International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1091-1093 www.ijaem.net ISSN: 2395-5252

Use of Substitute Material in Concrete- Hand Made Plastic Aggregates (Hmpa)

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Submitted: 25-06-2021 Revised: 04-07-2021 Accepted: 07-07-2021

ABSTRACT – In this paper, we have Reserch That In this work, plastic waste is considered for to check suitability in concrete by partial replacement to the naturally available granite coarse aggregates. Plastic wastes like polythene covers which are used as carry bag of less than 40 micron thickness were collected from garbage and are subjected to heating but not melting completely (temperature around 450° C to 600° C for a period of 3 to 5 seconds) and reshaping them to aggregates of size approximately 10mm were used as Hand Made Plastic Aggregates (HMPA) for partial replacement to natural granite coarse aggregates. These HMPA, were used in the controlled concrete mix of 25MPa and tested for compressive strength, and slump test.. Light weight concrete can also produced since, the density of HMPA were varies from 500 kg per cubic meter to 600kg per cubic meter, whereas natural granite coarse aggregates were approximately 1730 kg per cubic meter.

I. INTRODUCTION

Monolithic The present major problem in the environment is the plastic waste generation and its reuse with proper collection methods, separation and disposing it without affecting human beings and animals. In India, approximately 12 million tones plastic products are consumed every year and which is expected to rise further and also about 50% to 60% of its consumptions is converted in to waste .

The government has taking up so many steps to adopt standard methodologies to minimize the waste generation that is from the beginning of its source to proper disposal through Plastic Waste Management (PWM) system. In Karnataka about 2996 plastic industries producing about 600 metric tons of plastic per day and generates plastic wastes of 28 tons/day. From pastone decade, plastic waste became major issues in terms of collecting, separating and reusing it. Since use of plastic from industries to house hold purposes as containers to store items and up to a package to food items and hence it is very difficult to segregate from other type of organic waste because of its non bio-degradable property.

Currently, the world produces 4.4 billion tons of **concrete** annually, but that number is expected to rise to over 5.5 billion tons by 2050 as poorer countries rapidly urbanize, according to the Chatham House report.

By replacing the coarse aggregate by the waste material which is harmful to the environment we shall be reducing the volume of concrete production throughout world.

This research is about the study of replacement of plastic aggregates to the natural aggregates in certain percentages and trying to find the most efficient amount of percentage of replacement so as to achieve the nearest of the target strength of the concrete after 28 days of curing in college laboratory's curing tank. Strength was investigated using the compressive strength test.

II. AIM AND OBJECTIVE

Cost Cutting
Environment Aspect
Learning about Strength Development and Testing .
Making of Light weight concrete

III. LITERATURE REVIEW

Amalu. R. Get. In 2016 performed the study the use of waste plastic as fine aggregate in

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concrete. They use plastic as substitute of fine aggregates in proportion of 10%, 15%, 20% and 25%. They found reduction in strength of concrete but support the use of plastic in non-structural concrete for the Reason it shows higher workability and reduce environmental waste.

Praveen Mathew. In 2013 study the use of Recycled Plastics as Coarse Aggregate for Structural Concrete. They performed test on concrete with various proportions of plastic aggregates in replacement of coarse aggregates and found the optimum result at 22% replacement of coarse aggregates with plastic aggregates. They further performed the test for other properties on concrete with 22% plastic aggregates and found that concrete with plastic aggregates was weaker in fire resistance.

Baboo Rai in 2012 study of Waste Plastic in Concrete with Plasticizer. They prepared M30 grade of concrete with varying proportion plastic pallets and then test the concrete with and without plasticizers. They add plastic pallets in proportion of 5%, 10% and 15% by weight of concrete. They found that there was reduction in density that can help in achieving low density or light weight concrete. they also found that there was reduction in slump and hence affects the workability but addition of plasticizers resolves the problem. They found reduction in compressive and flexural strengths but it was very low and can be allowed.

T. Subramani and V. K. Pugal in 2015 performed an experiments on plastic waste as coarse aggregates in concrete. They prepared the concrete with 5%, 10% and 15% replacement of aggregates in concrete with plastic. They found the optimum results at 10% replacement of aggregates with plastic. Further increase in plastic content decreases the strength of concrete.

Raghatate Atul M. in 2012 performed study on use of plastic bags in form of fiber in concrete and test it properties. He adds fiber in proportion of 0.2%, 0.4%, 0.6%, 0.8% and 1% by weight of concrete. He found that there was reduction of compressive strength with increase in plastic content, but there was increase in tensile strength with optimum strength at 0.8% addition.

IV. METHODOLOGY

The main theme of this project is to utilize recycled materials for the production of concrete. As disposal of plastic waste is not possible easily, they create adverse impact on environment. Reuse of plastic waste in concrete industry is considered as the most feasible application. It decreases the pollution of the environment and reduces the cost of the material.

