

Compressive Strength of Recycled Aggregate Concrete with Different Ratio

Jinxu Guo¹, Yaojia Sun²

¹School of Civil Engineering, Henan Polytechnic University, Jiaozuo, China;

²Zhejiang Zhongcheng Construction Co., Ltd., Shaoxing, China.

Abstract

Taking recycled concrete with different mix ratio as the research object, the influence of recycled aggregate on the strength change rule of recycled aggregate concrete was analyzed through cube compression test, and the most appropriate proportion of recycled concrete was selected for the backfilling of fertilizer tank.

Keywords

Recycled Aggregate Concrete; Cube Compression; Fat Slot Backfill.

1. Introduction

In the maternity and child health care hospital, the distance between the side wall supporting structure of the foundation pit and the exterior of the buildings in the pit is only about 1.5m, and there are 2-3 waist beams, wedge-shaped plates and anchors and other obstacles in the middle. The implementation of backfilling and pressing of raw soil is difficult and its quality is difficult to be guaranteed. The settlement of the first stage foundation pit after backfilling reaches more than 100mm, causing ground settlement and pavement cracking. Had to re-break the road repair, affecting the road access and the overall image of the hospital.

When studying the durability of concrete materials [1-2], it is found that with the continuous aging of reinforced concrete buildings, more and more construction wastes are generated by the demolition and reconstruction in urban construction. A small part of the abandoned concrete soil is used for backfilling after simple treatment, and most of the untreated concrete soil is directly transported to the suburban area for stacking or burial. Concrete soil is the most widely used building material in the world. In the production process, a large number of stones and stones are needed to produce coarse aggregate, which causes great pressure to the ecological environment. And the production and transportation of waste concrete also cause a lot of environmental pollution and energy consumption. To reduce these problems, recycled aggregate concrete is used. Reclaimed aggregate concrete refers to the new concrete prepared by partially or completely replacing the natural bone material with the recycled aggregate made of broken waste concrete, which is referred to as recycled concrete. The new technology of recycled concrete has become a hot research issue [3-8]. The cubic compressive strength and tensile strength are the most basic mechanical properties of concrete. At present, the research on the compressive strength or tensile strength of recycled concrete mainly consists of single recycled coarse aggregate or recycled fine bone aggregate, and there is almost no research on the addition of recycled coarse and fine aggregate. This study from the single recycled coarse aggregate, recycled fine aggregate and mixed with recycled coarse aggregate and fine aggregate concrete mechanical properties, comparative analysis of the addition of recycled aggregate on the performance of concrete. It is expected to provide reference for the research of recycled concrete and its application in engineering structures. Using solid construction waste to prepare recycled aggregate and adding a certain amount of cement to mix the lean concrete has the advantages of easy mixing, moderate

strength and low cost. In recent years, it has been popularized and applied in fertilizer tank backfilling. According to the current situation of the proposed backfill fertilizer tank and the situation of recycled materials in Jiaozuo urban area, coarse and fine recycled aggregate of the recycling workshop of Jiaozuo Power Plant was selected to make 70.7mm square cube specimen by using the mix ratio in Table 1 for compressive test.

2. Test design

2.1 Test raw materials

The cement used in this test is 425 ordinary silicate cement. Since recycled aggregate of thickness and fine is the key factor affecting the performance of recycled concrete, the performance indexes of recycled aggregate are measured in ordinary tap water, as shown in the table below. The crushed pieces of 5 ~ 31.5 mm are regarded as recycled coarse aggregate. Take less than 5mm as recycled fine aggregate. The recycled coarse and fine aggregate is prepared in different proportions for concrete.

Table 1. The performance index of coarse and fine aggregate

raw materials	Bibulous rate/%	Packing density ($g \cdot cm^{-3}$)
Reclaimed fine aggregate	12.55	1.49
Regenerate coarse aggregate	5.65	1.18

2.2 Proportion design

This test is done in four groups, the first group with 500 grams of coarse aggregate, 50 grams of cement, 50 grams of tap water, the mix ratio is 10:1:1, cement content is 10 percent of the mass of aggregate. The second group used 550 grams of fine aggregate, 55 grams of cement, 110 grams of tap water, the mixture ratio was 10:1:2, the cement content was 10 percent of the mass of aggregate. The third group used 550 grams of fine aggregate, 27.5 grams of cement, 110 grams of tap water, the mixture ratio was 20:1:4, the cement content was 5% of the mass of aggregate. The fourth group used 250 grams of fine aggregate and 250 grams of coarse aggregate, 50 grams of cement, 100 grams of tap water, the mix ratio of 5:5:1:2, cement content for the mass of aggregate is 10 percent. Then it was made into a standard 70.7mm cube.

