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Green Concrete a Stepping Stone for Future

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ABSTRACT:
Green Concrete is a type of 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. Green concrete is very low energy & resource consumption, no environmental pollution & sustainable development. Green cement concrete is produced by using recycled waste materials such as activated fly ash and recycled concrete aggregates. Other concrete alternatives can be equally used to significantly increase the sustainability and durability. Secondly, one must plan for structural designs involving environmentally friendly maintenance strategies which will need less of energy and resources. Although green concrete seems to be providing lot of benefits, still one needs to consider the potential barriers on its way. They are increase in cost of recycling and reusing along with use of additional energies and resources for the same and the fear of failure of the green concrete as it is made from reused products. One can conclude that overcoming the above demerits would help to use green cement concrete with a potentially new environmental friendly world.

KEYWORDS: Recycled cement aggregates, sustainability, green concrete, greenhouse gases

1. INTRODUCTION:

A potentially sustainable new form of concrete has been recently created that might make it the most environmentally friendly type of building material. Concrete in its traditional form is made from cement, mixed with a range of coarse aggregates such as gravel, limestone or granite, and some finer particle aggregates such as sand or fly ash. These are mixed together with water, to form a quick drying bonded structure, which can easily be manipulated into many forms such as the surface of roads, or driveways or footings for structures. It is the most commonly used building material in the world-some estimate that in the region of 7 cubic kilometers of concrete are manufactured each year, and that there already is 1 cubic meter of concrete for every human on earth. Unfortunately concrete is not an environmental friendly material, either to make, or to use, or even to dispose of. To gain the raw materials to make this material, much energy and water must be used, and quarrying for sand and other aggregates causes environmental destruction and pollution. Concrete is also claimed to be a huge source of carbon emissions into the atmosphere. Some claim that concrete is responsible for up to 5% of the world's total amount of carbon emissions, which contribute to greenhouse gases. **[1]**

The reason for the huge popularity of concrete is the result of a number of well-known advantages, such as low cost, general availability, and wide applicability. But this popularity of concrete also carries with it a great environmental cost. The billions of tons of natural materials mined and processed each year, by their sheer volume, are bound to leave a substantial mark on the environment. Most damaging are the enormous amounts of energy required to produce Portland cement as well as the large quantities of CO_2 released into the atmosphere in the process. This paper summarizes the various efforts underway to improve the environmental friendliness of concrete to make it suitable as a “Green Building” material. Foremost and most successful in this regard is the use of suitable substitutes for Portland cement, especially those that are

byproducts of industrial processes, like fly ash, ground granulated blast furnace slag, and silica fume. Also efforts to use suitable recycled materials as substitutes for concrete aggregate are gaining in importance, such as recycled concrete aggregate, post-consumer glass, tires, etc. The paper also discusses some of the economic drivers which determine the degree of commercial success. Simply deposing of waste materials in concrete products is unlikely to succeed except in unusual situations. But by identifying and exploiting specific properties inherent in various waste materials or byproducts, it is possible to add value to such materials and increase their chances of success in a market-driven economy of supply and demand **[2].**

2. SUSTAINABILITY OF CONSTRUCTION MATERIALS:

In order to estimate the environmental impact of a construction material, it is necessary to consider all stages in the life of the material (**Fig.1**). Each construction material is manufactured from some combination of raw materials, with some expenditure of energy, and with associated wastes. Therefore manufacture is an essential element in computing the environmental impact, and manufacture is probably the element most widely cited when considering the environmental impact of construction materials. Are the raw materials renewable? Are they scarce? Are they important to the global environment? How much energy is required in the manufacture? How much waste is produced during the manufacture? What impact do these wastes have on the environment? These questions are very important and this phase probably receives the most attention, both from the general public and from the government. The construction process also involves some expenditure of energy and produces some waste. There are several important questions. How much of each manufactured material is used? Can materials be used that have less environmental impact? How much energy is used? How much waste is produced? What is the impact of the waste on the environment? Some of these questions can only be answered for a specific structure. Increasing attention is being given to the construction phase as part of global and regional efforts to make development more sustainable. The lifetime of the structure has a direct impact on sustainability. When the structure deteriorates, it must be destructed and rebuilt. The lifetime is directly controlled by the durability of the construction materials. It is further influenced by the adaptability of the design to repair and renovation, and repair and renovation themselves have environmental impacts. Finally, the lifetime of a structure is influenced by cultural and market forces. When a structure no longer serves an important function (not necessarily the function for which it was constructed), it is likely to be destructed. And if it is not aesthetically pleasing, it may be destructed. So materials and design considerations directly affect the lifetime of a structure and the lifetime must be considered when computing environmental impact.

