Research on the Application of Recycled Concrete and Regenerated Block in Green Building

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Abstract: It is the trend of building design to develop in China and all over the world, and the construction of green building is a global problem. Based on the requirements of green building for energy saving and material saving, we put forward a construction technology of recycled concrete and recycled block, and construct a resource saving and environment-friendly building construction mode. The application of recycled concrete and regenerated block in green building is briefly discussed in this paper.

1. INTRODUCTION

With the acceleration of urbanization, construction industry in China is developing rapidly, construction waste and building energy consumption are increasing. In this case, the of advanced technology to the preparation of concrete garbage into recycled concrete and recycled brick are put forward witch can not only reduce energy consumption, save construction materials, but also reduce environmental pollution. It is the way to achieve the propose of sustainable development and construction of green building. But the technology of the recycled concrete block and regeneration has just developing and not widely used in China. Further research on technical indexes of recycled concrete and recycled brick remain to do to provide support for the construction of green building and green building industry.

3. GREEN BUILDING AND ITS ENERGY SAVING REQUIREMENTS

Although it is not got a unified definition for green building both in China and abroad, there is a general consensus, namely in the whole life period and to maximize the conservation of resources (energy, land, water and materials), protect the environment and reduce pollution, provide healthy, suitable and efficient use of space for people in harmony with nature the building. It can be seen that green building is not simply a Roof garden or a three-dimensional greening, but an image or symbol, which requires saving resources, protecting the environment, reducing pollution, allowing buildings to return to nature, and realizing the harmonious co-existence of buildings and nature.

According to the "Green Building Evaluation Criteria" (GB/T 50378-2006) the relevant provisions of the green building energy saving requirements are: 1) the rational use of high performance concrete material; 2) the solid waste comes form building construction, demolition of old buildings and site cleaning process should be classification treatment, recycled materials can be recycled used; 3) the recycled materials can be used in recycled building as resource under the condition of ensuring the quality of construction, and the proportion should not be less than 30%.

2. THE APPLICABILITY OF RECYCLED CONCRETE AND REGENERATED BLOCK IN GREEN BUILDING

Recycled concrete refers to use the discarded concrete blocks by crushing, cleaning and grading treatment. All or part of the natural aggregates such as sand and gravel are instead of the discarded concrete blocks, mixed with water, cement and other materials in a certain proportion according to a certain gradation to make new concrete. The recycled concrete block is made by recycled concrete as the base material and added the cut off wheat straw as fiber. It is not difficult to see that the disused concrete blocks are the basic m éiers of recycled concrete and recycled concrete block. The use of construction waste not only reduces the cost of construction waste disposal, but also solve the building energy consumption, reduce environmental pollution, and meet the green building evaluation standards. It is feasible to use the recycled concrete and block to build green building, and it is a way to adapt to the green building energy saving requirements.

According to the relevant investigation, the total amount of garbage in our country is about 6 billion tones a year, and 40% is construction waste, witch cost high to garbage disposal. Moreover, building garbage and dust, the scattered, sand is one of the important sources of city atmospheric pollution. Construction waste storage and burial will corrode urban land not only, but also cause land pollution and water pollution. In construction waste, most of the waste concrete blocks are available. If these waste concrete can be made into recycled concrete and recycled concrete blocks, it will bring big environmental benefits, economic benefits and social benefits.

4. THE APPLICATION OF RECYCLED CONCRETE AND REGENERATED BLOCK IN

GREEN BUILDING

The owner of a common housing building in a place required to build a building according to the standard of green building. In order to meet the requirements of green building construction for users, the types of garbage produced in the local construction work of new building and dismantling old buildings are analyzed. The results show that the main construction wastes are concrete blocks, stones, bricks, gravel, metal, wood, glass, plastic and so on. The garbage situation of the construction work of new building is shown in Figure 1, and the garbage disposal of the old buildings is shown in Figure 2. It can be seen rom Figure 1 and Figure 2 that the proportion of concrete garbage produced by construction work and demolished old buildings is 30% and 35% respectively. Compared with other types of construction waste, the proportion of concrete block waste is larger, which provides strong support for the realization of green building construction.

