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A Review Paper on Replacement of Fine Aggregate, Coarse Aggregate and Cementitious Material in Conventional Concrete: A Critical Review

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Abstract: ***The production of plastic is increasing at a faster rate. It is very difficult to dispose this plastic waste as it creates environmental pollution. Plastic bottles usually take thousands of years to degrade and produce toxic fumes when incinerated. For solving this problem, construction industry can take a step to utilize this plastic waste as a substitute for aggregates. By replacing coarse aggregate as well as fine aggregate with waste plastic known as green innovation. As the years go by, waste plastic increases day by day, since most of the plastic used by human is non-bio-degradable. The idea behind this review is to identify research done by the researchers who uses recyclable material such as plastic obtained mostly from waste plastic that the people had generated around the world by utilisation of waste plastic in becoming of construction materials in order to overcome the environment problem that the society are facing. This paper aim to review the using of waste plastic to replace fine and coarse aggregate and stated the mechanical properties of the concrete. With different percentage replacement of aggregates will affect the different properties such as slump, compressive strength and ultimate strength of the concrete and compare with the control sample in order to find the suitable percentage of the waste plastic to replacement of aggregates for the concrete used. It was found that plastic as replacement for fine and coarse aggregate both have has lower compressive quality of the concrete, almost the same or lower slump test value for ordinary concrete and waste plastic concrete and lower density for the waste plastic concrete compare to the ordinary concrete.***
Keywords: Concrete, Low density polyethylene and Polyvinyl Chloride Waste, Silica Fumes.

I. INTRODUCTION

Concrete is the mostly used man made material used in construction industry and is the second after water as the most utilized thing on the Earth. In simple words it is defined as a mixture of four ingredients as coarse aggregates that form the largest proportion of the mix, fine aggregates such as sand that act as filler material in the voids, binding material such as lime or Portland cement that binds these material together and water that reacts with binding material. The mixing of these four materials gives us a paste that is called as matrix. At this stage it is called as fresh concrete or green concrete and get hardened like a stone, as the water reacts with binding material. This reaction is called as hydration of concrete. In fresh state concrete can be casted into any desired shape by placing it in forms. This property of concrete help in using the concrete in most efficient manner. Plastic needs no introduction as it is the widely used material now a days on our Earth. Due to its properties like strength, durability and easy processing it can be used for many purposes. Studies shows that plastic is nearly inert that is it get very less affected by the chemicals and have higher durability. Disposal of plastic waste is a huge problem as due to absence of organic compounds, it is non-decomposable material and proves to be a threat to our environment as it has many health hazards. As decomposition of plastic is a serious problem as it takes very long time and adversely affection the environment in many ways. So we can use it in construction, where we need life of structure to be improved and use of waste plastic after small processing can help us to reduce the waste in the environment which is new motto of civil engineering.

II. LITERATURE SURVEY

1) *Elango A and Ashok Kumar A in 2018 (1):* They performed study concrete with plastic fine aggregates. They used OPC 53 grade, River sand and crushed aggregates. They used plastic in place of fine aggregates in proportion of 10%, 20% and 30%. They test mechanical and durability properties on their concrete samples. They found the decrease in strength of concrete. But found that the concrete shows good results against acid attacks and increase in elasticity. So they concluded that the plastic aggregate concrete can be used in place where we need less compressive strength but more durability.

