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EXPERIMENTAL STUDY ON THE STRENGTH OF CONCRETE BY PARTIAL REPLACEMENT OF COARSE AGGREGATE BY USING PLASTICS

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ABSTRACT: Many ways of reusing plastics for were implemented, yet those ways were not enough to manage the amount of plastic wastes being generated. So incorporating plastic wastes in concrete can be another way to reduce the disposal problem of plastic wastes. It can not only reduce the waste disposal problem but also reduce the excessive extraction of natural aggregates. Excessive extraction of natural aggregates can cause silting and sedimentation in rivers and can also change river courses, causes death of aquatic life and expose land to agents of degradation. Since waste is abundantly available, concrete with plastic aggregates can be cheaper compared to conventional concrete.

INTRODUCTION

The productive use of waste material represents a means of alleviating some of the problems of solid waste management (Davis and Cornwell, 1998). The reuse of wastes is important from different points of view. It helps to save and sustain natural resources that are not replenished, it decreases the pollution of the environment and it also helps to save and recycle energy production processes. Wastes and industrial by-products should be considered as potentially valuable resources merely awaiting appropriate treatment and application. Plastic wastes are among these wastes; their disposal has harmful effects on the environment due to their long biodegradation period, and therefore one of the logical methods for reduction of their negative effects is the application of these materials in other industries (Hassani et al., 2005).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 pcc 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 show 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.

OBJECTIVES

The main objective of this research is to explore the possibility of using waste plastics in concrete as concrete aggregate and reduce the problems

associated to plastic wastes disposal as well as the extraction of natural aggregates from the environment. Other objectives of the research are as follows:

- To obtain optimum 50% percentage of aggregate replacement.
- To study the change in mechanical properties of concrete.
- To study the feasibility of its application based on the properties obtained.

SCOPE

We get most of the aggregates by quarrying the stones and then crushing. As quarrying of stones cause change in geological aspects of the area, crushing causes the entry of dust particles in the environment. So causing bad impact to the environment in dual manner. To minimize these researchers focused on the usage of waste materials that were also adversely affecting the environment. Some of these are already in use such as Iron slag, Crusher Dust, etc. and many others are under research. So usage of these waste materials helping in dual role by minimizing the usage of raw material of concrete and by using the waste materials that are affecting the environment. The other advantage of using these waste materials is that they are helping in improving the properties of concrete. The waste

materials we have taken for our study is Plastic. Plastic has very bad impact on our environment but due to some of its properties it can be used in concrete.

PLASTIC MIX CONCRETE

The hardened properties of waste virgin plastic mix concrete have studied (CUR Report 1991). A number of concrete mixes were prepared in which sand was partially replaced by waste plastic flakes in varying percentages by volume.

HIGHLIGHTS OF PLASTIC AGGREGATES

- Plastic waste is potential to replace the natural aggregate at specific percentage.
- Material are fulfilling the standard requirement even after the addition of plastic.
- Plastic addition improves the durability and mechanical properties of the materials.
- Plastic waste utilisation provides benefits to the society, economy and environment.
- Future exploration is required to examiune other perspective of examine other perspectives.

LITERATURE REVIEW

Elango A and Ashok Kumar A in 2018 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.

LhakpaWangmoThinghTamanget. al. in 2017 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.

B Jaivignesh and A Sofi in 2017 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.

MB Hossain et. al. in 2016 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.

RaghatateAtul 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.

Praveen Mathew et. al. 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.

S. Vanitha et al. in 2015 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.

Baboo Rai et. al. 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.

Daniel Yaw Osei in 2014 performed experiments on plastics aggregate in concrete. He replace the coarse aggregates in concrete of ratio 1:2:4 by 25%, 50%, 75% and 100% with plastic. He found that there was reduction in strength of concrete as well as density of concrete. They suggested that replacement of aggregates more than 36% is not suitable for structural concrete. They also suggested plastic as a medium for production of light weight concrete.

T.Subramani and V.K.Pugal in 2015 performed an experiments on plastic waste as coarse aggregatesin 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.

NabajyotiSaikia and Jorge de Brito in 2012 study use of plastic in cement mortar and concrete. They found that workability decreases on use of angular plastic aggregates but increases with use of smooth aggregates. Irrespective of type of plastic, there was reduction of compressive strength, but the reduction of flexural and tensile strength was low as compared to compressive strength.

Amalu.R.Get. al. in 2016 performed the study the use of waste plastic as fine aggregate in 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 forthe reason it shows higher workability and reduce environmental waste.

Manhal A Jibrael and Farah Peter in 2016 studies the Strength and Behaviour of Concrete Contains Waste Plastic. They replace fine aggregates in concrete with plastic bottles and plastic bags in varying proportions from 0% to 5%. They concluded the results to use the plastic in concrete for non structural purposes as it reduces the strength in both cases.

PREPARATION OF PLASTIC AGGREGATE

COLLECTION OF PLASTIC MATERIAL

- Collect the polypropylene (pp) plastic for good flexible and strong.
- Compare with other plastics materials polypropylene plastic is easier for melting and moulding.
- Polypropylene is most commonly used for plastic moulding. Examples included chairs, plastic carries.

MELTING

After collection of materials, melting on materials using „FIREWOOD STOVE" steel pan .collected plastic materials should be broken into pieces in the oven and melt for up to 900˚C.

Plastic will start to lgnito after it is somewhat melt.so cover the plastic to prevent oxygen from getting to it .once the plastic is melted is melted, remove the steel plate from the oven now we got a plastic melting slurry.

