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Experimental Investigation on Green Concrete by Using M30 Grade

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ABSTRACT

Green concrete is nothing but concrete made with eco friendly wastes. Green Concrete is a environmental friendly material. Normal concrete is responsible for release of carbon dioxide to some extent. To reduce such emissions, various types of concrete were developed by various researchers by using some waste products from industries and agriculture. It depicts the convenience of the usage of various by products such as dust, fly ash, plastic waste, glass wastes, demolished brick waste, silica fumes, blast furnace, slag, etc. which requires less amount of energy and it is also less harmful to environment.

Green Concrete is capable for sustainable development by the application of industrial waste to reduce the consumption of natural resources and energy etc. Use of such materials saves approximately 20% of cements. Thus, green concrete is an excellent substitute of cement as it is cheaper, due to which it is made up of waste products, saving energy. Green Concrete has greater strength & durability compared to normal concrete.

Keywords*: Green concrete , Fly ash , silica fume, demolished bricks, CO2 emission, eco-friendly conc*

I. INTRODUCTION

1.1 Green Concrete

Green Concrete is the revolutionary topic in the history of concrete industry, this was first invented in Denmark in year 1998.Green concrete has nothing to do with colour. Green concrete is the type of concrete which is much like the conventional concrete but the production of such concrete require minimum amount of energy and causes least harm to environment. It is a concept of using eco-friendly materials in concrete, to make the system more sustainable. Green concrete is very often and also cheap to produce, because for example, waste products are used as a partial substitute for cement, charges. The size of 13 construction industry all over the world is growing at faster rate. The huge construction growth boosts demand for construction materials. Aggregates are the main constituent of concrete. Due to continuously mining the availability of aggregates has emerged problems in recent times.

II. METHODOLOGY

- To find out number of literature on green concrete.
- To study about the ingredients of green concrete.
- Collection of various ingredients required for project from different outsources.
- To design a concrete mix for M40 grade as per the Indian Standard Recommended method.
- To cast cubes, beams & cylinders by using a various ingredients as per mix design.
- To test the casted cubes, beams & cylinders for strength after 7, 14, 28 days of curing respectively by performing various test like compressive test & split tensile test.
- To compare between conventional concrete and green concrete based on various parameters.

III. MATERIALS USED

The Different Types Of Materials Used In This Investigation Give Below

3.1 Cement:

Ordinary Portland cement 53 grade cements conforming to IS: 169-1989.the result of tests included on cement are as follow.

TABLE 3.1. RESULTS OF CEMENT

Si.no	Property	Required as per IS 1489-1	VALUE
1.	Fineness	<10%	9%
2.	Specific gravity	3.1-3.16	3.16
3.	Initial setting time	30MINS	32MINS
4.	Final setting time	<600MINS	602MINS

3.2 Fly ash

Fly ash is a fine gray powder consisting mostly of spherical, glassy particles that are produced as a byproduct in coal-fired power stations. Fly ash has pozzolanic properties, meaning that it reacts with lime to form cementitious compounds.

It is commonly known as a supplementary cementitious material. A high percentage of the cement within concrete can be replaced by fly ash without adversely affecting concrete properties for specific applications. However, high-percentage replacement of cement by fly ash may result in concrete that has such low workability that it is unusable in common manufacturing processes.

This standard determines the usability of fly ash that can be used in concrete and classifies the various types, based partially on the measurement of the combined cumulative amounts of three oxides in the fly ash chemical composition - silicon dioxide (SiO2), aluminum oxide (Al2O3) and iron oxide (Fe2O3).

Picture 3.1 Fly ash

3.3 Silica fume

Silica fume is a byproduct of producing silicon metal or ferrosilicon alloys. One of the most beneficial uses for silica fume is in concrete. Because of its chemical and physical properties, it is a very reactive pozzolan. Concrete containing silica fume can have very high strength and can be very durable. Silica fume is available from suppliers of concrete admixtures and, when specified, is simply added during concrete production. Placing, finishing, and curing silica-fume concrete require special attention on the part of the concrete contractor.

