

Experimental Study on Behaviour of Concrete with the Partial Replacement of Aluminium Caps

Manju.S¹, Sathish Kumar.C², Surya Narayanan.R.N³, Raj Kumar.M⁴

¹Assistant Professor, Dept. of Civil Engineering, K. Ramakrishnan College of Technology, Tamilnadu, India

^{2,3,4}B.E Student, Dept. of Civil Engineering, K. Ramakrishnan College of Technology, Tamilnadu, India

Abstract - The aim of this project is to partially replace the coarse aggregate with aluminium caps and to reduce the use of coarse aggregate in the concrete when compare to that of conventional concrete. At present this is one of the industrial waste to dump in the environment. On the view of waste recycling material in this research paper the aluminium caps of beverage bottles are the recyclable one. It can be used in the concrete as a partial replacement for coarse aggregate. The analysis initiated with 15% replacement of coarse aggregate. By using aluminium cap in concrete up to certain limit the corrosion effect can be reduced. The size of 2.5cm is used in the concrete mix of grade M20 is adopted with w/c ratio of 0.50. These caps are first checked for the moisture content and the quality content. After the inspection is completed they are crushed into smaller pieces. And then the replacement is carried out for various percentage (20% & 25%) and the compressive strength of each percentage is compared with the compressive strength of conventional concrete. Then the desired result obtained is optimum for construction. This help to reduce the cost of construction.

Key Words: Aluminium caps, Waste recycling material, Compressive strength.

1. INTRODUCTION

Now a day the cost of construction material is high and its demand also is increased. Therefore, the replacement of construction materials by innovative, cost effective and eco-friendly materials as alternative in concrete. Utilization of solid waste or secondary materials has encouraged in construction to produce concrete because it contributes to reducing the consumption of natural resources. For many years, aluminium-products such as aluminium caps were considered as waste materials. They have been successfully used in the construction industry for partial replacement for fine and coarse aggregates.

1.1 Literature Review

The following literature review were studied. The introduction of other metals, such as copper to improve strength, will reduce the durability of the aluminium alloy. One option is a dual alloy with pure aluminium cold-rolled, if it is a sheet material; the second option is to anodise or powder coat the aluminium. The next step is to make certain

that the proposed assembly is well detailed and the workmanship on site is of a high standard. Particular attention should be made to ensure the avoidance of bimetallic corrosion between dissimilar metals such as aluminium and copper.

Here they are examined the concrete produced with 20% Al dross replacement gave optimum strength and decent workability for hot weather concrete condition. The mortar produced with 20% Al dross blending rendered a 30 min delaying the initial setting time, realised using penetrometer test. However the final setting time of 20% aluminium dross concrete was attained after 720 mins. The concrete produced with 30% Al dross replacement experience the higher rate of flexible strength reduction due to inhomogeneity in the distribution of hydration product in concrete at hot weather condition. The Al dross improve the durability of concrete. The water absorption of Al dross concrete is significantly less as compared to that showed about of control concrete. The aluminium dross concrete 20% to 30%.more resistance to acid attack. The exposure of al dross concrete to the acidic solution resulted in the decrease of compressive strength up to 12% and reduction in weight about 5%. The weight and strength loss of control concrete are much higher at all periods when compared to that of al dross blended concrete mixes.

In this they are analysed Aluminium and concrete composite structure are not an new invention since worked on this issue as early as the previous century. They described a composite girder consisting of an aluminium beam and reinforced concrete slab. Aluminium and concrete structures were not commonly used because of the lack of a connector which could effectively join an aluminium beam and concrete slab. The lengthiness of construction was yet another problem. Moreover, the authors analysed the resistance and stiffness of a 5.2m aluminium and concrete composite beam. The aluminium and concrete beam consist of a concrete slab, steel sheeting, connector and aluminium beam. Aluminium and concrete composite structure may be an alternative steel and concrete composite structure.

Here they examined the characteristics strength of the concrete containing recyclable Aluminium caps have the following valuable conclusion: The strength of concrete containing 10% of Aluminium caps shows a gradual increase in Compression test after 28 days curing. The percentage of

increase in strength is found to be 12%. The size of Aluminium caps also varies the strength parameter which can be further studied in detail. That helps to fix the ratio of Coarse aggregate to required amount of replacement. The research also focused to utilize the waste caps as coarse aggregate so that the natural coarse aggregates which is obtained from the quarries can be reduced in order to save the natural resources and to go eco friendly environmental condition.

