

Experimental Study on Partial Replacement of Coarse Aggregate by Crown Caps

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ABSTRACT

As we all know cement concrete is widely and commonly used in construction industry. All the materials required to make the concrete are extracted from the environment. The environmental resources are need to be used in control to protect the environment. There is excess amount of industrial waste that needs to be treated so that it won't cause any harm to the surrounding human race and the other environmental elements. Here we are trying to deal with the large amount of metal waste generated in the form of soft drink bottle caps. These caps are hard to biodegrade therefore these can be recycled or reused. The experiment initiated with 10% replacement of coarse aggregate with waste bottle caps. The size of bottle caps is 2.5cm (diameter) and 3mm projections. M30 grade mix is used with 0.42 water cement ratio. The mechanical properties are tested by carrying out the compression test, flexural test and split tensile test.

Keywords : Waste Bottle Caps, Compression Test, Flexural Test, Split Tensile

I. INTRODUCTION

We need the special attention towards the metal and plastic waste generated from the industry as these are not biodegradable which leads the saturation of these materials on the earth for a very long period. Concrete is most used man-made material as construction is a vital part of the development of the country or the facilities provided for the living. Using the bottle caps is one of the way to utilize it in the concrete production. The caps are lighter in weight than the stone metal. The metal caps are collected and partial replacement of coarse aggregate is

carried out and the experimental results are studied in order to compare the mechanical properties of this concrete with the regular concrete. The tests namely compression, flexural and split tensile test are carried out on different specimens. For compression test; cube of 150x150x150 mm, for Split tensile test; cylinder 150mm diameter and 300mm height and for flexural test; beam 100x100x500 mm are tested. The test results are taken for 7 days, 14 days and 28 days.

II. MATERIALS

Cement- Cement is a binding medium in the concrete production. Ordinary Portland cement of grade 53 is used conforming to IS 12269-1987. Initial setting time is 30 min. And final setting time is 600 min. The specific gravity of cement is 3.15.

Coarse Aggregate- Locally available aggregates are used. The size of aggregates used is 10-20mm . 0.5% water absorption The impact value and crushing value is 7.49% and 24.40% respectively. Specific gravity is 2.67, and fineness modulus is 7.2 and all are under limits and were tested in accordance to Indian Standard specifications IS: 383-1970.

Fine aggregates- Locally available sand confirming to zone II with specific gravity 2.65 and .25% water absorption was used. The testing of sand was done as per Indian Standard Specification IS: 383-1970. The size of the aggregate lesser than 4.75 mm is considered as Fine aggregate.

Water- Water is used for mixing, curing purpose should be clean, potable, fresh and free from any bacteria and desire matter confirming to IS 3025-1964 is used for mixing. water is a key ingredient in the manufacture of concrete.

Waste bottle caps- Crown caps of soft drinks and other beverages are collected and cut into half as shown in the fig.(1)



Fig. 1 - Crown caps cut half

III. METHODOLOGY

In this experiment M30 grade with nominal mix as per IS 10262-2009 is used. The concrete mix proportion (cement: fine aggregate: coarse aggregate) is 1: 0.75: 1.5 by volume and a water cement ratio of 0.43. The amount of materials in the mix is given below.

Detail mix proportion

Cement	Fine aggregate	Coarse aggregate
338 kg/m ³	686 kg/m ³	1082 kg/m ³

IV. EXPERIMENTAL PREPARATIONS

Total 18 cubes, 12 cylinders and 12 beams were casted. Metal caps were partially replaced with coarse aggregates in concrete in 2 different percentages 0% and 10%. For each percent of metal cap addition, 3 cubes, 2 cylinders and 2 beams were casted. Final strength of cubes, cylinders and beams were tested after 7, 14 and 28 days of curing.

All the three tests were carried out on universal testing machine

Compression test-Compression testing machine was used for testing the compressive strength of cubes [150 X 150 X 150] mm,

Split tensile test-split tensile strength of cylinders [Ø 150 mm, height 300 mm]

Flexural test-flexural strength test on beams of size [100X 100 X 500 mm]

V. REVIEW

This study is intended to find the effective ways to reutilize the waste Aluminium caps, which can be reused as a useful raw material (Coarse aggregate) for the preparation of the concrete. Possibly the compressive strength of the concrete increases when coarse aggregate is partially replaced by the metal caps. Also the concrete obtained is of lightweight.

VI. ACKNOWLEDGMENT

The author is grateful to the Principal, Yeshwantrao Chavan College of Engineering, Nagpur, Maharashtra, India for encouragement and granting permission for this project and also to publish this project. The author would also like to thank Prof. Amruta Yadav

for her valuable guidance. Author acknowledges the support received from the department and well-wishers.

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