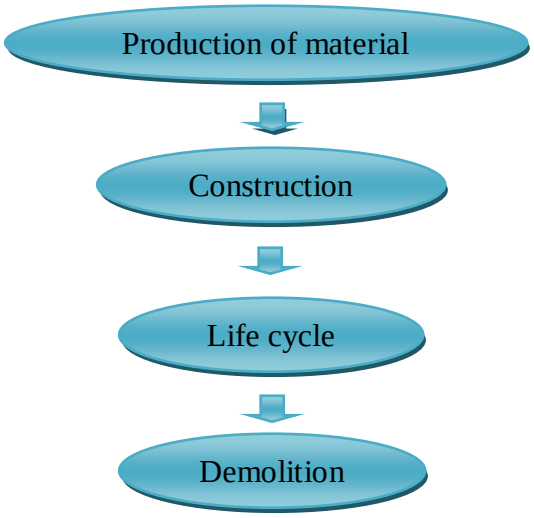

Fig. 1: Stages considered when estimating environmental impact

3. SUSTAINABILITY OF CONCRETE:

Concrete is manufactured from aggregates (rock and sand), hydraulic cement, and water. It usually contains a small amount of some chemical admixture, and (at least in the USA) it often contains a mineral admixture replacing some portion of the cement. A typical concrete formulation contains a large amount of coarse and fine aggregate, a moderate amount of cement and water, and a small amount of admixture. Most of these constituents are themselves manufactured products, byproducts, or materials extracted by mining. In order to assess the environmental impact of concrete manufacture, it is necessary to consider the impact of each separate constituent. The aggregates are usually obtained by mining. The coarse and fine aggregates are usually mined separately. Occasionally aggregate is obtained as a by-product of some other process (e.g., slag or recycled concrete). Aggregates may be crushed and may be washed. They are usually separated into various size fractions and reconstituted so as to satisfy the grading requirements. They may need to be dried. A modest amount of energy is involved in all these processes. The principal wastes are dust and water, neither of which is especially damaging to the environment. The dust may be used in some other process or may be disposed in a landfill.

4. NEED OF GREEN CONCRETE:

Cement-based materials are the most abundant manufactured materials in the world. Today's exciting trend is the Green building is in our country. The potential environmental benefit to society of being able to build with green concrete is huge. Green Concrete as the name suggests is eco friendly and saves the environment by using waste products generated by industries in various forms like rice husk ash, micro silica, etc to make resource-saving concrete structures **[3-5].** Use of green concrete helps in saving energy with emissions, waste water. Green concrete is very often also cheap to produce as it uses waste products directly as a partial substitute for cement, thus saving energy consumption in production of per unit of cement. Over and above all green concrete has greater strength and durability than the normal concrete. It is realistic to assume that the technology can be developed, which can reduce the CO_2 emission related to concrete production. Generally the construction industry accounts for a massive environmental impact due to its high demand of energy. As a result of the awareness built during the past few years about green house effect and damage to the nature, more people and countries became conscious about their future. Traditional ready mix concrete is a significant cause of production of green house gases, less in regards to GHG emissions per m^3, but in particular in regards to the high quantity produced world-wide**.** New available technologies allow the use of different types of concrete and advanced ways of production which represent a lesser hazard to the environment. Green concrete capable for sustainable development is characterized by 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. Consequently, this contributes to improve the strength of concrete. An attempt has been made to durability studies on green concrete compared with the natural sand concrete by usage of quarry rock dust and marble sludge powder as hundred percent substitutes for natural sand in concrete **[6].** Recent focus on climate change and the impact of greenhouse gas emissions on our environment has caused many to focus on CO_2 emissions as the most critical environmental impact indicator. These issues made researchers to put efforts to reduce greenhouse gas emissions **[7].**

