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USE OF RECYCLED PLASTIC AS REPLACEMENT OF FINE AGGREGATE IN STRUCTURAL CONCRETE

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Abstract- Now a days disposal of dissipate plastic is one of the major green problem all above the world. The objective of this review paper is to examine the usefulness of using waste plastic as fine aggregate substitute in concrete mixtures. The compressive and tensile strength of a variety of concrete specimens were tested to establish how the amalgamation of recycled plastic as a replacement of fine aggregate would affect the expansion of strength in the mixes. In this reading plastic waste was mixed with cement concrete in a variety of scope such as 0%-15% and the M20 grade test specimen were casted to learning the behavior of plastic mixed concrete. All stages of plastic replacement show a perceptible diminish in compressive strength and tensile strength.

Keywords: Compressive Strength, Tensile Strength, Plastic waste.

INTRODUCTION

The speedy urbanization and industrialization all over the world has resulted in large statement of waste polymer materials. The world's yearly consumption of plastic materials has bigger from around 5 million tons in the 1950s to nearly 100 million tons in 2001. Now it touches to figure of 126.5 million tons in 2016.

As lone of the maximum inventions in 20th century, plastic has bring huge promote in human life. Numerous plastic products are being frenzied with the growth of civilization. However, large amounts of plastic waste give much pressure on the environment due to the very low biodegradability of plastic and permission of waste plastic consumer bags / bottles from the domestic has become a major problem to the agencies in the town and cities. Plastic bags / bottles neglected in the dustbins and their way into the drainage system and clog them. Often, these are burnt along the roadside, which produce fumes cause air pollution. Plastics have become an in discrete and basic part of our lives. The amount of plastics consumed annually has been growing steadily. Large magnitude of plastic waste is produced every year.

present the particulars about the amount of plastic burning up and plastic waste generate According to vital Pollution Control Board of India the plastic waste generated approximately 56 hundred thousand tons of plastic waste per annum and total plastic waste which is collected and second hand in the country is probable to be 9,205 tons per day Approximately 60% of total plastic waste and 6,137 tones remain uncollected and littered of which Delhi alone contributes 689.5 tons each day. Approximately 60 percent of the total plastic waste in Delhi is collected and recycled every day, while 40 percent remains uncollected or is discarded as litter and that the quantity of municipal solid waste (MSW) generation has rapidly bigger in China due to growing urbanization, population growth and industrialization. The total amount of MSW increased from 31.3 million tons in 1980 to 212 million tons in 2006, and the waste generation rate increased from 0.50 kg/capita/day in 1980 to 0.98 kg/capita/year in 2006.

Definition problems of the plastic

Plastic waste is essentially garbage. It is a sum total of all the solid waste produced in our homes, businesses and some industrial sources. As the plastic is not a biodegradable material it cannot be decomposed. As the waste producing is increasing the disposal of the waste is one of the major problems. The waste is sent for the landfills which cause the land to pollute as the waste material is contacting plastic which is non- biodegradable which causes many problems .The percentage of plastic waste in solid waste is growing in volume and in toxicity. More and more of our everyday plastic products contain toxic chemicals and these toxic products are combined with a plethora of other chemicals, which eventually impact public health and the environment. This has necessitated the importance of study on disposal of plastic waste otherwise it will create very serious health issues and problems.

PREVIOUS WORKS

This chapter presents a review of relevant research in the use of recycled plastic as a replacement of coarse aggregate in structural concrete. The main objective of the literature review is to explore studies related to use of recycled plastic as a replacement of coarse aggregate in structural concrete. Most of literature has been referred from the books, seminars, thesis conference proceeding, and research papers on over the use of waste plastic as replacement of aggregate.

Kshiteesh Gaur .et.al.[2017][1]. Modern activities in India leads to use of plastic bags in excess. Plastic being non-biodegradable material, it takes years to decompose.

Plastic bags have main constituent as poly-ethylene. The poly-ethylene when combusted produces a by-product of Carbon dioxide which leads to global warming .In this ,we study the efficiency of reusing plastic waste in concrete by comparing compressive strength of concrete whose fine aggregate is partially replaced by plastic(5%,10%,15%,25%) with control concrete of M20 grade. To compensate for the strength lost due to replacement, iron fibers of diameter 1-2 mm are used in fixed amount.

Gaurav verma[2016][2]. This paper represents a collection of waste plastics materials in concrete mixes. From this study it's concluded that the fine aggregate can't be replaced by plastic materials so only the course aggregate are used. The strength decreases drastically after replacing more than 20% plastic waste.

M Mahesh. Et.al.[2016][3]. The increase in population and the changed lifestyle has resulted in a significant rise in the quantity of plastic waste. This project in particular deals with the possibility of using the waste polyethylene as partial replacement of fine or coarse aggregate in concrete. Concrete with 2%, 4%, 6% pulverized/non pulverized polyethylene material is prepared after doing the mix design. Various tests on cement like specific gravity, fineness, setting time, etc., tests on coarse and fine aggregates like sieve analysis, fineness modulus, specific gravity, etc. are performed. Mix design using IS Code method is done and cubes and cylinders are cast for M25 grade concrete with and without plastics and tests on concrete like slump, cube tests and cylinder tests are performed to understand their behavior and usefulness as replacement. The standard mechanical properties of concrete like compressive strength, split tensile strength are tested and compared with the results of standard specimen.