Figure 1 the situation of garbage in the construction work of new building

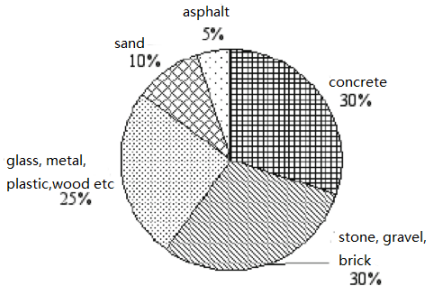
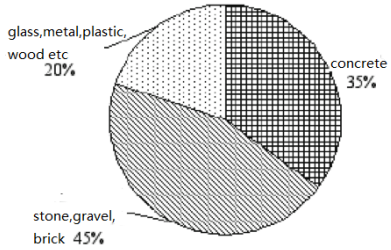


Figure 2 the dismantling of old buildings



Use the abandoned concrete blocks of the new construction and dismantling old buildings, the recycled aggregate is made after the treatment of crushing, washing and screening them. Then, the original natural aggregate replace by recycled aggregate, and the amount of replacement can be between 30%-100%. Under the advanced preparation technology, the strength grade of recycled concrete can be up to C30-C70 according to the scientific and reasonable mix ratio. However, when the recycled aggregate is used more than 50% of all the aggregate, the strength of recycled concrete will be reduced. In order to ensure the strength of recycled concrete, ordinary portland cement should be used instead of waste cement. What is more, the water reducing agent and air-entraining agent should be added to the recycled concrete, which can improve the technical index of recycled concrete. Adding a proper amount of water reducing agent in the mixture can reduce the amount of cement, and enhance the simplicity of regenerated mixed concrete during the agitation process. In general, the use of high efficiency water reducing agent in Colleges and universities should between 0.5%-1.5%. The concrete construction process is to mix the recycled aggregate and cement together, then add proper amount of water reducer to the recycled concrete, and then stirring the second times to form the final recycled concrete.

Under the condition of constant water cement ratio, the workability of recycled concrete can be improved by adding an appropriate amount of air entraining agent.

The problem of bleeding can be controlled and the surface pores can be reduced. The main function is to enhance the strength of recycled concrete. The investigation shows that for recycled concrete, the gas content increases by 1%, and the strength will decrease by 3%-5%. Therefore, adding an appropriate amount of air entraining agent into the recycled concrete can reduce the gas of recycled concrete and ensure the strength of recycled concrete.

Under the reasonable design of recycled concrete mix proportion, we can accurately calculate the amount of recycled aggregate, cement, air entraining agent, water reducing agent and water and so on. We can prepare high-quality recycled concrete, and its technical index is in line with the national standard of building quality. Take the C30 strength grade of recycled concrete as an example, its technical index is shown in Table 1.

Table 1 technical index of recycled concrete C30

strength grade	Amount of recycled aggregate	Slump	compressive strength	Depth of Carbonization	Flux
C30	30%	190mm	39.0MPa	9.9mm	2200C

The recycled concrete blocks produced by the above technology can reach to MU5.0-7.5 strength grade or even higher than this strength. When the strength grade of recycled concrete block is MU5.0-7.5, the measured heat transfer coefficient of recycled concrete block is 2.45W/m2-k, which is very similar to the heat transfer coefficient of ordinary concrete block. It can be seen that the physical and working properties of recycled concrete meet the standard of the regenerated block, and can be used in the construction of green building. There is no specific requirement for the strength of green building, users can use recycled concrete block with MU5.0 strength grade. The technical specifications are shown in

Table 2.

strength grade	dosage of Regenerated coarse aggregate	dosage of Regenerated fine aggregate and the micro powder	compressive strength	Hollow ratio	heat transfer coefficient
MU5.0	30	50	5.4	49	2.45

Besides using recycled concrete, recycled coarse and fine aggregate and fine powder when making recycled concrete block, proper amount of cut wheat straw should be used as fiber, and its dosage should be based on the strength grade of recycled concrete block. In addition, the proportion of each material should be scientifically designed to ensure that the mix proportion is reasonable in order to prepare the standard recycled concrete block.

5. CONCLUSION

In summary, using of recycled concrete and recycled concrete block in the green building construction can meet the requirements of the construction of green building project, but also reduce building materials consumption, and construction pollution, reduce the cost of waste disposal. It will bring huge environmental and economic benefits, promote the sustainable development of construction industry. In the future, the technology of recycled concrete and recycled concrete block should be widely used in the construction of green buildings.

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