5. ADVANTAGES OF GREEN CONCRETE:

It is found that the compressive, split tensile strength and durability studies of concrete made of quarry rock dust are nearly 14 % more than the conventional concrete. The concrete resistance to sulphate attack was enhanced greatly **[8].** Concrete remains less harmful than most other common building materials. Application of green concrete is an effective way to reduce environment pollution and improve durability of

concrete under severe conditions. Green concrete is very often also cheap to produce, as the waste products are used as a partial substitute for cement, charges for the disposal of waste are avoided, energy consumption in production is lower, and durability is greater. Waste can be used to produce new products or can be used as admixtures so that natural sources are used with more efficiency and the environment is protected from waste deposits.

6. GREEN CONCRETE TECHNOLOGY:

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. Traditionally the concrete industry has been considered a major producer of GHG emissions, mainly due to the high environmental footprint of cement. The carbon footprint is a measure of the quantity of carbon dioxide emitted through fossil fuel combustion. It is often expressed as tons of carbon emitted per annum **[9, 10].** Currently the concrete industry is taking a number of steps to reduce the carbon footprint of concrete, from using less Portland cement and more fly ash or slag to enhance the mix with chemicals that allow working with less water. Further the introduction of coarse aggregate cooling systems help to find ways to more innovative solutions including carbon sequestration **[11].**

7. SUITABILITY OF GREEN CONCRETE IN STRUCTURES:

a) Reduce the dead weight of a façade from 5 tons to about 3.5 tons.
b) Reduces crane age load, allow handling, lifting flexibility with lighter weight.
c) Good thermal and fire resistance, sound insulation than the traditional Granite rock.
d) Improve damping resistance of building, speed of construction, shorten overall construction period
e) There are numerous advantages in usage of Green concrete in fresh stage such as Enhances the rheology of the mix, workability, Deficiency in sand is corrected by providing sufficient fines, which makes the concrete ideal for pumping, No bleeding & No cold joints.
There are numerous advantages in usage of Green concrete in hardened stage such it, Increases the durability as lower permeability is achieved, Improves the quality of cover to the reinforcement, Protection against sulphate attack and chloride penetration, Safeguard against Alkali-Silica reaction, Decreased thermal cracks due to lower heat of hydration.
f) It helps nation by Substantial saving in power, Decrease in emission of CO_2 – pollution free environment, If all the fly ash generated each year were used in producing concrete, the reduction of carbon dioxide released from cement production would be equivalent to eliminating 25% of the world's vehicle. By reducing consumption of OPC, the rate of depletion of mineral resources (National Resources) required for production of cement can be reduced. If SCMs are used the problem of disposal will be reduced, thus reducing the environmental hazards and will clear many many acres of land used for disposal.

8. CONCLUSIONS:

Concrete continues to play a pivotal role in overall economic growth both locally and globally. In order to improve the sustainability of all concrete structures, there is a need to understand the interactive effect of the many issues from 'cradle to grave' in the design phase, during construction and end-of-life and, most importantly, the energy savings achievable during the use phase. The importance of assessing a building or structure's impact is via a life-cycle assessment.
Green concrete technology is one of the major steps that a construction industry can implement to achieve sustainable construction with various means as discussed above. 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. With the time, the virgin material will deplete and so the cost for the material will increase which will add to more cost for the construction but if we use waste materials for construction the virgin materials will become a sustainable material and as well the cost will be reduced. With waste material as alternative we can help

reduce the environmental problems and protect the naturally available materials for future generations as well. The usage of green concrete ensures sustainable development and it's gaining its popularity ever since its inception

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