Picture:- 3.2 Silica fume

3.4 Aggregates

Aggregates are the important and large used constituents in concrete. They give bond to the concrete, reduce shrinkage and effect economy. One of the most important factors for 20 producing workable concrete is good gradation of aggregates. It indicates that fractions of aggregates in required proportion such that the sample contains minimum voids. Aggregate properties greatly influence the behavior of concrete, since they occupy about 80%of the total volume of concrete. The aggregates are classified as

- Fine aggregates
- Coarse aggregates

Fine aggregates are material passing through an IS sieve that is less than 4.75mm gauge beyond which they are known as coarse aggregate. Coarse aggregate form the main matrix of concrete, whereas fine aggregate form the filler matrix between coarse aggregate. The most important function of the fine aggregate to provide workability and uniformity in the mixture. The fine aggregate also helps the cement paste to hold the coarse aggregate suspension. According to 18 383:1970 the fine aggregates is being classified into four different zones, that is Zone -1, Zone-2, Zone- 3, Zone- 4. Also in case of coarse aggregate maximum 20mm coarse aggregate is suitable for concrete work. But where there is no restriction 40mm or large size may be permitted. In case of close reinforcement 10mm size also used.

Picture:-3.3 River sand

Picture:-3.4 Coarse aggregates

3.4 Quarry dust

Quarry dust is a byproduct of the crushing process which is a concentrated material to use as aggregates for concreting purpose, especially as fine aggregates. In quarrying activities, the rock has been crushed into various sizes; during the process the dust generated is called quarry dust and it is formed as waste. So it becomes as a useless material and also results in air pollution. Therefore, quarry dust should be used in construction works, which will reduce the cost of construction and the construction material would be saved and the natural resources can be used properly.

Picture:- 3.5 Quarry dust

3.5 Recycled coarse aggregate

The first type of coarse recycled aggregates was obtained through the crushed concrete wastes of a old buildings from the Anakapalle . The concrete rubbles were crushed through impact hammers and the unwanted wastes such as reinforcements and aggregates were separated. Further crushing, water was hingand screening were done to attain the required size of the recycled aggregates. The second type of recycled aggregates was obtained by treating the sized recycled aggregate immersed in water for 72hours .After completion of immersion remove the RCA then dried the RCA for 48hours. nominal size of recycled aggregate used for this work was less than 20 mm.

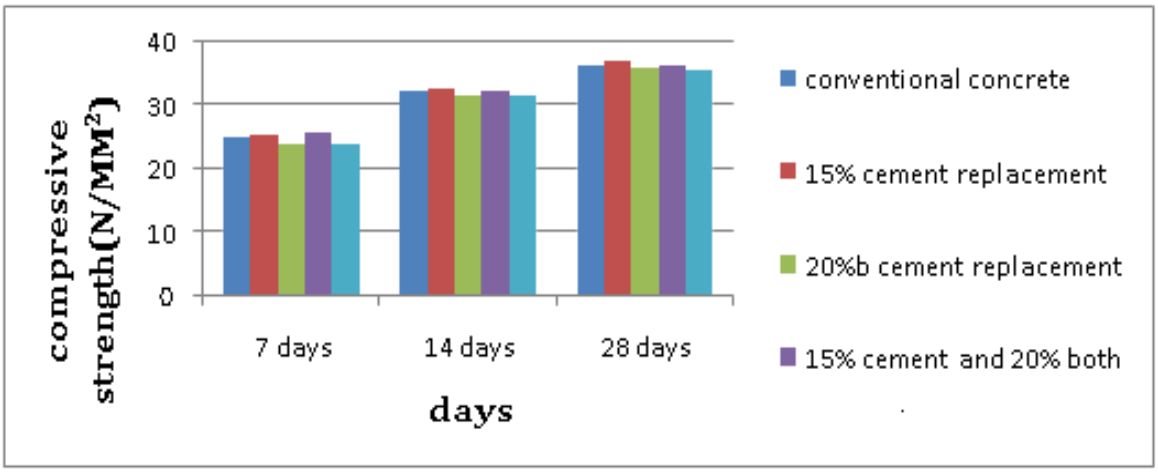
Picture:- 3.5 Recycled coarse aggregates