STEPS INVOLVED

Calculation for casting of cubes4 cubes are going to be casted of M25 grade in the mould of 150X150X150mm.

1- **Conventional Method**- Using Coase Aggregate (10mm),Crushed Sand, Cement of grade 43 and water.
2- By replacement of 10% HMPA in place of coarse aggregate
3- By replacement of 15% HMPA in place of coarse aggregate
4- By replacement of 20% HMPA in place of coarse aggregate.

CALCULATIONS- •

- **Grade of concrete- M25**

1)Size of mould- 0.15X0.15X0.15m 2)Volume of mould- lxbxh of mould
=0.003375m3

3) Shrinkage factor= 0.003375x1.57= 0.00529875m3 Dry density of concrete
4) Ratio for M25= 1:1:21.Quantity of cementVolume- 0.0013246875m3 Density of cement- 1400kg/m3 Thus weight= VolumexDensity Weight of cement= 1.90kg Total- 1.90x12= 22.8kg

Weight of fine aggregate= 2.11kg Total- 2.11x12= 25.32kg.

4) Water content= cement content x w/c ratio =1.90 x 0.5 =0.95kg Addition of 5% due to wastage during mixing, handling= 0.9975 =1L Water content Total- 1x12= 12L

- For Aggregates with HMPA1. 10% replacement.

1.The 10% replacement will be by volume. Volume of coarse aggregate- 0.002649375m3.
2.Its 10% - 0.0002649375m3 will be the volume of HMPA to use.
3.Weight of aggregate= volume density. 4.Density of HMPA- 500 kg/m3

5. Thus weight of HMPA in this cube= 0.0002649375x500 = 0.13246875 kg
6. And weight of coarse aggregate-4.1065 kg Total- 0.13246875x3= 0.39740625kg2. 15% replacement.

1.The 15% replacement will be by volume.
2.Volume of coarse aggregate= 0.002649375m3
3.Its 15% = 0.00039740625m3 will be the volume of HMPA to use.
4.Weight of aggregate- volume x density.
5.Density of HMPA- 500kg/m3

6. Thus weight of HMPA in this cube= 0.00039740625x500 = 0.198703125 kg

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7. And weight of coarse aggregate- 4.0402kg Total- 0.198703125 x3= 0.596109375kg 3. 20% replacement.

1.The 20% replacement will be by volume.
2.Volume of coarse aggregate- 0.002649375m3
3.Its 20% - 0.0000529875m3 will be the volume of HMPA to use.
4.Weight of aggregate- volume x density
5.Density of HMPA- 500 kg/m3

6. Thus weight of HMPA in this cube= 0.000529875x500 =0.2639375 kg
7. And weight of coarse aggregate-3.9750 kg Total-0.2639375 x3= 0.7918125 kg.

2. Quantity of Coarse AggregateVolume- 0.002649375m3- As there are 2 parts of coarse aggregate Density of coarse aggregate- 1600 kg/m3 Weight of coarse aggregate= 4.239kg Total- 4.239x12= 50.868kg.

Quantity of Fine Aggregate Volume 0.0013246875m3. Density of Fine Aggregate- 1600 kg/m3

Procedure:

1. Remove the specimen from the water after specified curing time and wipe out excess water from the surface.
2. Take the dimension of the specimen to the nearest 0.2m.
3. Clean the bearing surface of the testing machine
4. Place the specimen in the machine in such a manner that the load shall be applied to the opposite sides of the cube cast.
5. Align the specimen centrally on the base plate of the machine.
6. Rotate the movable portion gently by hand so that it touches the top surface of the specimen.
7. Apply the load gradually without shock and continuously at the rate of 140 kg/cm2 /minute till the specimen fails.
8. Record the maximum load and note any unusual features in the type of failure.

V. CONCLISION

The comprehensive strength decreases with increasing waste plastic ratios at all curing ages. This may be attributed to the decrease in the adhesive strength between the waste plastic and the cement paste. It seems that the bonding between the plastic particles and the cement paste is weak. With increasing amount of waste plastic, the rate of reduction in strength gets flatter and the maximum reduction is only about 15% for all grades of concrete. Waste plastic as a HMPA can be used up to 10 % replacement to natural granite coarse aggregate in concrete without decreasing its strength. Slump test -The reduced slump values of waste plastic concrete mixes show that it can be used only in situations that required low- degree workability. Such situations are numerous in civil engineering applications, namely, precast bricks, partition wall panels, canal linings, and so forth. However, the workability increases by about 10 to 15% when superplasticizer is added to the waste plastic mix concrete. This plastic waste helps in reusing in concrete to avoid difficulties in recycling of plastic, difficulties in proper collection and disposing of waste plastic, helps to avoid death of cattle's by eating plastic covers at garbage yards and finally keeps the environment safe by reusing plastic waste. Light weight concrete can be made as the lesser density of plastic aggregates.

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