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EXPERIMENTAL STUDY ON GREEN CONCRETE MADE WITH RECYCLED AGGREGATES

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Abstract: With the new technological development increasing very fast to tackle different difficulties in the construction industry. Increased production of concrete will leave harmful and hazardous effects on the environment. To solve the problem of increasing solid waste and increasing carbon dioxide in the environment we need an alternative to avoid this problem. In this research paper, we will discuss the concept of green concrete which will be prepared by replacing traditional coarse aggregates with recycled concrete aggregate and a certain amount of cement with fly ash. By the use of green concrete, we can reduce carbon dioxide emissions in the atmosphere. It is the need of the present time to focus on the methods of producing good quality recycled aggregates from the demolition waste generated from the construction sites. The crushed demolition concrete waste is segregated by sieving to obtain the required size of aggregates. This concept will also lead to saving of the construction cost.

Keywords: Sustainable development, compressive strength of concrete, Concrete, Efficient concrete, Green Concrete, Fly ash, Green House, Construction industry.

I. INTRODUCTION

Concrete is the most consumed material in the construction industry. Concrete plays an added role in the contribution of increasing Green House Gas emissions into the environment and when these concrete constructions are demolished it will lead to the problem of solid waste disposal. To reduce the production of carbon dioxide produced during the blasting of the rocks and the increasing construction waste. We already know that fly ash is a by-product of coal burning. It is available in good amounts at thermal power plants. Fly ash is also a source of air pollution. We can utilize this fly ash in the partial replacement of cement with the appropriate amount to get the desired compressive strength of the green concrete. We will work on the two concepts in a single production of green concrete. It involved the preparation of recycled aggregates by various methods and also minimizing the use of cement to develop a better green concrete than the traditional concept.

II. LITERATURE REVIEW

A comprehensive search of topic-related papers. After the collection of most related papers, a filtering process was then performed to identify how the collected papers match the research scope by observing titles and abstracts. A cross-check referencing study was further done to ensure the best information of the research. A brief analysis has been made to reflect the research-related interest.

Mr.Vardhan Nagarkar, et al in the year 2016 published good research on green concrete. In which they affirmed that green concrete is very low energy and resources consuming material. And it is also reducing the environmental pollution. This method is useful for saving natural resources for future generations. He also studied the silica fume and conclude that cement is a scarce resource all over the world because the demand for cement increases day by day. At the recent time, the use of silica fume increases because when it mixes with cement it enhances the hardness and freshness of cement.

Bulgaria (Zaharieva Hadejeiva et al., 2003) Fast-paced Urbanization and construction of infrastructural facilities such as roads, bridges, municipal and industrial structures, since the 1990s, gave rise to an increased amount of construction waste, but in 2000, of the 22% of the total expenditure on environmental protection and rehabilitation, only 0.5% was spent on management of such waste. Efforts are underway by agencies including the Municipality of Sofia, and the Bulgarian Academy of Sciences, besides the Ministry of Environment and Water Resources towards better Construction & Demolition waste management and utilization. Through a pilot project, called “Recycled Concrete Aggregates”, submitted in collaboration with Universities in northern France, Krupp Hazemag Group and RMN recycling company on producing of recycled aggregates from rejected panels could not be funded under the NATO program titled “Science for Peace”, it was highly appreciated by legislative institutions, local authorities, developers, construction companies, etc.

Mr. Abhijeet Baikerikar also studied the effect of concrete on the environment he obtained that at present time approximately one ton of carbon dioxide is released into the atmosphere from one ton of cement. Carbon dioxide is one responsible gas for global warming. Without aggregates, concrete cannot be produced. Blasting rocks to obtain also produces a significant amount of Carbon dioxide.

III. OBJECTIVE OF THE STUDY

- Developing green concrete with the help of recovered waste concrete from the construction and demolition sites.
- Reducing a certain amount of cement used by engaging a partial replacement of cement with the fly ash.
- Reducing the production of carbon dioxide to a certain extent.
- Minimizing the air pollution from the fly ash produced at the thermal power plants
- Solving the problem of disposal of construction and demolition waste materials.
- Minimizing the cost of producing the concrete to a certain extent.
- Developing and maintaining the required properties of the green concrete such as compressive strength etc.

IV. PROPERTIES OF RECYCLED GREEN CONCRETE

Mechanical Properties of Green Concrete

Cube compressive strength:

The universal testing machine is used for testing the compressive strength of concrete. Three cubes of concrete 150*150*150 cm3 are prepared for every set of observations at 7^{th} day, 14^{th} day, and 28^{th} day tests.

Splitting tensile strength

The split tensile strength of the concrete generally varies from 10 to 12 percent of the obtained compressive strength.

Durability Properties of Concrete:

The ability of concrete to resist the weathering action, chemical attack, and abrasion without degrading its desired strength properties. Lack of durability properties will lead to fine to wide cracks and efflorescence of concrete.

V. ADVANTAGES OF USING GREEN CONCRETE

- Reduced Carbon Footprint.
- Minimized production costs as waste directly replace the natural and costly aggregates and materials.
- Saves energy emissions, and wastage of water.
- Helps in recycling and reusing industrial waste.
- Reduces the overall cement consumption in the construction industry.
- Sustainable development will be achieved.
- Better workability in the case of recycled green concrete is obtained
- Higher-strength and durability properties than the traditional concrete.
- Compressive strength and flexural strength are developed in equal proportion to that of the traditional concrete by using a fixed amt of fly ash.

VI. LIMITATIONS OF RECYCLED GREEN CONCRETE

- Limited and less popular among the contractors and clients, people do not want to shift from the traditional concrete to a greener alternative as they have limited knowledge and understanding of the properties and nature of the green concrete.
- The benefits of Green Concrete to the environment are obtained seen in the long run and environmental awareness among the common people is limited.
- More and more experimental research is needed to get the better split tensile strength in the case of green concrete.
- The cost of reinforcement in the case of green concrete is more as compared to the traditional concrete it should also be improved with help of research and development in the field of green concrete.

VII. POTENTIAL BARRIERS IN THE PRODUCTION OF GREEN CONCRETE

Concrete properties:

Using waste streams as concrete ingredients could improve certain types of concrete properties while undermining some others.

Cost-effectiveness:

Cost-effectiveness would be the driving force for the industry to implement “green” concrete. Recycling and reuse of wastes require extra labor and energy input.

Industry perception/practice:

The construction and building product industry are conservative in nature due to the fear of product failure, which becomes a barrier to the utilization of waste materials as pointed out by Duxson et al. (2007).

RESULTS AND CONCLUSIONS

Compressive Strength Chart for different grades of concrete at 7 and 28 days

GRADE OF CONCRETE	MINIMUM COMPRESSIVE STRENGTH (N/mm2) at 7 DAYS	MINIMUM COMPRESSIVE STRENGTH (N/mm2) at 28 DAYS
M 7.5	5	7.5
M 10	7	10
M 15	10	15
M 20	13.5	20
M 25	17	25
M 30	20	30
M 35	23.5	35
M 40	27	40
M 45	30	45

In this Research article, we have given a piece of outline information about the need and importance of green recycled concrete for making sustainable development and achieving GREEN BUILDING ratings. The construction solid waste disposal problem is countered with the usage of recycled concrete aggregates. The problem of air pollution by thermal power plants is also countered with the usage of fly ash in the green concrete. Green House Gases are countered by discouraging the use of natural aggregates and using a decreased amount of cement than the normal concrete. Properties of green concrete like compressive strength and split tensile strength are calculated by performing the required experiments. We got better results in the case of green concrete saving on costs and sustainability in nature.

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