B.Harini & K.V.Ramana[2015][4].
Concrete is combination cement, aggregates and water. Due to enormous growth in concrete, aggregates are facing crisis. Apart from this growth of plastic has provoked the methods to solve environmental issue caused by plastic. We have made an experiment by partially replacing fine aggregate with plastic an investigation has been carried out. The strength properties of M30 grade concrete are studied with different plastic percentage proportions. The various plastic proportions are 5%,6%,8%,10%,15%,20% by volume. We studied strength properties of these mixes. There is decrease in compressive strength when the ratio of plastic to aggregate was increased. We have taken the mix for which compressive strength was least and to that mix we have partially replaced cement with silica fume of 5%,10%,15% by weight. The strength properties were again studied, It was noticed that when cement was partially replaced by 10%, 15% of silica fume was higher than reference mix.

Khilesh Sarwe[2014][5]. This study presents the results of addition of waste plastics along with steel fibers with an objective to seek maximum use of waste plastic in concrete. Two different categories of mix were casted in cubes (150mm x 150mm x 150mm), one with varying percentages of plastic wastes (0.2%, 0.4%, 0.6%, 0.8% and 1% weight of cement) and another mix of plastics waste/steel fibers (0.2/0.1, 0.4/0.2, 0.6/0.3,0.8/0.4 and 1/0.5 % by weight of cement) to study the compressive strength at 7 and 28 days strength. The combine mix of plastic waste and steel fibers has shown more strength as compare to concrete mix prep only with plastic waste. He has reached to conclusion that a plastic waste of 0.6% weight of cement when used with steel fiber of 0.3 % (weight of cement) has shown the maximum compressive strength. This study has really focused on addressing the issue of reduced compressive strength with addition of plastic waste. Steel fibers when used along with plastic wastes will affect all the properties of concrete but the researcher only focused on compressive strength property which is insufficient to give clear picture of concrete behavior.

Raghatate Atul M3[2014][6] The paper is based on experimental results of concrete sample casted with use of plastic bags pieces to study the compressive and split tensile strength. He used concrete mix by using Ordinary Portland Cement, Natural River sand as fine aggregate and crushed granite stones as coarse aggregate, portable water free from impurities and containing varying percentage of waste plastic bags (0%, 0.2%, 0.4%,0.6% 0.8% and 1.0%). Compressive strength of concrete specimen is affected by the addition of plastic bags and with increasing percentage of plastic bag pieces compressive strength goes on decreasing (20% decrease in compressive strength with 1% of addition of plastic bag pieces). On other hand increase in tensile strength of concrete was observed by adding up to 0.8% of plastic bag pieces in the concrete mix afterward it start decreasing when adding more than 0.8% of plastic bags pieces.

METHODOLOGY

The size of the polythene sheets, road waste, raw plastics, and plastic straws were cut in to the size of course aggregates. The percentage of addition of plastics was varied from 0%-10% by weight and the specimen was cast. The compression testing samples were cast in cubes of 150 X 150 X 150 mm cast iron mould. The flexural members were cast in the standard 700 X 150 X 150 mm mould. The specimens were systematically placed in curing tanks after 24 hours for 7 and 28 days respectively. For each given percentage of glass fibers, six cubes and six beams were cast. Similarly, The workability for each of the given percentage of glass fiber is reported by taking the average of three slump test results. The Specimens were tested according to IS 516-1959 and IS 1199-1959.

RESULTS

Plastic aggregates can be successfully and effectively utilized to replace conventional aggregates. Use of plastic material in concrete as replacement of fine aggregate shows the good characteristics. Use of plastic in concrete shows the increase in compressive strength up to certain percentage (up to 4%) and then it start to decrease. The following table shows the compressive strength for normal and plastic used concrete for 7 days, 14 days and 28 days.

Density: As we use the plastic as replacement of fine aggregate it has great effect on density of concrete. As percentage of plastic increases the density of concrete

goes on reducing. The variation in density as increase in % of plastic is given in the following table.

Table -Result for Pavement Blocks

% of plastic as replacement of F.A	Density in Kg/m3
00	2400
5	2350
10	2240
15	2080
20	1990

Compressive strength:

Table: Compressive strength(cube)

Replacement of aggregate in %	Compressive strength after days in MPa	
	7 Days	28 Days
0%	14.8	24.9
1%	14.92	24.96
2%	14.98	25.1
3%	15.2	25.22
4%	15.31	25.40
5%	15.39	25.5
10%	15.40	25.52
11%	14.9	24.3
12%	13.4	23.4
13%	12.10	21.8

Table: Result for cylinder

Percentage of plastic added	Tensile strength of concrete in MPa	
	7 day	28 day
0	3	3.25
1	3.20	4.12
2	3.31	4.33
3	3.50	4.4
4	3.45	4.21
5	2.9	3.12

CONCLUSION

1. Plastic aggregates can be successfully and effectively utilized to replace conventional aggregates. Use of plastic material in concrete as replacement of _ne aggregate shows the good characteristics. Use of plastic in concrete shows the increase in compressive strength up to certain percentage (up to 4%) and then it start to decrease. The following table shows the compressive strength for normal and plastic used concrete for 7 days, 14 days and 28 days.
2. As expected, the unit weight of concrete decreased with an increase in the percent replacement owing to the light weight property of the plastic. As the percent replacement increased, the compressive strength of the concrete decreased. As we use the plastic as replacement of _ne aggregate it has great effect on density of concrete. As percentage of plastic increases the density of concrete goes on reducing. Hence this is most suitable for high rise structure to reduce the self-weight of structural element.
3. The important point to be noted that at the time of compacting of plastic mixed concrete by vibrator, the plastic ingredient separate from concrete mass due to its light weight property. Hence care should be taken at the time of compaction of concrete with vibrator.

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