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Green Concrete by Using Industrial Waste Material- Fly Ash, Quarry Dust & Marble Powder

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Abstract: *Green concrete is a concept of using eco-friendly materials in concrete, to make the system more and more sustainable. This concrete should not be confused with its color. There are many choices of selection of materials in any type of constructions. Fly ash is not highly reactive; the heat of hydration can be reduced through replacement of part of cement with fly ash. Industrial waste such as marble powder, quarry dust, fly ash etc. to reduce consumption of natural resource and energy and pollution of the environment. So by reuse of the industrial waste materials we reduce impact on environment and also reduce disposal problem of industries. In our project we prepared M25 concrete mix with 50% of cement was replaced by fly ash and sand was totally replaced by 50% of quarry dust and 50% of marble powder. The concrete mixture were produced which tested and compared by conducting compressive test for 7days and 28days.*

Keywords: Green Concrete, Industrial Waste, Fly Ash, Marble Powder, Quarry Dust, Compression Test, etc

I. INTRODUCTION

Construction industry produces large amounts of waste and CO_2 emissions. Traditional concrete consumes natural resources like cement, sand, and gravel. Green concrete has nothing to do with colour. It is not in green colour. It is concept of thinking environment into concrete considering every aspect from raw materials manufacture over the design to structural design, construction and service life Green concrete is an eco-friendly alternative that uses industrial and recycled waste materials. It helps reduce environmental pollution and construction costs.

II. LITERATURE REVIEW

Dhoka (2013), carried out "green concrete: using industrial waste of marble powder, quarry dust and paper pulp" The green concrete is prepared by using industrial waste of marble powder, quarry dust with proper proportions". The versatility of green concrete & its performance derivate will satisfy many future needs.

Desai (2013), carried out green concrete: need of environment. Green concrete has capable of application of industrial wastes to reduce consumption of natural resources and energy and pollution of the environment. Marble sludge powder can be used as filler and helps to reduce the total voids content in concrete. Natural sand in many parts of the country is not graded properly and has excessive silt on other hand quarry rock dust does not contain silt or organic impurities and can be produced to meet desired gradation and fineness as per requirement. It concluded that, this contributes to improve the strength of concrete. Green concrete is an effective way to reduce environment pollution and improve durability of concrete under severe condition.

Garg and Jain (2014), studied on green concrete: efficient & eco-friendly construction materials. It presents the feasibility of the usage of by product materials like fly ash, quarry dust, marble powder/granules, plastic waste and recycled concrete and masonry as aggregates in concrete. It concluded that, it focuses on known benefits and limitations of a range of manufactured and recycled aggregates. Use of concrete product like green concrete in future will not only reduce the emission of CO2 in environment and environmental impact but it is also economical to produce.

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Wangchuk et.al. (2013), studied that green concrete for sustainable construction. It is characterized by application of industrial wastes to reduce consumption of natural resources and energy and pollution of the environment. Replacement of materials over nominal concrete is what makes green concrete more environmentally friendly concrete. Marble sludge powder, quarry rocks, crushed concrete and fly ash are some of the materials used for making green concrete, a sustainable construction. With green concrete technology we can save the natural materials for future use or the generations to come and sustain it for good amount of time.

