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CRUSHED PLASTIC WASTE IN CONCRETE

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Abstract - *Concrete is the most widely used construction material in the world, as well as the largest user of natural resources. Basically it consists of aggregates which are bonded together by cement and water. The major part of concrete besides the cement is the aggregate. Aggregate include sand and crushed stone. Use of these conventional materials in concrete is likely to reduce the resources unless there is a suitable substitute. Plastic waste materials are often used as a partial replacement of coarse aggregate reducing the cost of construction and help to overcome the deficiencies associated with the use of crushed stones. Also, these materials are identified very harmful to the environment if it is disposal to the land and water. Hence we in this project have aimed to study the effectiveness of Plastics as substitute for coarse aggregate. Aggregate properties viz., specific gravity, water absorption were conducted to ascertain the properties of concrete specimens and has been casted and tested for concrete mix with various percentage of replacement (10%,20%&30%) and its viability for replacement were discussed.*

Keyword: Aggregate, crushed stone, Gravel, conventional material, replacement.

1. INTRODUCTION

Concrete is the major construction materials, which are bonded together by cement and water. The major part of concrete besides the cement is the aggregate. Aggregate includes sand and crushed stones/gravel. Use of these conventional materials in concrete is likely to deplete the resources unless there is a suitable substitute. Plastic which is generated in large quantities as waste doesn't have useful disposal till now. But it possesses properties that are required for viable replacement of coarse aggregate in concrete. Hence in this project we are aimed to study the effectiveness of plastic as substitute for coarse aggregate. Aggregate properties viz., specific gravity, water absorption, is to be conducted. Specimen to be prepared to conduct compressive, tensile and flexural strength of concrete for M_{40} grade with replacement of crushed stone by plastic waste (10%, 20%, and 30%). To utilize the waste plastic in concrete, and also to minimize global warming. To study the properties of plastic waste concrete. To minimize the cost of concrete products. To study the possibility of make it as the alternative for coarse aggregate. To utilize the waste plastic in concrete, to minimize global warming. To study the properties of plastic waste concrete. To minimize the cost of concrete products. To study the possibility of make it as the alternative for coarse aggregate.

2. METHODOLOGY

In this methodology a concrete can be made utilizing the crushed plastic waste, in which the coarse aggregate is partially replaced with the crushed plastic waste. The utilization of industrial waste in a useful manner is a major challenge in this current situation, because of the pollution there is a great harm to the nature and common life. For this purpose the very harmful and non-degradable material waste, Plastic is chosen, in order to minimize the stack piling of plastics in the environment and to control the pollution on earth. Hence it needs an immediate remedy and according to the past studies made on the use of plastic waste plastic in concrete tell us that the usage of waste material in structural elements is a challenging activity in the construction industry.

3. MATERIALS USED

The general raw materials used in this project are;

Cement	-	OPC (53grade)
Fine Aggregate	-	River Sand
Coarse Aggregate	-	12 To 20mm (Angular)
Waste Plastics	-	8 To 10mm (Angular)
Chemical Admixtures	-	Conplast Sp430

The selected raw materials are carried out several test to know about its physical characteristics property, the above all raw materials undergo they respective test and thus selected for the further process.

4. MIX DESIGN

4.1 General

Concrete mix design is defined as the appropriate selection and proportioning of constituents to produce a concrete with pre-defined characteristics in the fresh and hardened states. In general, concrete mixes are designed in order to achieve a defined workability, strength and durability. The selection and proportioning of materials depend on:

- The structural requirements of the concrete oThe environment to which the structure will be exposed
- The job site conditions, especially the methods of concrete

- Production, transport, placement, compaction and finishing
- The characteristics of the available raw materials The concrete mix has been designed for M40 grade as per IS 10262 - 2009. The specified concrete grade involves the economical selection of relative proportions of cement, fine aggregate, coarse aggregate and water.

4.2 Mix Proportion:

Table -1: Mix Design Proportion

Water	Cement	Fine Aggregate	Coarse Aggregate
140 litre	390 Kg/m³	771.003 Kg/m³	1174.03 Kg/m³
0.40	1	1.98	3.01

5. TESTS CONDUCTED ON CONCRETE:

In concrete the tests carried out in two stages;

1. Fresh concrete
2. Hardened concrete

5.1 Fresh concrete test:

Fresh Concrete Concrete remains in its fresh state from the time it is mixed until it sets. Workability means ease to mix, transport and placed in a homogenous state. The workability of concrete can be tested by slump cone, flow table, v-bee test and compaction factor.