2) *LhakpaWangmoThinghTamanget. al. in 2017 (2):* They performed experiment on Plastics in Concrete as Coarse Aggregate. They performed the testing of mechanical properties of concrete containing Plastic aggregates They use plastic aggregates in proportion of 10%, 15%, and 20%. They found marginal reduction in strength and suggested the optimum result as 15% replacement.
3) *B Jaivignesh and A Sofi in 2017 (3):* They performed Study Properties of Concrete with Plastic Waste as Aggregate. They used the plastic place of fine aggregates as well as coarse aggregates in proportion of 10%, 15 % and 20%. They also added steel fibre to the concrete. Their research concludes to the reduction in strength but suggested its use in favor of reduction of waste material and eco friendly materials.
4) *MB Hossain et. al. in 2016 (4):* They performed work on Use of waste plastic in concrete as a constituent material. They replace coarse aggregates in proportion of 5%, 10% and 20 5. They found that the concrete was lighter in weight. But the compressive strength was lesser than that of conventional concrete. They also found that the concrete with 10% plastic aggregates shows strength nearly similar to the conventional concrete. So, the optimum result was 10% plastic aggregates.
5) *S. Vanitha et al. in 2015 (5):* They performed studies on use of waste plastic in Concrete Blocks. Paver Blocks and Solid Blocks of size 200 mm X 150 mm X 60 mm and 200 mm X 100mm X 65 mm were casted for M20 grade of concrete and tested for 7, 14 and 28 days strength. Plastic was added to a proportion of 2%, 4%, 6%, 8% and 10% in equal replacement of aggregates. They found the optimum result for paver block at 4% replacement of aggregates with plastic aggregates. And 2% of plastic in case of solid blocks.
6) *Ghutke & Bhandari (2014) (6):* They examine the Influence of silica fume on concrete.Results showed that the silica fume is a good replacement of cement. The rate of strength gain in silica fume concrete is high. Workability of concrete decreases as increase with % of silica fume.The optimum value of compressive strength can be achieved in 10% replacement of silica fume.As strength of 15% replacement of cement by silica fume is more than normal concrete. The optimum silica fume replacement percentage variesfrom 10 % to 15 % replacement level.
7) *Praveen Mathew et. al. in 2013 (7):* They 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.
8) *RaghatateAtul M. in 2012 (8):* They 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.
9) *Amudhavalli& Mathew (2012) (9):* They studied the Effect of silica fume on the strength and durability characteristics of concrete.The main parameter investigated in this study is M35 grade concrete with partial replacement of cement by silica fume by 0, 5, 10,15and by 20%. a detailed experimental study in Compressive strength, split tensile strength, flexural strength at age of 7 and28 day was carried out.Results Shows that Silica fume in concrete has improved the performance of concrete in strength as well as in durability aspect.
10) *Perumal& Sundararajan (2004) (9):* They observe the Effect of partial replacement of cement with silica fume on the strength and durability properties of high grade concrete. Strength and durability properties for M60, M70 and M11 0 grades of HPC trial mixes and to arrive at the maximum levels of replacement of cement with Silica fume, investigations were taken.The strength and durability characteristics of these mixes are compared with the mixes without SF. Compressive strengths of 60 N/mm2 , 70 N/mm2 and 110 N/mm2 at 28days were obtained by using 10 percent replacement of cement with SF. The results also show that the SF concretes possess superior durability properties.

III.CONCLUSION

As we can studied the research of all authors from that we can conclude that there is some research required in plastic aggregate to used it in partial replacement of the common aggregate. As we can see nowadays the depletion of natural resources in main parts so we have to move towards our next option i.e. plastic aggregate so from our study on plastic aggregate it can be implies that we can gives an better option to society as well to our world. And also we replace cement by silica fumes in our project to reduce cost of concrete. And we studied that the rising needs of middle class and lower-class people and ability of satisfy them to cheaper price as compared to other materials From the above study the following conclusions can be drawn.

1) Due to use of recycled aggregate in construction industry it can slow the impact of waste on environment.
2) It is clear that recycled aggregate can be used with natural aggregates.
3) It can be studied that again much more enhancement is needed in the recycled aggregate to replace common aggregate.
4) Due to its fineness and high amorphous silicon dioxide content, silica fume is a very reactive pozzolanic material.
5) Addition of silica fume accelerates the hydration of cement at all stages of hydration.

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We are very thankful to the entire researchers who have done excellent work for drawing attention towards possible disposal of plastic waste in concrete. Their efforts will really helps in saving environment from plastic waste.

