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GREEN CONCRETE: MEETING TODAY'S NEED

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Abstract: The concrete is made with concrete wastes which are eco-friendly so called as Green concrete. Green concrete is a revolutionary topic in the history of concrete industry. Concrete is an environmental friendly material and the overall impact on the environment per ton of concrete is limited. The paper covers the aspect on how to choose a material for green concrete. It presents the feasibility of the usage of by product materials like fly ash, query dust, marble powder granules, plastic waste and recycled concrete and masonry as aggregates in concrete. The use of fly ash in concrete contributes the reduction of greenhouse emissions with negative impacts on the economy. It has been observed that 0.9 tons of CO2 is produced per ton of cement production. Also, the composition of cement is 10% by weight in a cubic yard of concrete. Thus, by the use of green concrete it is possible to reduce the CO2 emission in atmosphere towards eco- friendly construction technique. Thus, green concrete is an excellent substituent of cement as it is cheaper, because it uses waste products, saving energy consumption in the production. Over and above all green concrete has greater strength and durability than the normal concrete.

Keywords: Green concrete, Materials for green concrete, Applications of Green concrete.

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INTRODUCTION

Green concrete is a revolutionary topic in the history of concrete industry. This was first invented in Denmark in the year 1998. Green concrete has nothing to do with the colour. It is a concept of thinking environment into concrete considering every aspect from raw materials manufacture over mixture design to structural design, construction and service life. Green concrete is a very cheap to produce, because, for e.g. waste products are used as a partial substitute for concrete materials, the charges for the disposal of waste are avoided, energy consumption in the production is lower and durability is greater. Green concrete is a type of a concrete which resembles the conventional concrete but the production or usage of such concrete requires minimum amount of energy and causes least harm to the environment. Inorganic residual products like stone dust, crushed concrete, marble waste are used as green aggregates in concrete. Further, by replacing cement with fly ash, micro silica in larger amounts, to develop new green cements and binding materials, increases the use of alternative raw materials and alternative fuels by developing or improving cement with low energy consumption.

A. Material Selection Criteria:-

- **Resource Efficiency:** Resource efficiency basically includes properties like recycled content, natural or renewable, resource efficient manufacturing process, locally available, salvaged/refurbished or remanufactured, reusable or recyclable and durability.
- **Indoor Air Quality:** Indoor air quality (IAQ) is enhanced by utilizing materials that meet the following properties: low or non-toxic, minimal chemical emission, moisture resistant and healthfully maintained.
- **Energy Efficiency:** This mainly refers to the energy used for making the concrete. Those materials are preferred that require the minimal amount of energy at the time of construction of the concrete.
- **Water Conservation:** Materials that help us and conserve water in landscaped areas are preferred to be used as construction save water at the time of construction or even help reduce water consumption in building materials.
- **Affordability:** Affordability can be considered when building product life-cycle costs are comparable to conventional materials or as a whole, are within a project-defined percentage of the overall budget.

1. Fly Ash As Cementitious Material:-

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.

2. Stone Crusher Waste As Fine Aggregates:-

Quarry dust is made while blasting, crushing, and screening coarse aggregate. Quarry dust has rough, sharp and angular particles, and as such causes a gain in strength due to better interlocking. The use of alternate materials for sand in construction works need attention with respect to their availability and applicability. The use of quarry dust sometimes causes an increase in the quantity of cement required to maintain workability. Quarry rock dust concrete experiences better sulphate and acid resistance and its permeability is less, compared to that of conventional concrete. However, the water absorption of Quarry Rock Dust concrete is slightly higher than Conventional Concrete.

The use of quarry sand is generally limited due to the high cement paste volume needed to obtain an adequate workability of concrete. The amount of additional paste content depends on shape, texture, grading and dust content of the sand. The increase of water demand of concrete mixtures produced by the adverse effects of shape and texture of quarry sand can be mitigated using a high-range water-reducing admixture also.

3. Recycled Concrete And Masonry As Aggregates:-

Coarse recycled concrete and masonry (RCM) is graded aggregates produced from sorted and clean waste concrete and masonry typically for road soubise applications. The material may contain small quantities of bricks, gravel, crushed rock or other forms of stony material as blended material. Fine recycled aggregates may also be referred to as crushed concrete fines. The shape, grading and excessive amount of fines may impact the workability, bleeding rate, finish ability and susceptibility to plastic cracking of concrete. Manufactured sand can be used to replace a major proportion of natural sand with no significant loss of performance in cement based products.

4. Marble Waste As Filler Material:-

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.

