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Investigation on Waste Plastic Sustainable Cellular Lightweight Concrete

Nisha. N[1], K. Vaidhegi[1], Jawahar[2]

[1]Assistant Professor, [2]Student,
[1,2]Sri Sairam Engineering College, Chennai, Tamil Nadu, India

ABSTRACT

The main objective of this project is to use the waste plastic as a coarse aggregate for making concrete. It is due to rapid industrialization and urbanization and increase on the plastic waste. The purpose of this investigation is to examine the custom of waste plastic as coarse aggregate in concrete mix of M20 grade concrete in a fractional way. In this investigation, the three mixes are prepared by using waste plastic. The waste plastic can be replaced in place of coarse aggregate in terms of volume (10%, 20%, and 30%) and the suitable ratio can be obtained which meets the desire strength and cost effectiveness. The waste plastic is still not used in many areas where it can be used. It's observed that up to 10%replacement of ordinary coarse aggregate replaced by plastic coarse aggregate the compressive strength of concrete will increases after 10% it start decreasing. It is eco-friendly building material it does not harm environment. And it is was observed that an increase in percentage of plastic waste will decrease the density of concrete. It satisfies the SDG goal of RESPONSIBLE CONSUMPSTION, PRODUCTION good involving use the product which affect the environment.

KEYWORDS: *waste plastic, coarse aggregate, eco friendly*

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INTRODUCTION

The use of plastic for various domestic purposes is increasing with time, which causes an increase in plastic waste day by day. Every country has different composition of waste, because of socioeconomic characteristics, pattern of consumption, and excess management programs but generally the percentage of plastics composition in waste is high studied by Murari et al. The main constituent of the plastic waste is namely polyethylene, followed by polypropylene, polyethylene, and polystyrene. As development is increasing, there is an increase in cost of construction and the maintenance of pavements. So, the Engineers and designer are looking for latest idea of using plastic wastes in cement concrete, Paver Blocks, and Solid Blocks.

The formation of low biodegradable and non-decaying waste materials, combined with a rising population has resulted in waste dumping problems. One solution to this problem is recycling wastes into useful products. Many Government agencies, private organizations, and individuals are in the process of implementing a wide variety of studies and research projects regarding the feasibility and environmental suitability of plastic waste. Use of waste plastic in construction industry which may provide better cost-effective construction material and reduce environmental Pollution. Here for the preparation plastic coarse aggregates, Mathew and Paul and Patil et al. Also presented that the recycled plastic waste was used and which provides an alternative option to deal with the plastic waste. Failure of concrete structures occurs due to the failure in concrete by crushing aggregates. Plastic coarse aggregates having low crushing values are not crushed easily as compared to natural aggregates. The density of natural coarse aggregate is more than plastic coarse aggregates. Total replacement of NCA was not possible, so partial replacement with varying percentage was done. About 500 billion plastic bags are used every year. In India the population is more than 1 billion and consumption of plastic is near about 4 million tones which causes increase in plastic

waste. Due to eating of discarded plastic, thousands of aquatic animals die every year similarly, on ground many animals suffer from similar fact in the direction of marine life. An additional environmental impact is produced due to gathering, hauling, and dumping of plastic bag. In a landfill or in environment, nearly 1000 years are required to degrade buried plastic. So there is a need to implement such innovative and environmental friendly technique to minimize the plastic waste at that point use of plastic aggregate in road construction is one of the effective technique to minimize the plastic waste

Plastic characterization

Chemical properties

The term "plastics" includes materials composed of various elements such as carbon, hydrogen, oxygen, nitrogen, chlorine, and sulfur. Plastics typically have high molecular weight, meaning each molecule can have thousands of atoms bound together. Plastics can be classified by the chemical process used in their synthesis, such as condensation, poly addition, and cross-linking. The ketone specially acetone has highly reactivity towards plastics. So acetone dissolved plastic readily, or at least affect it's surface, softening, smearing or dissolving plastic

Physical properties

Physical properties, including hardness, density, tensile strength, thermal resistance, and glass transition temperature. it has high capacity of insulation in thermal conductivity it describe the behavior of polymer against the action of heat. And it has 15%GF polyester. Plastic have slow rate of degradation and tend to be durable and they are poor conductors of heat and electricity. The plastic that act as insulators mostly have a high dielectric strength. Properties of plastic vary depending on the chemical composition, arrangements and the processing method of its subunits. Plastics can additionally be classified by their resistance and reactions to various substances and processes, such as exposure to organic solvents, oxidation, and ionizing radiation. Thermoplastics do not undergo chemical change in their composition when heated and thus can be molded repeatedly. Examples include polyethylene (PE), polypropylene (PP), polystyrene (PS). Thermosets, or thermosetting polymers, can melt and take shape only once: after they have solidified, they stay solid. If reheated, thermosets decompose rather than melt.

OBJECTIVES

The main objective of this project is to use the waste plastic as a primary material for making concrete blocks. The waste plastic can be replaced in terms of volume (10%, 20%, and 30%) and the suitable ratio can be obtained which meets the desire strength and cost effectiveness. And it provide sufficient strength and low density. And it reduce waste plastic and it is environmental friendly.

Observation

COMPRESSIVE STRENGTH

In order to check mix design for M20, block shaped specimens of dimensions (150 × 150 × 150) mm were casted and tested at the curing period of 7, 14, 28 days.

Compressive strength of block

S. No	Grade of Concrete	Curing days	Compressive strength (N/mm^2)
1	M20	7	11.5
2		14	18.6
3		28	24.8

s. no	% of M sand	% of plastic waste	7 days compressive strength	14 days compressive strength	28 days compressive strength
1	90	10	11.5	18.6	24.8
2	80	20	10.4	15.7	21.3
3	70	30	8.6	12.5	18.2

COMPARISON OF COMPRESIVE STRENGTH FOR DIFFERENT % OF WASTE PLASTIC WATER ABSORPTION FOR DIFFERENT % OF RED MUD**:**

W= (W_2-W_1 / W_1) X 100 10% WASTE PLASTIC = 1.61 % 20% WASTE PLASTIC = 2.1% 30% WASTE PLASTIC = 1.44%

% replacement of waste plastic	Wt of block before immersing (w1)kg	Wt of block after immersing (w2) kg	Compression Strength of block N/mm2
10	7.42	7.54	22.6
20	7.52	7.68	20.5
30	7.63	7.74	17.3

COMPARISON OF WATER ABSORPTION TEST FOR DIFFERENT % OF WASTE PLASTIC

WATER ABSORPTION

Also, the split tensile strength and the flexural strength of concrete increases up to certain percentage (i.e., up to 10%) and then gradually decreases with the increase in test the percentage of PCA. As the percentage of plastic increases, the density of concrete goes on decreasing.

The comparison of compressive strength for different percentage of Waste Plastic (10%, 20% and 30%) at 28 days is shown in this chart. From this chart, 10% block have optimum compressive strength of 22.6 N/mm2 which is greater than the 20% and 30% block

CONCLUSION

From the above result the following observations are made:

The compressive strength of concrete is increased up to certain percentage (i.e., up to 10%) and then drastically decreases with an increase in the percentage of PCA. perceived from the present study is that the concrete made of PCA gives intimation before failure (i.e., produce sound)

It is concluded that the concrete mix containing plastic material tends to reduce its mechanical properties of concrete due to the poor bond between the plastic and surrounding matrix.

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