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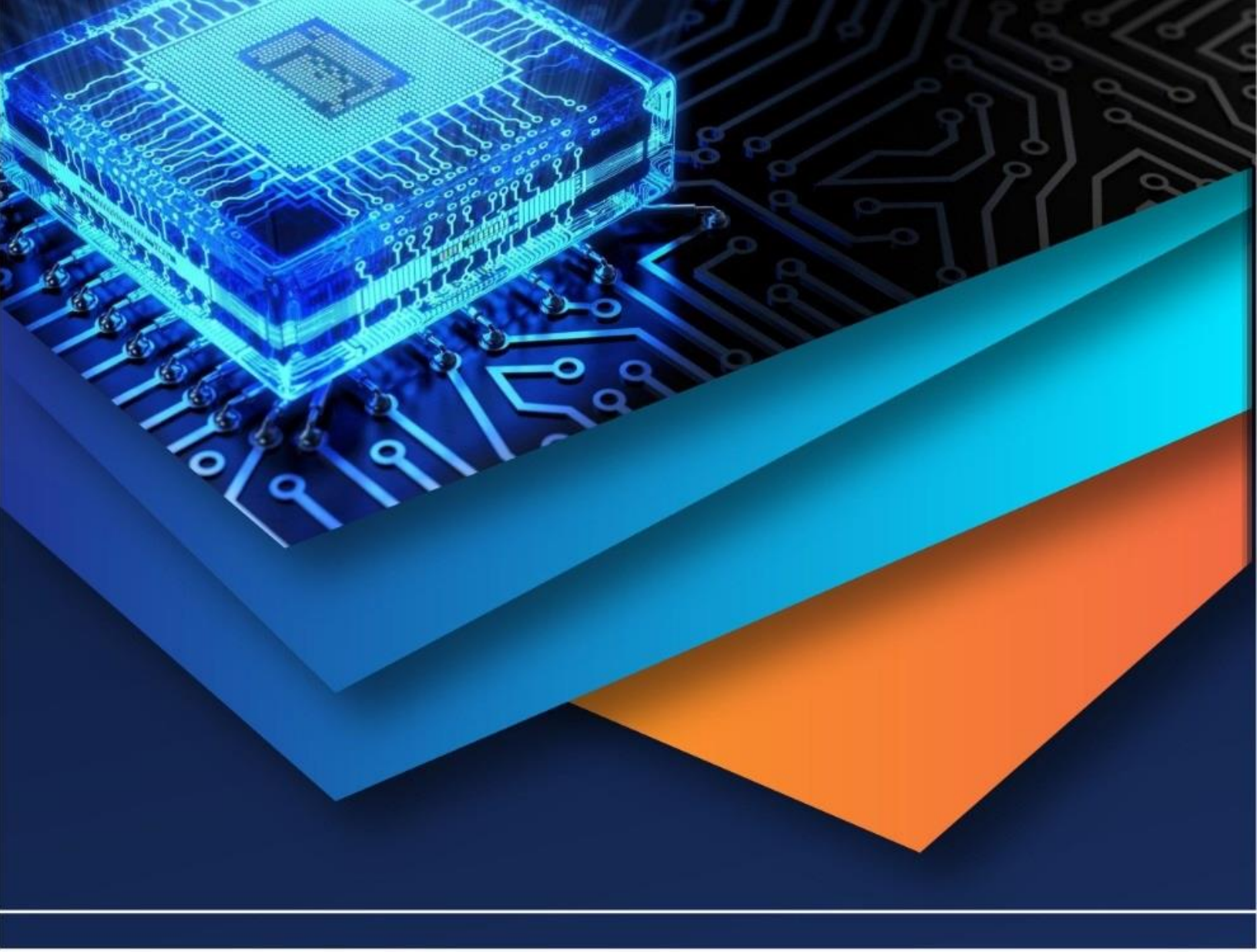

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