Application research of steel fiber rubber regenerated concrete engineering

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Abstract: With the booming development of China's building industry, the recycling of building materials can achieve the effect of reducing energy consumption. For the construction and development of rural areas, rural roads and small water conservancy projects are also being gradually optimized and transformed, in which a lot of waste building materials will be generated. With the progress of science and technology and the in-depth research on regenerated concrete, the regenerated concrete began to be promoted everywhere. This paper elaborates the performance of the new steel fiber regenerated concrete rubber, considered from the aspects of reducing engineering cost and shortening the construction period, discusses application of regenerated concrete to rural road construction, small water drains and other projects, so as to provide a reference for the use of renewable resources in rural areas, and promoting the development of more scientific and ecological construction industry.

1. Introduction
With the gradual improvement of people's requirements for the quality of living environment, all kinds of old buildings are constantly demolished in the process of urban reconstruction and new construction. In the process of reconstruction, a large amount of new building resources are needed and a corresponding amount of construction wastes are generated. Concrete, as one of the basic materials of buildings, consumes a lot. It is necessary to develop and utilize the construction wastes reasonably to promote the effective recycling of building resources. The research on regenerated concrete technology was first put forward in Europe[1]. However, relative to the development of cities, the demand for regenerated concrete is not only reflected in cities, but also in rural areas. There is a certain gap between rural infrastructure construction and urban construction in China, and the housing construction in many areas is still relatively backward. In the process of reconstruction and expansion, if the waste materials can be used reasonably, it will help to solve the problem of building houses and obtaining materials in rural areas. In this context, this paper analyzes the research progress of steel fiber rubber regenerated concrete and the specific situation in rural areas, and expounds its application and future development prospect.

2. Research progress of steel fiber rubber regenerated concrete

2.1. Preparation of steel fiber rubber regenerated concrete
The waste building materials are cleaned and screened again, and mixed at a certain ratio, so that their performance can reach or exceed that of ordinary concrete. Especially in post-disaster reconstruction areas, urban old renovation projects or small projects in rural areas, if the waste concrete is well
treated, it not only effectively reduce costs but also effectively improve the environment, so the promotion and application of regenerated concrete is becoming more and more important. At the same time, in order to improve the characteristics of regenerated concrete, a certain amount of admixture is added into the mixture to make it randomly distributed in the concrete, so as to form a new type of building composite material (Figure 1). This kind of steel fiber concrete has better performance and can better block the cracks in the concrete. Effectively enhance the performance of concrete, not only has good tensile strength, compressive strength will also be increase, and thus have better elasticity and ductility, it also effectively improve the quality of buildings. In addition, with the continuous investment of economy and technology, rubber regenerated concrete made from waste tires is also gradually used. This is the integration of waste tires, using a machine to grind them into rubber powder or rubber particles, and mix them with cement in proportion to the final rubber regenerated concrete. This regenerated concrete also has unique properties, as well as the characteristics of rubber and cement concrete[2].

Figure 1. Mixing process of regenerated concrete

Figure 2. Vibration process of regenerated concrete

2.2. Properties of steel fiber rubber regenerated concrete
Ordinary concrete is one of the most common and commonly used resources in the construction process. Compared with ordinary concrete, steel fiber rubber regenerated concrete has different characteristics and good performance. Using the waste building materials, extract useable regenerated aggregate, added steel fiber and rubber particles in proper proportion to develop new concrete materials. Because steel fiber can disturb the arrangement in the concrete, it can enhance its tensile strength and compressive strength. The greater the amount of steel fiber, the greater the compressive
strength of concrete\cite{3}. Steel fiber can also effectively block the occurrence of cracks in concrete, if the rubber particles are mixed in, not only can play the function of steel fiber itself to increase the toughness of concrete(Figure 2). It can improve the mobility of concrete, so that its elasticity and toughness after hardening is also improved. In the research of steel fiber rubber regenerated concrete, different adjustment tests were carried out for various dosage, the results showed rubber particles had the greatest influence on the overall performance of regenerated concrete, steel fiber came second. In this constant research and experimentation, the reasonable ratio of various materials is obtained, so that the steel fiber regenerated concrete to achieve the best performance of rubber.

3. Research on engineering application of regenerated concrete

3.1. Overview of current rural road and water conservancy projects

According to the investigation, the present situation of roads and water conservancy in some rural areas showed some obvious problem. Firstly, the quality of some new constructions more or less just reach the engineering quality standard, but for the long run they had a high maintenance difficulties. During these projects located in remote area, hiring a team of professionals to do the work has economically difficulty. Therefore when construction take place, locally experienced contractor was employed to supervise an unskilled construction team. Engineering technology and project management capability were all rely on the contractor’s experiences. This might have problems such as contractor’s project management capability lagging behind, site management has low comprehensive utilization efficiency and uncoordinated problems and so on.