III. METHODOLOGY

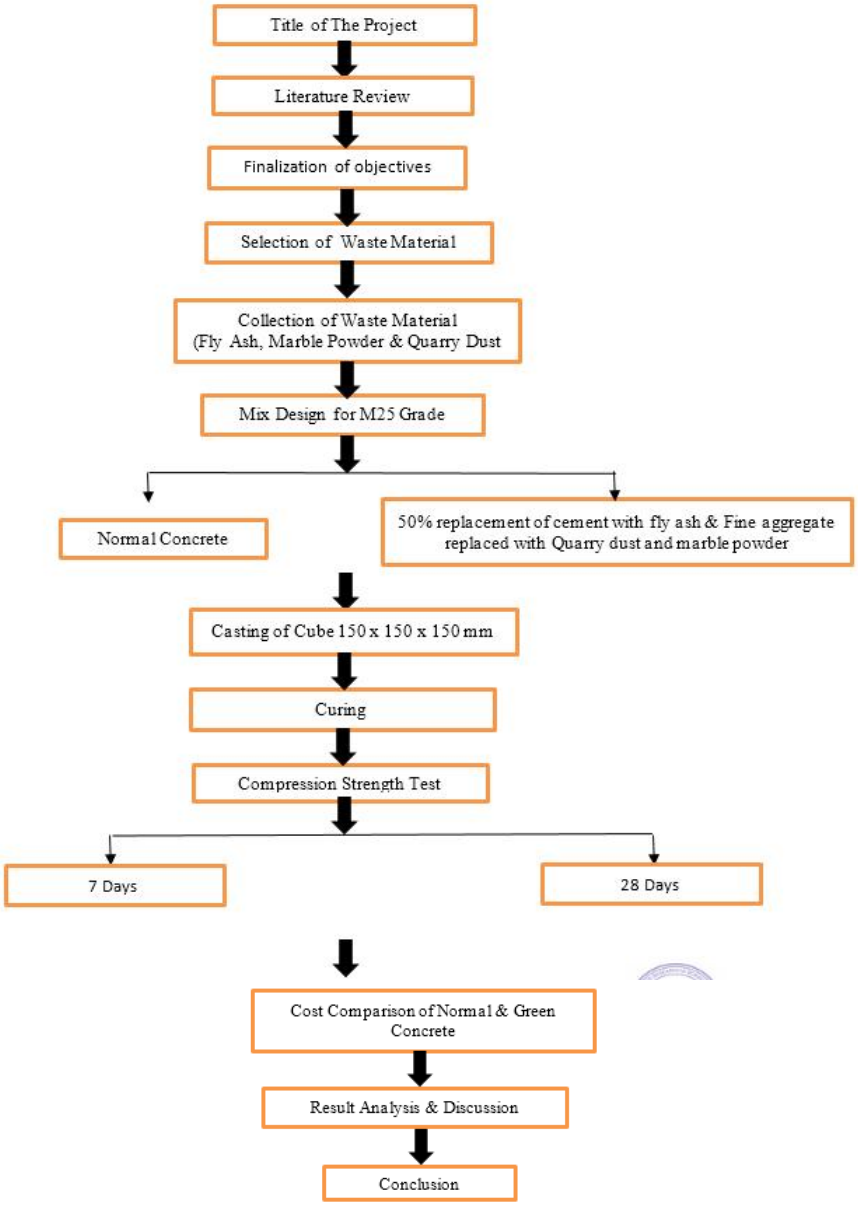

Fig. 1 Methodology of Green Concrete

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IV. WASTE MATERIAL USED IN CONCRETE

Fly ash
Stone Powder
Marbel Powder
Cement
Crush Sand
Aggregate

Coarse Aggregate:
Crushed Coarse aggregate passing through sieve of size 12.5-20mm and normal continuous grading is used. The specific gravity is 2.37.

Fig. 2 Coarse Aggregate

Quarry Dust:
The most widely used fine aggregate for making of concrete is the natural sand mined from the riverbeds. However, the availability of river sand for the preparation of concrete is become scarce due to excessive non-scientific methods of mining from the riverbeds, lowering of water table, sinking of bridge piers, etc. are becoming common problems. The present scenario demands identification of substitute materials for the river sand for making concrete. Quarry Dust as a by product from crushing process during quarrying activities is one of those materials that have recently gained attention to be used as concreting aggregates, specially as fine aggregates. In concrete production it could be used as a partial or full replacement of natural sand. Besides, the utilization of quarry waste, which itself is a waste material, will reduce the cost of concrete production.

Fig. 3 Quarry Dust

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Marble Powder:

Marble has been commonly used as a building material since ancient times. Disposal of the waste materials of the marble industry, consisting of very fine powders, is one of the environmental problems worldwide today. However, these waste materials can be successfully and economically utilized to improve some properties of fresh and hardened properties of mortar and concrete. Marble waste powder is an industrial waste containing heavy metals in constituent. Fineness with 90% of particles passing by300µm sieves. Marble powder was collected from the deposits of marble factories during shaping. It was retained on IS-150 micron sieve before mixing in concrete.

