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STUDY ON WORKABILITY AND COMPRESSIVE STRENGTH OF SELF COMPACTING CONCRETE BY USING PLASTIC WASTE AS AGGREGATES

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Abstract *In this present era, the usage of plastic was becoming essential for all emerging sectors. The probability that you are surrounded by plastic is high. This Plastic plays a crucial role in the growth of the economy. The raw materials of plastic from crude oil, coal, etc., When we look into the merits of plastics which are helpful in this advancing technology. But, after the conversion of plastic into plastic waste, its demerits started because of improper plastic waste management. This plastics waste handling becomes a challenging problem in our daily life and present social scenario. In this plastic waste little was recycled remaining is occupying the landfills. Because of the low degradation rate, the accumulation of plastic increasing day by day in the environment which imparts hazardous effects for wildlife, the human food chain.*

On the opposite hand, because of urbanization and industrialization, there was an enormous demand for concrete. We have reused the plastic waste in concrete in the process of finding substitute material for fine aggregate. In this experimental study the fine aggregates are replaced with plastic waste in M40 grade of concrete. The results of fresh and hardened properties of concrete are determined for different percentages namely 0%, 5%, 10%, 15% and 20%.

Key words: Self compacting concrete, *plastic, workability, strength,*

1. INTRODUCTION

Advancement of self-compacting concrete (SCC) is an alluring accomplishment in the development business keeping in mind the end goal to conquer issues related with cast set up concrete. Self compacting concrete isn't influenced by the abilities of laborers, the shape and measure of fortifying bars or the course of action of a structure and, because of its high-smoothness and protection from isolation it very well may be pumped longer separations (Bartos, 2000). Self-compacting concrete was created around then to enhance the solidness of solid structures. From that point forward, different examinations have been completed and SCC has been utilized in commonsense structures in Japan, for the most part by substantial development organizations. Examinations for setting up an objective blend plan technique and self compactability testing strategies have been done from the perspective of making it a standard cement.

1.1 Self compacting concrete

Self-uniting concrete or self-compacting concrete (normally abridged to SCC) is a solid blend which has a low yield pressure, high deformability, great isolation obstruction (forestalls detachment of particles in the blend), and direct thickness (important to guarantee uniform suspension of strong particles amid transportation, position (without outside compaction), and from that point until the solid sets).

In ordinary terms, when poured, SCC is an amazingly liquid blend with the accompanying unmistakable down to earth highlights - it streams effectively inside and around the formwork, can move through deterrents and around corners ("passing capacity"), is near self-leveling (in spite of the fact that not really self-leveling), does not require vibration or packing in the wake of pouring, and takes after the shape and surface of a shape (or frame) nearly once set. Accordingly, pouring SCC is likewise considerably less work concentrated contrasted with standard cement blends. Once poured, SCC is generally like standard cement regarding its setting and restoring time (picking up quality), and quality.

1.2 Motive of self-compacting concrete

The intention being developed of self-compacting concrete was the social issue on strength of solid structures that emerged around 1983 in Japan. Because of a slow decrease in the quantity of gifted laborers in Japan's development industry, a comparative decrease in the nature of development work occurred. Because of this reality, one answer for the accomplishment of strong solid structures free of the nature of development work was simply the business compacting solid, which could be compacted into each side of a formwork, absolutely by methods for its own particular weigh.

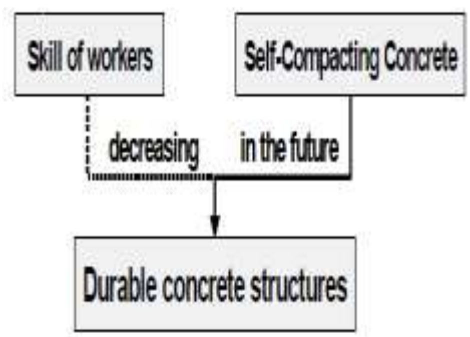


Fig 1: Necessity of Self-Compacting

1.3 Plastic waste

The synthetic and also the semi-synthetic materials today are referred to as plastics. These plastics have applications in many areas like Health-care, Transport, Packaging, Construction, Agriculture, Sports, Electronics, Energy, etc. since it is a versatile substance. Cellulose, natural gas, coal, and mixed oils are some of the core/raw materials that produce plastic. Plastics are of relatively low density and corrosion-resistant materials. They are also excellent thermal as well as electrical insulators. The circular economy can be established by recycling plastic waste.