IV. Results And Observations

Compressive Strength

% of silica fume(cement replacement)	% of fly ash(cement replacement)	% of quarry dust(fine aggregate)	% of demolish aggregate (coarse aggregate)	Compressive strength (N/mm²)		
				7 DAYS	14 DAYS	28DAYS
0	0	0	0	25	32	36.23
5	10	0	0	25.33	32.48	36.63
5	15	0	0	23.77	31.44	35.60
5	10	20	20	25.37	32.19	36.19
5	10	25	25	23.92	31.45	35.52

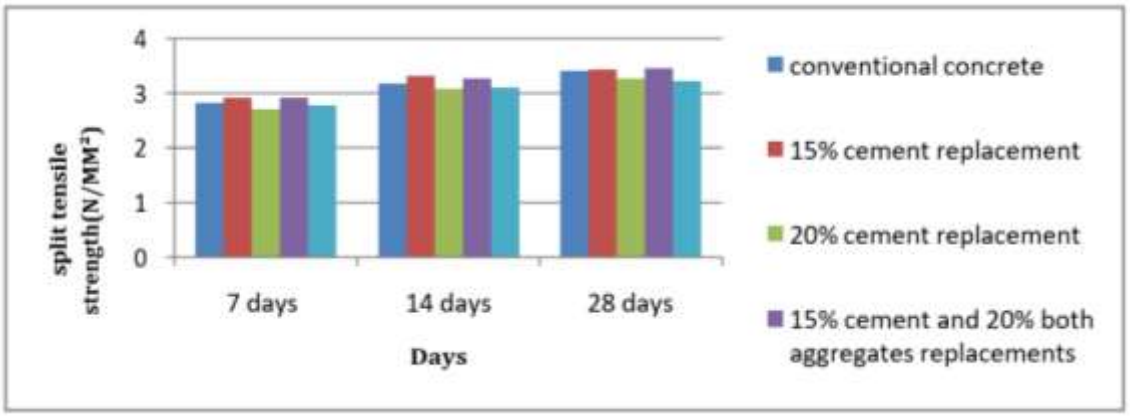
Comparison For Different Aggregates Replacement With Percentages Compressive Strength



Split Tensile Strength

% of silica fume(cement replacement)	% of fly ash(cement replacement)	% of quarry dust(fine aggregate)	% of demolish aggregate (coarse aggregate)	split tensile strength (N/mm^2)		
				7 DAYS	14 DAYS	28DAYS
0	0	0	0	2.84	3.18	3.40
5	10	0	0	2.94	3.26	3.39
5	15	0	0	2.77	3.06	3.3
5	10	20	20	2.96	3.27	3.46
5	10	25	25	2.76	3.1	3.27

Comparison For Different Aggregates Replacements With Percentages Split Tensile Strengths



V. Conclusion

- Silica fume and fly ash these are material which may cause air pollution these are the byproducts of some industries. Addition of these materials in cement reduces the air pollution and makes concrete more sustainable; as well as the optimum replacement of cement with silica 5% and fly ash 10% leads to increase in strength.
- These materials are finer than cement and more reactive to concrete ingredients so it increases the normal consistency of cement and achieves more strength in less time as compare to conventional concrete.
- By replacing the fine and coarse aggregate with quarry dust and recycled aggregates respectively there is no significant effect on any strength of concrete, but the overall cost of concrete reduces up to 20% so economically the concrete is more economical than conventional concrete
- It can be concluded that the 15% percentage of replacement with 5% Silica fume and 10% Fly Ash gives better compressive strength than ordinary Portland cement. The study also demonstrates the effect of silica fume and fly ash on durability parameters like water absorption, permeability, sulphate attack.
- Also cement replacement with both coarse and fine aggregates are replaced by recycled aggregates and Quarry dust Respectively 20% replacement. It gives better compressive strength and split tensile strengths then the conventional concrete

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