Table -2: Workability of Concrete

Type of concrete	Slump value (mm)	Remarks
Conventional concrete	58	Workable
Plastic Waste concrete (10% replacement of coarse aggregate)	64	Workable
Plastic Waste concrete (20% replacement of coarse aggregate)	68	Workable
Plastic Waste concrete (30% replacement of coarse aggregate)	74	Workable

The above table shows the slump value for Conventional concrete, Plastic Waste concrete 10%, 20%, 30% replacement of coarse aggregate as 58 mm, 64mm, 68mm and 74mm.

5.2 Hardened concrete test:

This test is carried out in concrete after when the concrete reaches its final setting time. The test carried out in hardened concrete are as follows;

1. Compression strength test
2. Flexural strength test

Compressive strength test:

F = P/A N/mm²

Table -3: Compressive Strength of Concrete

% of Waste Plastics (Replacement for Coarse Aggregates)	7days (N/mm ²)	28days (N/mm²)
0	34.76	53.14
10	29.65	48.84
20	27.41	45.32
30	24.57	42.18

The above table represent the 7 days of Compressive Strength of Conventional concrete and replacement of coarse aggregate by Plastic Waste as 10%, 20%, 30% as 34.76 N/mm ², 29.64 N/mm ², 27.41 N/mm ², 24.57 N/mm ² and 28 days strength as 53.14 N/mm ², 48.84 N/mm ², 45.32 N/mm ², 42.18 N/mm ².

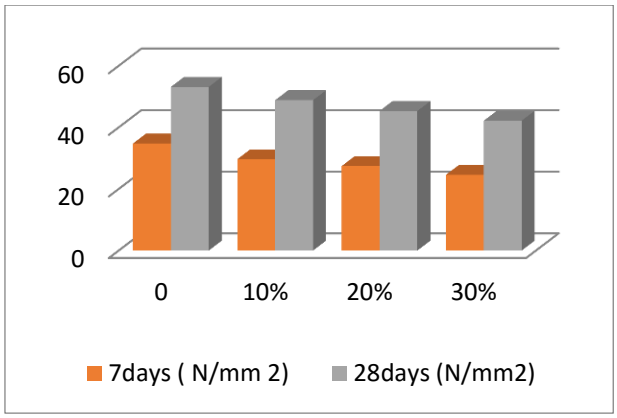

Fig-1: Compressive Strength of Concrete

The figure 1 shows the comparison of 7 days and 28 days compressive strength in various percentage of replacement.

Flexural strength test:

Flexural strength, also known as modulus of rupture, is a material property, defined as the stress in a material just before it yields in a flexure test.

Flexural strength = PL/bd²

Table -4: Flexural Strength of Concrete

% of Waste Plastics (Replacement for Coarse Aggregates)	7days (N/mm ²)	28 days (N/mm²)
0	3.58	5.26
10	3.47	5.12
20	3.23	4.89
30	3.17	4.26

The above table represent the 7 days of Flexural Strength of Concrete of Conventional concrete and replacement of coarse aggregate by Plastic Waste as 10%, 20%, 30% as 3.58 N/mm ², 3.47 N/mm ², 3.23 N/mm ², 3.17 N/mm ² and 28 days strength as 5.26 N/mm ², 5.12 N/mm ², 4.89 N/mm ², 4.26 N/mm ².

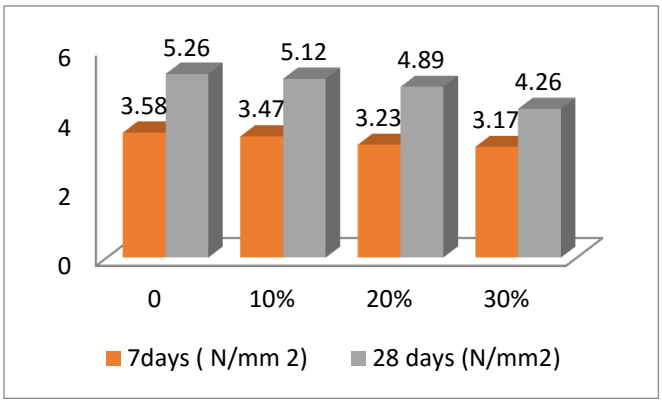

Fig-2 Flexural Strength of Concrete

The figure 1 shows the comparison of 7 days and 28 days flexural strength in various percentage of replacement.

6. CONCLUSION

The following are the conclusions drawn from the study on waste crushed plastic coarse aggregate concrete; the compressive strength of Waste Plastic concrete with 10% replacement is 48.84 N/mm²; it is almost Equal strength of normal concrete 53.14 N/mm² on 28th day. The compressive strength of Waste Plastic concrete with 20% replacement, it gives acceptable strength of 45.32 N/mm².In the flexural strength test conducted on Waste Plastic concrete, it shows a decrease in strength when compared to the strength of normal concrete. From the test results, it is found that the Waste Plastic Concrete posses less bonding ability which has affected on the strength of the concrete.

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