Due to increased urbanization across the globe, the concrete production demand has been at an all-time high. Usage of plastic as a substitute material in the concrete could reduce the usage of other non-replenishing sources used in the concrete. It is for the best to use the substitute materials in Concrete by safeguarding its properties, we protect the natural deposits. The recyclability is based on the quality of the plastic. After overstepping off the limit, they aren’t useful for recycling.

Fig 2: Plastic Waste aggregates

1.4 Objectives of the study

The following are the main objectives for the self compacting concrete

1. To study the self compacting concrete containing plastic waste as fine aggregates.
2. To study the various literatures involved in the concrete made with plastic aggregates usage in concrete.
3. To check the workability of concrete made with plastic waste.
4. To study the compressive strength, split tensile strength of concrete made with different percentages of plastic aggregates.
5. To find the alternative material to solve environmental problems.

2. LITERATURE REVIEWS

Kristine Claire G. Santos, Glysa Mae Serrano, et al.,(2024) Different types of plastics, such as PET bottles and PVC pipes, into concrete through methods including powder and fiber integration. This particular investigation aims to assess the impact of substituting polypropylene plastic, commonly found in packaging and daily-use plastics, in concrete at concentrations of 0%, 25%, and 35%.

From this study it was concluded that Polypropylene fibers can effectively control cracking and enhance toughness, improving the durability of concrete structures. It increasing the percentage at significantly higher amount of polypropylene can lead to reduced compressive strength, workability issues, and potential dimensional instability.

Kusuma Mounika, K Anand Goud, et al.,(2021)

Self compacting concrete is defined as concrete that has ability to flow under its own weight. In the present paper an experimental investigation was conducted to study the workability and strength properties of concrete by using plastic waste and alccofine as replacement materials for Fine aggregate and cement respectively. The percentage of plastic waste used as 0%, 2.5%, 5%, 7.5% and 10% of Fine Aggreagate and alccofine used is 5% for all mixes for M35 grade of concrete mix. The comparison of results like workability and strength was made with and without using alccofine.

From this experiment it was concluded that Eco friendly, Green Concrete has been promoted worldwide to encourage Sustainable Development in the field of Construction where huge amount of concreting works are carried out. Utilizing plastic Waste as a partial replacement for fine aggregates provides a significant role in its disposal due to its adversarial effects.

3. MATERIAL USED AND MIX DESIGN

3.1 Cement

Conventional Portland bond of 53 review from the nearby market was utilized and tried for physical and concoction properties according to May be: 4031 – 1988and observed to acclimate different particulars according to Seems to be: 12269-1987.

3.2 Fine aggregates

In the present examination fine total is regular sand from nearby market is utilized. The physical properties of fine total like particular gravity, mass thickness, degree and fineness modulus are tried as per IS :2386.

3.3 Coarse aggregate

The pulverized coarse total of 12.5 mm greatest size adjusted acquired from the neighborhood squashing plant, Robo silicon, keesera gutta; Hyderabad is utilized in the present investigation. The physical properties of coarse total like particular gravity, mass thickness, degree and fineness modulus are tried as per IS ; 2386.

3.4 Plastic waste

Plastics collected from the disposal area were sorted to get the superior one. These were crushed into small fraction and washed to remove the foreign particles. Then it was heated at a particular temperature so that the necessary brittleness was obtained. After extrusion the molten plastic was cooled down and collected in boulders of 100 mm size approximately. These plastic boulders were crushed down to the size of fine aggregates aggregates.

3.5 Superplasticizer

The super plasticizer utilized in solid blend makes it exceedingly functional for additional time with considerably lesser water amount. It is perceptive that with the utilization of substantial amounts of better material (fine total + bond + fly slag) the solid is much hardened and requires more water for required usefulness subsequently, in the present examination SP430 is utilized as water diminishing admixture.

