advantages in shear resistance.

## **4. Some suggestions on the application of new concrete materials in engineering**

### **4.1 Strengthen the selection of materials**

Reinforced concrete is still the most important building material in China, and its physical and chemical properties (hardness, strength and stability) can meet the requirements of construction projects. However, many civil engineering projects need to be built in some harsh environments and special geological structures, which poses a higher challenge to building materials, and traditional concrete materials may not meet the needs of the project. Many civil engineering projects will have cracks in different degrees in the long-term use process, which will affect the normal use of roads and bridges, so there will be great potential safety hazards in the driving process of automobiles. However, some new concrete can effectively solve this problem, and it will not appear various cracks in the long-term use process, such as fiber concrete. Fiber materials have more advantages in flexibility, which can significantly improve the flexibility, crack resistance and compressive strength of concrete when combined with concrete. However, fiber reinforced concrete has great limitations in hardness and strength, which makes this material unable to be used as a supporting structure for road and bridge projects.

The advantages, application scope, construction cost, construction reliability and construction period of various new concrete should be considered in the application of new concrete. Considering the influence of various factors, the best new concrete material can be selected. Try the application of various materials in the construction process, which can not only effectively improve the construction efficiency, but also effectively improve the economic benefits of construction.

### **4.2 Management of materials**

New concrete is an important guarantee to ensure the construction quality of civil engineering structures. In the process of purchasing fiber materials for civil engineering projects, it is necessary to select and purchase

them in combination with the actual construction environment and related performance requirements of civil engineering projects, and to select them in combination with price, material physicochemical properties and relevant credit standards of manufacturers. Especially, China has a vast territory, and materials for civil engineering projects are easily affected by extreme weather during use, which will cause serious damage to civil engineering projects under the long-term action. If the water content of concrete is high, the bridge deck will collapse or crack under the long-term action. At the same time, there are many kinds and properties of fiber materials in civil engineering projects, so how to select materials requires the construction company to make overall plans for various factors. Materials for civil engineering projects can be divided into many categories according to different physical and chemical properties, each category has great differences in price and performance, and the requirements for construction technology and construction period are different when choosing different materials, which requires the construction enterprises to coordinate various influencing factors in the process of formulating construction schemes, so as to select the best fiber materials as concrete ingredients.

#### **4.3 Suggestions on strengthening the construction site of new concrete construction**

A good design plan needs to start from three angles of construction technology, materials and construction environment, so as to carry out targeted design work. The

following problems should be paid attention to in the design process. First, the influence of various factors on the construction project should be fully considered in the design process, especially the influence of various bad weather in the geological environment, including the influence of wind speed, temperature and rainfall change. Only by taking these factors into account can targeted solutions be better formulated in the design scheme. For some operation areas, several sets of design schemes can be formulated, and the best construction scheme can be selected in the actual construction process, so as to better guarantee the construction quality.

### **5. Conclusion**

To sum up, new concrete is the future development trend. In the process of applying new concrete, it is necessary to develop the economy, reliability and safety of new concrete application from various angles, so as to better improve the application of new concrete in civil engineering.

### **References**

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