

Utilization of Crown Caps to Enhance Compressive Strength of Concrete

Sneha Barapatre, Twinkal Adekar, Prof. M. D. Pidurkar

Department of Civil Engineering, Priyadarshini J.L. College of Engineering, Nandanvan, Nagpur, India

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 crown caps. These caps are hard to biodegrade therefore these can be recycled or reused. The experiment initiated with 0%, 10% & 15% replacement of coarse aggregate with waste crown caps. The size of crown 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, slump cone test.

Keywords: - Waste Crown Caps, Compression Test, green building.

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 crown caps is one of the ways 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 test are carried out on different specimens. For compression test; cube of 150x150x150 mm. The test results are taken for 7 and 14 days.

II. MATERIALS

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

Table-1 Physical Properties of cement

| S.NO | PROPERTIES | TEST RESULTS |
|------|--------------------------------------|--------------|
| 1 | Fineness (%) | 95 |
| 2 | Soundness by: Le Chatelier (mm) Max. | 15 |
| 3 | Initial setting time (Min). | 30 |
| 4 | Final setting time (Min). | 600 |

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 2.70 and all are under limits and were tested in accordance to Indian Standard specifications IS: 383-1970.

Table 2: Properties of Coarse Aggregate

| S.NO | DESCRIPTION | TEST RESULTS |
|------|------------------|--------------|
| 1. | Size (mm) | 10-20 |
| 2. | Specific Gravity | 2.70 |

Fine aggregates- Locally available sand confirming to zone II with specific gravity 2.275 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.

Table 3: Properties of Fine Aggregate

| S.NO | DESCRIPTION | TEST RESULT |
|------|------------------|-------------|
| 1. | Sand Zone | Zone 2 |
| 2. | Specific Gravity | 2.275 |

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 crown 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 0.42. The amount of materials in the mix is given below.

Detail mix proportion

We are using M30 grade for mix design as per IS:10262-2009.w/c ratio we used is 0.42 all test performed on specimens which are curried for 7 ,14 & 28 days (including sea water).determine the maximum strength gain by the proportion of waste crown caps (aluminum caps) which may be added into the concrete mix, percentage of waste crown caps replaced by coarse aggregate is 0%, 10% and 15%.

| Cement | Fine aggregate | Coarse aggregate |
|-------------------------|--------------------------|---------------------------|
| 383.2 kg/m ³ | 800.94 kg/m ³ | 1087.75 kg/m ³ |

IV. EXPERIMENTAL PREPARATIONS

Total 22 cubes were casted. Metal caps were partially replaced with coarse aggregates in concrete in 3 different percentages 0%, 10% and 15%. For each percent of metal cap addition, 3 cubes were casted. Final strength of cubes were tested after 7, 14 & 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.

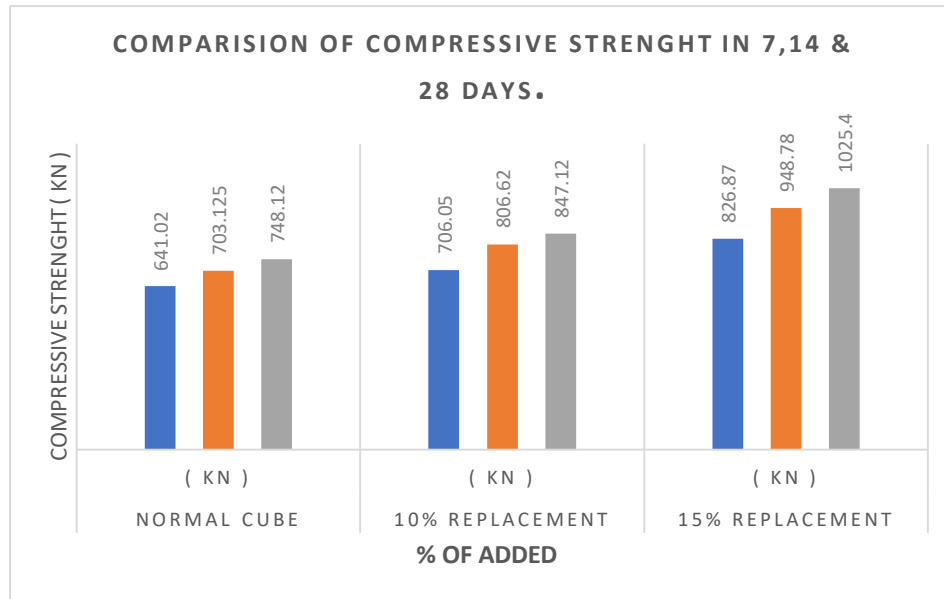


Fig. 2 – Compressive testing machine

| SRNO | DAYS | NORMAL CUBES (KN) | 10% REPLACE(KN) | 15% REPLACE (KN) |
|------|------|-------------------|-----------------|------------------|
| 1 | 7 | 641.125 | 703.175 | 748.135 |
| 2 | 14 | 706.06 | 806.625 | 847.125 |
| 3 | 28 | 826.875 | 948.780 | 1025 |

V. RESULT

From compressive strength test for 7 ,14 & 28 days we obtain strength increase by 8% and 11% for 10% and 15% replacement by crown caps as compare to normal cubes.



VI. CONCLUSION

Waste crown caps play the vital role in producing extra strength in concrete at very low cost. The possibilities of using waste crown caps (WBC) as partial replacement of gravel have been explored.

Addition of waste crown caps increases compressive strength of concrete to larger extent.

In compression tension and flexure the specimen with soft drink crown caps as waste material was found to be good.

Concrete is strong in compression and weak in tension but, percentage increase in tensile strength of soft drink crown concrete is more as compared to normal concrete.

The weight of concrete have been reduced considerably

Since, crown caps of soft drinks are easily available, they can be easily collected and cut into fibers and the compressive strength can be increased to it some extent.

Waste reduction, conservation of energy and increase green construction.

The inclusion of these crown caps is a positive effect which means that disposing the waste crown caps is not a problem now and the environmental impact of the crown crown caps has been reduced.

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