3.6 Water

This is the least expensive but most important ingredient of concrete. The water, which is used for making concrete , should be clean and free from harmful impurities such as oil, alkali, acid, etc., in general, the water, which is fit for drinking should be used for making concrete.

3.7 Concrete Mix

Final trial mix for M40 grade concrete

W	C	FA	CA
202.74	405.48	789.36	980.1
0.4	1	1.58	1.49

4. Experimental investigation

4.1 Casting of cubes and cylinders

Throwing of shapes and chambers as improved the situation M40 review self compacting concrete, the blend extent is for which we are throwing 3D squares for typical cement, with the fractional substitution of cement

Fig 3: Filling the mould (for 150 mm cube 3 equal layers)

4.2 Compacting with compacting bar

150 mm molds ought to be filled in three roughly square with layers (50 mm profound). A compacting bar is accommodated compacting the solid. It is a 380 mm long steel bar, weighs 1.8 kg and has a 25 mm square end for smashing. Amid the compaction of each layer with the compacting bar, the strokes ought to be conveyed in a uniform way finished the surface of the solid and each layer ought to be compacted to its full profundity

Fig 4: Compacting the concrete in the cube mould

Fig 5: Finishing

4.3 Curing

The solid sampless were restored utilizing until when their compressive qualities were resolved at ages 7,28 days and 56.