DRYING

After Melting We have plastic slurry. First of fall place a wooden board or iron plate in an empty space and spread M-Sand evenly over it. Then apply the Melt plastic slurry on the M-Sand with the help of a trowel. Then apply One Layer M-Sand on the slurry. This position should be 30 seconds to 60 seconds.

HAND MOULDING

After Drying 60 seconds. Then slurry the slurry with the M-Sand with the help of a trowel, split the slurry to the right size and roll the plastic by hand with the proper gloves on your hands to bring it to the Coarse Aggregate shape. Essentially it is necessary to mould this slurry within the next 180 seconds of removing it from the oven. If not again plastic Slurry will be Hard.

CEMENT

PHYSICAL PROPERTIES OF CEMENT

CONSISTENCY TEST ON CEMENT

The normal consistency or standard consistency of a cement is defined as that consistency which will permit the Vicat plunger of 10 mm diameter to penetrate to a point 5 mm to 7 mm from the bottom of the Vicat mould when the cement paste is tested as described.

FINENESS TEST ON CEMENT

The Fineness Test of Cement is **done by sieving cement sample through standard IS sieve**. The weight of cement particle whose size is greater than 90 microns is determined and the percentages of retained cement particle are calculated. This is known as the Fineness of cement.

INITIAL SETTING TIME OF CEMENT

The time elapsed between the moments when water is added to the cement to the time when the square needle penetrates a depth of 33 to 35 mm from the top of the mould is known as the Initial Setting Time of that cement. The initial Setting Time should not be less than 30 minutes for PPC .

FINAL SETTING TIME OF CEMENT

The time at which cement completely loses its plasticity and became hard is a final setting time of cement. Or. The time taken by cement to gain its

entire strength is a Final setting time of cement. The Final Setting Time is 600 minutes (10hrs).

SPECIFIC GRAVITY OF CEMENT

The specific gravity of cement is important because it is one of the factor which determines the density of the cement. As we know that, the cement may contain lots of moisture content if it is exposed to various conditions and humidity. We all know that water cement ratio is an important factor of cement paste.

REFERENCES

1. Elango A and Ashok Kumar A " Study on Partial Replacement of plastic waste as fine aggregate in concrete" International Journal of Current Engineering And Scientific Research, Volume 5, Issue 5, 2018, ISSN (Print):2393-8374, ISSN (Online): 2394-0697

2. LhakpaWangmoThinghTamang, TsheringWangmo, Karma TsheringDarjay, Karma SangayPhuntsho, PhuntshoNamgyal, UgyenWangchuk "Use of Plastics in Concrete as Coarse Aggregate" International Journal of Education and Applied Research, Volume 7, Issue 5, 2017, ISSN (Print) 2249-4944, ISSN(Online) 2348-0033.

3. Amula.R.G, Azeef Ashraf, Muhammad Hussain, Rejith.K.U, Vijitha.V. " use of waste plastic as aggregates in Concrete" International Journal of Scientific & Engineering Research. Volume 7, Issue 4, 2016, ISSN 2229-5518

4. S. Vanitha, V. Natrajan and M Praba" utilization of waste plastic as a partial replacement of coarse aggregates in concrete Blocks" Indian Journal of Science and Technology, Volume 8, Issue 12, 2015, ISSN (Print) 0974-6846, ISSN (Online) 0974- 5645

5. Daniel Yaw Osei, " Experimental investigation on recycled plastics as aggregate in concrete", International Journal of Structural and Civil Engineering Research, Volume 3, Issue 2, 2014, ISSN 2319-6009

6. T. Subramani and V K Pugal, " Experimental study on Plastic waste as a coarse aggregate for structural concrete", International Journal of Application or Innovation in Engineering & Management, Volume 4, Issue 5, 2015, ISSN 2319-4847

7. RaghatateAtul M., " Use of plastic in concrete to improve its properties", International Journal of Advanced Engineering Research and Studies, Volume 1, Issue 3, 2012, ISSN 2249-8947

8. Praveen Mathew, ShibiVarghase, Thomas Paul ,EldhoVarghase, " Recycled Plastic as coarse aggregates for structural concrete", International Journal for Innovative Research in Science, Engineering and Technology, Volume 2, Issue 3, 2013, ISSN 2319-8753

9. B Jaivignesh and A Sofi, " Study on mechanical properties of concrete using Plastic Waste as an Aggregate", IOP Conference Series: Earth and Environmental Science, 2016

10. NabajyotiSaikia , Jorge de Brito, " Use of plastic waste as aggregate in Cement mortar and concrete: A Review", ELSEVIER, Construction and Building Material, 2012

11. Manhal A Jibreal and Farah Peter, " Strength and Behavior of concrete contains waste plastic", Journal of Ecosystem and Ecography, Volume 6, Issue 2, 2016, ISSN 2157-7625

12. MB Hossain, P Bhowmik, KM Shaad, " Use of waste plastic aggregates in concrete as a constitutional material" Progressive Aggriculture Journal, 2016, ISSN 1017-8139

13. Baboo Rai, TabionRushad, Bhavesh Kr, S K Duggal, " Study of Waste Plastic Mix Concrete with Plastic", International Scholarity Research Network, ISRN Civl Engineering, Volume 2012, Article ID 469272

14. IS 10262:2009," Concrete mix proportioning-guidelines", Buereau of Indian Standards 15. IS 383:1970," Specifications for coarse and fine aggregates from natural resources", Buereau of Indian Standards 16. IS 456:2000, " Code of practice for plain and reinforced concrete", Buereau of Indian Stand