B. Features of Green Concrete:-

Cement production accounts for more than 6% of all CO2 emission which is a major factor in the world global warming (Greenhouse gas). India is the third largest cement producer in the World and one of the largest consumers of cement per capita in the world. Rough figures are that India consumes about 1.2 Ton/year/capita, while as World average is 0.6 Ton/year/capita. There have been a number of efforts about reducing the CO2 emissions from concrete primarily through the use of lower amounts of cement and higher amounts of supplementary cementitious material (SCM) such as fly ash, blast furnace slag etc. CO2 emissions from 1 ton of concrete produced vary between 0.05 to 0.13 tons. 95% of all CO2 emissions from a cubic meter of concrete is from cement manufacturing. It is important to reduce CO2 emissions through the greater use of SCM.

i) **Cement:**

Most of CO2 in concrete is from the cement manufacturing process. A typical cubic meter of concrete contains about 10% cement by weight. Out of all ingredients, cement gives out most carbon dioxide.

ii) **Aggregate:**

Use of aggregates contributes about 1% of all CO2 emissions from a typical cubic meter of concrete. Therefore, the use of alternate aggregate is desirable. The use of local and recycled aggregates is desirable as it can reduce transportation and fuel cost and support sustainable development.

iii) **Resources:**

While this may not appear to be a priority topic, pressure from environmentalist and The growing shortage of natural aggregate and sand is another aspect the construction industry. Use of recycled materials like aggregate, water is some ingredient which should be encouraged since fresh resources are becoming increasingly scarce.

Green Concrete:

Obtaining the most suitable mix based on the specification or suggesting improvements in the mix is to assist with the most suitable concrete for the project. The concrete which can fall in the category of green must have the following characteristics.

- Better Performance
- Enhanced cohesion workability / consistency
- Reduced shrinkage / creep.
- Durability - Better service life of concrete
- Reduced carbon footprint
- No increase in cost

C. Materials For Green Concrete:-

Green materials are environmentally responsible because impacts are considered over the life of the product. Depending upon project-specific goals, green materials may involve an evaluation of one or more of the following criteria.

- **Locally available:** Construction materials, components, and systems found locally or regionally, saving energy and resources in transportation to the project site.
- **Reusable or recyclable:** Select materials that can be easily dismantled and reused or recycled at the end of their useful life. Generation and use of recycled materials varies from place to place and from time to time depending on the location and construction activity as well as type of construction projects at a given site.

Recycled Demolition Waste Aggregate, Recycled Concrete Aggregate, Manufactured Sand, Fly ash etc. can be considered in this category.

D. Environmental Benefits to using Green Concrete :-

Green concrete is part of a movement to create construction materials that have a reduced impact on the environment. It is made from a combination of an inorganic polymer and 25 to 100 percent industrial waste.

1. Lasts Longer:-

Green concrete gains strength faster and has a lower rate of shrinkage than concrete made only from Portland Cement. Structures built using green concrete have a better chance of surviving a fire (it can withstand temperatures of up to 2400 degrees on the Fahrenheit scale). It also has a greater resistance to corrosion which is important with the effect pollution has had on the environment (acid rain greatly reduces the longevity of traditional building materials). All of those factors add up to a building that will last much longer than one made with ordinary concrete.

2. Uses Industrial Waste:-

Instead of a 100 percent Portland cement mixture, green concrete uses anywhere from 25 to 100 percent fly ash. Fly ash is a byproduct of coal combustion and is gathered from the chimneys of industrial plants (such as power plants) that use coal as a power source. There are copious amounts of this industrial waste product. Hundreds of thousands of acres of land are used to dispose of fly ash. A large increase in the use of green concrete in construction will provide a way to use up fly ash and hopefully free many acres of land.

3. Reduces CO2 Emission:-

In order to make Portland cement–one of the main ingredients in ordinary cement–pulverized limestone, clay, and sand are heated to 1450 degrees C using natural gas or coal as a fuel. This process is responsible for 5 to 8 percent of all carbon dioxide (CO2) emissions worldwide. The manufacturing of green concrete releases has up to 80 percent fewer CO2 emissions. As a part of a global effort to reduce emissions, switching over completely to using green concrete for construction will help considerably.

E. Applications of Green Concrete:-

Green concrete columns

Green concrete bridge

Green concrete dam

Green concrete building

II. CONCLUSION

Green concrete having reduced environmental impact with reduction of the concrete industries co2 commissions by 30%. Green concrete is having good thermal and fire resistant. In this concrete recycling use of waste material such as ceramic wastes, aggregates, so increased concrete industry use of waste products by 20%. Hence green concrete consumes less energy and becomes economical. So definitely use of concrete product like green concrete in future will not only reduce the emission of co2 in environment and environmental impact but also economical to produce.

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