Fig 6: Curing of specimens

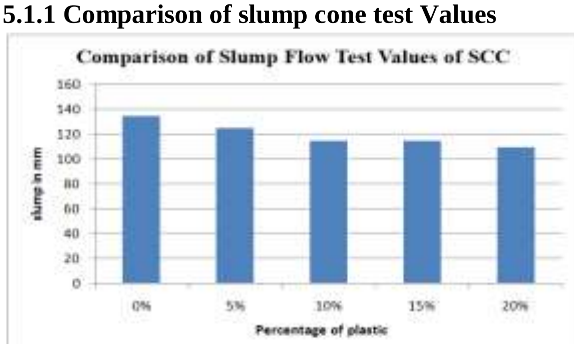
4.4 Tests to be conducted on concrete

1. Slump cone test
2. Compaction factor test
3. Compressive strength of concrete
4. Split tensile strength of concrete

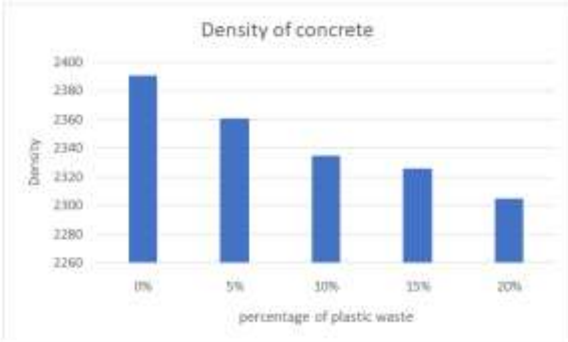
5. RESULTS AND ANALYSIS

5.1 Workability of concrete

5.1.1 Comparison of slump cone test Values

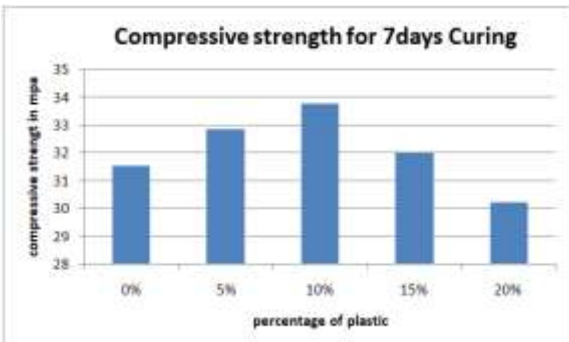


5.1.2 Comparison of density of concrete

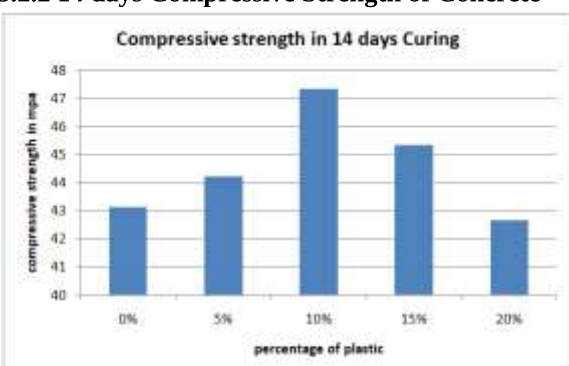


5.2 Strength Of concrete

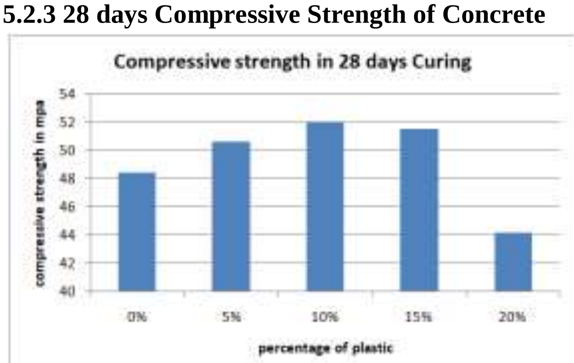
5.2.1 7 days Compressive Strength of Concrete



5.2.2 14 days Compressive Strength of Concrete

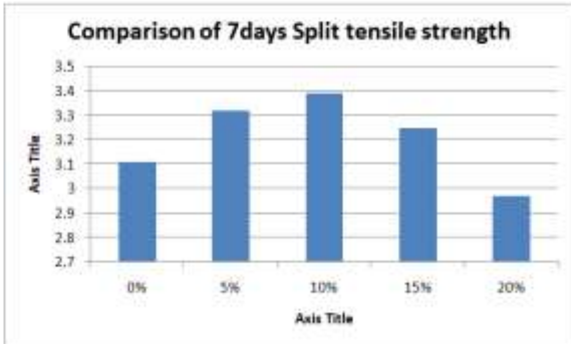


5.2.3 28 days Compressive Strength of Concrete

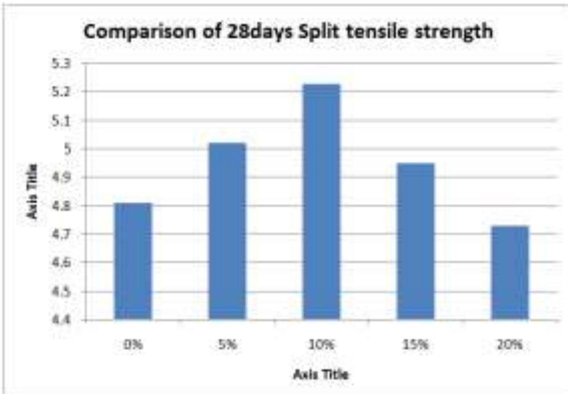


5.3 Split tensile strength of concrete

5.3.1 7 days Split tensile Strength of Concrete



5.3.2 28 days Split tensile Strength of Concrete



6. CONCLUSIONS

From the above experimental study the following conclusions were made

1. Self compacting concrete is made with the help of the various mineral admixtures.
2. The self compacting concrete can be compacted with vibrations by its own weight. The strength of self compacting concrete is higher than the normal concrete mixture.
3. By using plastic waste as fine aggregates the cracking effect of concrete will be reduces and it is also helps to increase the strength values related to compressive, split tensile and flexural.
4. By increase in the percentage of plastic waste as fine aggregates in M40 grade concrete the value of Slump flow decreasing from 135mm to 110mm.
5. By using plastic waste as fine aggregates replacement in M40 grade concrete the density was decreasing.
6. The optimal value of compressive strength was obtained for 10% Plastic waste replacement trial when we compared with other mixes. Initially the compressive strength increasing till 10% replacement of plastic waste and then decreasing with increasing the percentage of plastic waste beyond 10%
7. The maximum value of split tensile strength was obtained at 10% plastic waste in M40 grade concrete.

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