Secondly, the main ingredient of the project needs to be concrete, materials used to make concrete are very difficult to obtain. Because of these constructions located in rural area, It is very inconvenient to transport materials and equipment to the site. The cost is depends on transport distance, sometime the cost is double or triple just for transporting sand, stone, cements and other materials and equipments to the building site. In our country, the natural sand private mining is prohibited. Artificial sand can be used as concrete ingredient, but with high price which are not affordable to buy for road or water conservancy projects in rural areas. Transporting stone to rural areas is also a long way off, often due to a shortage of goods caused by the slow construction, which makes an increased time and material costs of engineering construction. these are problems existing in current rural construction engineering projects.

Thirdly, locals have lack awareness of the maintenance of existing roads and water conservancies. Therefore, in order to change the status quo, the reuse rate of construction resources in rural areas can be improved through the regenerated concrete technology, which can not only reduce the cost of construction projects and improve the quality of project management, but also improve the rural environment, shorten the distance between urban and rural areas, and promote the economic development of rural areas.

3.2. The application of regenerated concrete in rural roads and water conservancy projects

Due to the lack of engineering technology management and maintenance funds in rural roads. Regenerated concrete can be used regenerate old water conservancy projects and rural road projects. In the process of road retrofitting, the recycled aggregate can be used as semi-rigid base because of its good water stability and shrinkage. For the road soft soil foundation, according to the method of ripping-stone compaction, the waste concrete panel is broken to a block of more than 300mm, and the soft soil is filled in and squeezed, which can effectively improve the condition of road soft soil foundation and reduce the pavement settlement caused by unstable foundation\cite{4,5}. In addition, the strength of the waste material in the lower fine aggregate can also be mixed with stone chips through the ratio of cement mortar, can be used in part of the road brick inspection Wells\cite{4}. Finally, it is proved that the performance of the standard concrete can be achieved by the experiments of the waste materials after deep processing, which will be beneficial to the popularization and application of the recycled materials for the concrete pavement.
For roads or water conservancy regeneration projects, waste materials were collected from the site. Through the recycle process of crushing, screening, grading and then mixed with new materials as concrete ingredients. This can reduce the waste material disposal freight cost. It also can rapid processing and utilization of waste materials. Such a fast and convenient recycling system can help reduce the cost of construction, especially on production, transportation and management to be able to have certain cost savings in rural areas. At the same time, convenient renewable resources had shorten the construction period. Disposing of waste materials can also improve the quality of the environment and overall quality of buildings. Promote an easy way in regenerated or new construction of roads and water conservancy projects in many rural areas.

3.3. Application prospect of regenerated concrete in rural roads and water conservancy projects
In the future, natural resources will be gradually reduced. Through the scientific methods to improving the resource utilization rate of China's construction industry, it needs all kind of policy to support and publicity form local government for new technologies and new materials’ development and application. Through relevant policy, strengthening people's understanding of environmental protection so as to gradually promote the application of regenerated materials in various regions. Especially the infrastructure construction in rural areas, the promotion and application of new materials should have certain policy support. Promote the development of regenerated concrete related industries and give introduction and guidance in time. Offer certain support in the fiscal and tax, strengthen the awareness of regenerated concrete industries as well as the development of the relevant industries. The promotion of regenerated concrete related industries can provide a certain resource base for construction projects in rural areas. The more dispose of related waste materials, the effective use of resources in other projects. In a way that It can also help some villages and towns to alleviate poverty economically.

Secondly, according to China's development strategy, we should strengthen people's awareness of environmental protection, timely publicize the use and value of renewable resources to rural residents. so that people can have a more comprehensive understanding of renewable resources, and on this basis, we should adopt corresponding strategies to regulate people's behavior towards environmental protection. Good environmental protection awareness can promote people to deal with construction waste more reasonably. In the actual construction process, The most appropriate way is related enterprises and government departments worked together on recycle projects. Waste materials from all kinds of old building dismantled, and then conduct scientific and reasonable reconstruction, so as to quickly apply regenerated concrete to the construction.

4. Conclusion
At present, the research of steel fiber rubber regenerated concrete in China still needs to be further developed. Research interests include the mechanical properties and engineering applications of related materials, scientific and reasonable ratio of regenerated concrete, other properties of under different temperature, environments and climates. So as to strengthen the application of regenerated concrete technology, in addition, with the rapid development of the construction industry today, steel fiber rubber regenerated concrete, as an indispensable technology, can effectively solve the waste building materials while providing more resources for buildings materials. The application of this technology not only protects the environment, but also promotes the development and progress of the construction industry to some extent.

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