2. METHODS

The availability of course aggregate is becoming less now a days and the scrap deposits of aluminium is increasing, such that caps are made of aluminium which are used as a lid of cold drinks and another beverages are collected, the reason for selection of these caps because the size of aggregates used in the design mix should not greater than 30mm. Plastic such that to prevent the degrading of concrete when mixed with plastic liners. Tampering of liners present inside caps are removed manually caps is done such that there will be no hallow space present inside and has a rough texture.

Concrete is prepared in four types, first is without replacement of aluminium caps, second is with 15% replacement, third is with 20% replacement, fourth is with 25% replace of these caps by weight. The grade of concrete used for this test is M20 using IS:10262-1982. The cube size 150 x 150 x 150mm has been chosen to determine the compression test. We tested the cube after the 7, 14 and 28 days of curing.

2.1 Materials Used

Cement (grade OPC43), coarse aggregate, fine aggregate, aluminium caps, water.

2.2 Material Properties

Cement

1. The specific gravity of cement is about 2.97.
2. Consistency of cement is about 31.6%.
3. The initial setting time of cement is about 35 minutes.
4. And the final setting time of the cement is about 450 minutes.

M-sand

1. The specific gravity of m sand is about 2.5.
2. The sieve size taken as per IS Code range from 150 microns - 4.75mm.
3. Water absorption value is about 1.08%.

Coarse aggregate

1. The impact strength value of the conventional coarse aggregate is about 5.16%.
2. The water absorption value is about 1.5%

3. The specific gravity of coarse aggregate is about 2.8.

Aluminium caps

1. Specific gravity of aluminium caps is about 2.56 g/cm³.
2. Its melting point is 660.31°C.
3. Its boiling point is about 2499°C.

Table -1: Mix proportion

DIFFERENT MIXES	MIX 1	MIX 2	MIX 3
ALUMINIUM CAPS	15%	20%	25%



Fig -1. Aluminium caps in concrete.

3. COMPRESSION TEST

The compression test were carried out after 7, 14, 28 days of curing. The test results are showed in the below.



Fig -2. Compression test.

Table – 2: Compressive Strength gain for different mixes.

COMPRESSIVE STRENGTH	MIX 1 15%	MIX 2 20%	MIX 3 25%
7 th day	17.4	13.89	9.53
14 th day	19.64	19.22	13.21
28 th day	21.82	21.36	14.7

- Gireesh mailer, sujay Raghavendra N(2016), "Investigation of concrete produced using recycled aluminium dross for hot weather concrete conditions".
- Venu Malagavelli(2011), "An experimental investigation of Strength characteristics of concrete using solid waste.

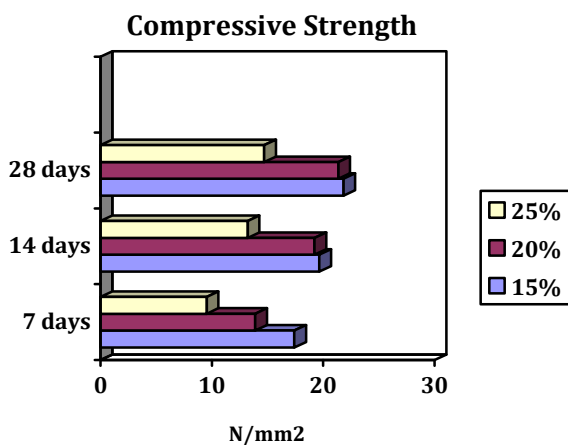


Chart -1: Behaviour of concrete when aluminium caps are added.

4. CONCLUSIONS

- As per IS code the mix design is prepared and casted the cube.
- The above graph clearly shows that compression strength of concrete containing 15% of aluminium caps increases gradually.
- On observing from the strength, it is clear that the strength decreases when the percentage of aluminium caps increases.
- This study helps to fix the ratio of coarse aggregate to required amount of replacement.

REFERENCES

- Michale Stacey and Chris Bayliss(2015), "Aluminium and durability : reviewed by inspection and testing".
- Mr.Sai Gopi Kamepalli, Ms.Misbah Bashir, Mr.S.Ganesh(2017), "Experimental study of replacement of coarse aggregate with aluminium caps".