Fig. 4 Marble Powder

Water: Water used for manufacturing of Green concrete is potable and simply a tap water.

Fly Ash:

When pulverized coal is burnt to generate heat, the residue contains 80% fly ash and 20% bottom ash. Fly ash produced in Indian power stations are light to midgrey in color and have the appearance of cement powder. Use of Fly ash concrete in place of PCC will not only enable substantial savings in the consumption of cement and energy but also provide economy. The use of fly ash has a number of advantages. It is theoretically possible to replace 100% of Portland cement by fly ash, but replacement levels above 80% generally require a chemical activator. Studies have found that the optimum replacement level is around 30%. Moreover, fly ash can improve certain properties of concrete, such as durability. Because it generates less heat of hydration, it is particularly well suited for mass concrete applications. The use of fly ash in concrete in optimum proportion has many technical benefits and improves concrete performance in both fresh and hardened state. Fly ash use in concrete improves the workability of plastic concrete, and the strength and durability of hardened concrete. Generally, fly ash benefits concrete by reducing the mixing water requirement and improving the paste flow behavior.

Fig. 5 Fly Ash

Mix Design : Mix design proportion of standard M25 grade concrete as 1:1:2.

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V. COMPRESSION STRENGTH

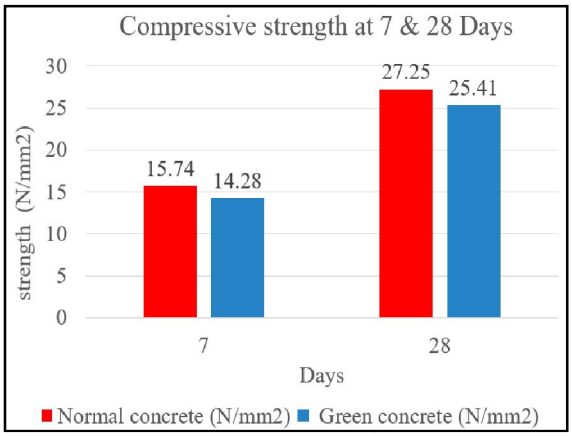
Compressive strength was conducted on concrete cube as per guidelines given in IS 516-1959. The specimen were surface dried before testing the same on Compression Testing Machine of 1000KN capacity. The result of compression test using industrial waste as 50% replacement of cement as fly ash & 100 % replacement of sand as Quarry dust & Marble Powder at curing age of 7 days & 28 days.

Fig. 6 Compression Testing

VI. RESULT & DISCUSSION

Days	Specimen No.	7	28
Normal concrete (N/mm2)	1	15.76	27.24
	2	16.89	28.54
	3	14.57	25.97
Average (N/mm2)		**15.74**	**27.25**
Green concrete (N/mm2)	1	13.34	26.37
	2	15.09	24.02
	3	14.43	25.86
Average (N/mm2)		**14.28**	**25.41**

Table 1: Compressive Strength At 7 & 28 Days



Graph 1: Compressive Strength At 7 & 28 Days

VII. CONCLUSION

The replacement of total fine aggregates with 50% of marble powder and 50% of quarry rock dust gives an nearly same result in strength aspect and quality aspect at 7 & 28 days.

Increase the marble powder content by more than 50% improves the workability.

Green concrete induced higher workability.

As per to cost comparison Green concrete is less costly than Normal Concrete.

The use of Marble Powder in concrete results in a smoother surface of the cube, which helps for getting a good aesthetic of the structure.

In this project we have conclude that we can manufacture Green Concrete by using waste material such as fly ash, marble powder, quarry dust etc.

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VIII. FUTURE SCOPE

Increased demand for sustainable buildings
Government support for green construction
Development of new recycled materials
Smart and eco-friendly cities

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