Table 2. Mix ratio and density of recycled lean concrete

Serial number	width /mm	Mix (coarse: fine: cement: water)	cement/%	density kg/m ³
The first group	69.95	10:0:1:1	10	1562.45
The second group	69.97	0:10:1:2	10	1785.62
The third group	69.96	0:20:1:4	5	1774.52
The fourth group	69.94	5:5:1:2	10	1685.46

2.3 Production and maintenance of recycled concrete test blocks

The recycled concrete is mixed manually. First, all the concrete materials are mixed evenly, and then water is added for mixing. After stirring for 3-5min, the mixing material is injected into the mold with a size of 70.7mm×70.7mm×70.7mm. After the vibration table is compacted, smooth the surface with a scraper. After 24h, the recycled concrete test blocks were removed and put into the curing room for 28d under standard conditions, and then their compressive strength was measured respectively.

2.4 Test equipment and test method

The main equipment for the test is WDW-50 universal testing machine, and the loading speed of the compressive strength test is 0.02MPa/s

3. Test design Test results and data analysis

After the cube compression test, the test parameters of different groups of test blocks are shown in the figure 1-4.

Table 3. Strength and failure mode of recycled lean concrete

Serial number	intensity /Mpa	Failure pattern
The first group	2.0	Figure 1
The second group	3.2	Figure 2
The third group	0.9	Figure 3
The fourth group	5.1	Figure 4



Figure 1. The first group of destruction modes



Figure 2. The second group of destruction modes



Figure 3. The third group of destruction modes

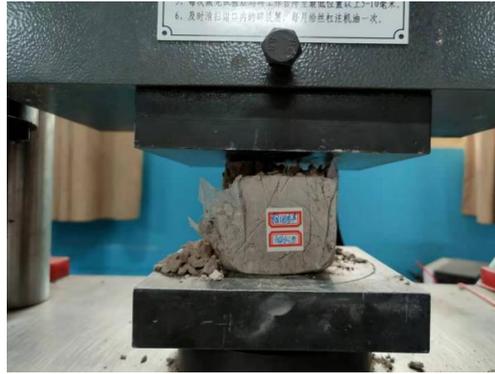


Figure 4. The fourth group of destruction modes

On the basis of the test data, in order to more accurately analyze the strength law of recycled concrete, under the premise of adding a certain proportion of recycled coarse aggregate, the change law of strength with different amount of recycled fine aggregate was studied. In the first group, the maximum failure load is 9.86kN and the compressive strength is 2.0MPa. In the second group, the maximum failure load is 15.85kN and the compressive strength is 3.2MPa. In the third group, the maximum failure load is 4.52kN and the compressive strength is 0.9MPa. The fourth group was tested with a maximum failure load of 24.75kN and a compressive strength of 5.1MPa. By comparison, the fourth group has the highest compressive strength and good failure mode.

4. Conclusion

On the basis of economy, through the cube compression test of recycled aggregate and concrete ratio with different dosage, it is finally concluded that when the dosage of coarse aggregate and fine aggregate is each half, the dosage of cement is 10% of recycled aggregate, and the dosage of tap water is 20% of recycled aggregate, the compressive strength is the largest, and the failure mode is good. Therefore, the lean concrete formed by adding a certain amount of cement has the advantages of easy mixing, moderate strength and low cost. In recent years, it has been popularized and applied in the backfilling of fertilizer tank. According to the current situation of the planned backfill fertilizer tank and the situation of recycled materials in Jiaozuo city, the optimal ratio of coarse and fine recycled aggregate mixed with half and 10% cement in the recycling workshop of Jiaozuo power plant was selected.

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