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REVIEW PAPER ON GREEN CONCRETE

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Abstract - Construction industry is growing rapidly and new technologies have evolved very fast to cater different difficulties in the construction industry. Among all materials used in the construction industry concrete is main material for construction purposes. Billions of tons of naturally occurring materials are mined for the production of concrete which will leave a substantial mark on the environment. Nowadays recycling of waste and industrial by products gaining popularity to make concrete environment friendly material and the concrete can be called as Green Concrete. This review paper will give us a brief idea about as well as advantages and disadvantages about green concrete.

Key Words — Concrete, Green Concrete, Recycled Aggregates, Quarry Dust, Recycled Aggregate Concrete, Cement, Fine Aggregate, Course Aggregate.

I. INTRODUCTION

The word concrete comes from the Latin word "concretes" (meaning compact or condensed). Concrete is a composite construction material made primarily with aggregate, , and water. There are many formulations of concrete, which provide varied properties, and concrete is the most used man-made product in the world. The environmental impact of concrete is a complex mixture of not entirely negative effects; while concrete is a major contributor to greenhouse gas emissions and creates problem for the disposal of waste concrete from demolished sites which in turn effects the environment. Therefore recycling of concrete waste is the need of hour. Concrete is also interesting in relation to other environmental problems than those related to CO2 emission. Due to all these above mentioned reasons civil engineers have come up with a new concept of concrete, named "GREEN CONCRETE".

The size of 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. To overcome this problem, there is need to find replacement to some extent. Nowadays, there is a solution to some extent and the solution is known as "Green Concrete". Green concrete has nothing to do with color. It is a concept of thinking environment into concrete considering every aspect from raw materials manufacture overmix design to structural design, construction, and service life. Green concrete is also cheap to produce because, waste products are used as partial substitute for cement, charges for the disposal 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 resources are used more efficiently and the environment is protected from waste deposits. Traditionally aggregates have been readily available at economic prices and of qualities to suit all purposes. However, in recent years the wisdom of our continued wholesale extraction and use of aggregates from natural resources has been questioned at an international level. This is mainly because of the depletion of quality primary aggregates and greater awareness of environmental protection.

In light of this, the availability of naturalresources to future generations has also been realize. The size of construction industry all over the world is growing at faster rate". Concrete is a widely used construction material consisting of cementing material, fine aggregate, coarse aggregate and required quantity of water, where in the fine aggregate is usually natural sand. The use of sand in construction results in excessive sand mining which is objectionable. Due to rapid growth in construction activity, the available sources of natural sand are getting exhausted. (Planarian, 2003) Also, good quality sand may have to be transported from long istance, which adds to the cost of construction. With the sharp development of construction and increase of people's awareness of environmental protection, waste control and management becomes one of the great challenges of modern society for the mission of sustainable development. Construction and demolition (C&D) waste constitutes one major portion of total solid waste produced in the world, including demolished concrete, bricks, and masonry, limestone, ceramic and other materials.

The environmental protection agency EPA defines the C&D debris as "waste material that is produced in the process of construction, renovation, or demolition of structures. Structures include buildings of all types, both residential and non-residential, as well as roads and bridges. Components of C&D debris typically include concrete, asphalt, wood, metals, gypsum wallboard and roofing". The nature of building in Mosul city is distinguished with using concrete as main construction material. Concrete blocks are widespread in construction as bearing wall or even partitions. The availability and cheapness of concrete constituents made it the most famous material compared to other construction materials. This means that most of D&C wastes in Mosul city are composed of concrete. Recycling process is the most important method for consuming the waste and protects the environment.

II. IMPACT ON ENVIRONMENT DUE TO CONCRETE

1. About 0.9 tons of carbon dioxide is produced for every 1 ton of cement produced. Carbon dioxide is one of the greenhouse gas which is responsible for global warming.

2. Major ingredient in the production of concrete is aggregates without aggregates it is impossible to produce concrete. Aggregates are mined from the rock mines and the rate with which concrete is produced there will be significant reduction innaturally occurring materials.

3. Disposal of construction and demolition waste has become a major problem these days, according to the report of Technology, Information, Forecasting, Assessment Council the total amount of waste from construction industry is estimated to be 12 to14.7 million tons per annum. Out of which 7.8 million tons are concrete and brick waste. Because of increasing problems of these wastes many countries have started researches to use these materials as source.

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SR. NO.	TRADITIONALINGREDIENTS	REPLACEMENT MATERIALS FOR GREEN CONCRETE
1	Cement	Eco-cement, sludge ash, muncipal fly solid waste ash
2	Coarse aggregate	Recycled aggregates, waste ready mix concrete, waste glass, recycled aggregates with crushed glass, recycled aggregateswith silica fume.
3	Fine aggregate	Fine recycled aggregate, demolished brick waste, quarry dust, waste glass powder, marble sludge powder, rock dust and pebbles, artificial sand, waste glass, fly ash and micro silica, bottom ashof muncipal solid waste

III. USE OF RECYCLED AGGREGATES

Construction and Demolition disposal has emerged as a major problem in all over the world. In USA, approximately 135 million tons of Construction and Demolition waste is generated annually. Wastes' arising from construction and demolition Constitutes one of the largest streams within the European Union and many other countries. It is now widely accepted that there is significant potential for reclaiming and recycling demolished debris for use in value added applications to maximize economic and environmental benefits. As a result recycling industries grew up. Many governments throughout the world have now introduced various measures aimed at reducing the use of primary aggregates and encouraging reuse and recycling, where it is technically, economically, or environmentally acceptable. Recycling industries in many parts of the world converts low value waste into secondary construction material such as aggregate grades, road materials and aggregate fines. While accepting the need to promote the use of Recycled Concrete Aggregate (RCA) in wider applications, it must be remembered that the aggregate for concrete applications must meet the requirements set in relevant specifications for its particular use. The gap between these interests has to be reduced in steps that are manageable and the use of RCA in structural concrete has to be promoted gradually. Similarly considerable attention is required to the control of waste processing and subsequent sorting, crushing, separating and grading the aggregate for use of the concrete construction industry. In addition, there is an urgent need forlegislative or regulatory measures to implement sustainable Construction & Demolition waste management strategy and encourage recycling for use in value added applications. A number of different processes are possible for the crushing and sieving of Construction & Demolition waste. Such material often contains foreign matter in the form of metals, wood, hardboard, plastics, papers etc. Hence, a process scheme has to be adopted which removes large pieces of these materials, mechanically or manually, before crushing and thorough cleaning of the crushed product.

- It has been reported that there is a loss in compressive strength of concrete when recycled aggregates are used for production of concrete as direct replacement to natural aggregates.

- Therefore it can be used as partial replacement to natural aggregates.

- The lower compressive strength recorded for concrete produced with recycled aggregate was due to higher water cement ratio, which was required to facilitate mixing due to absorption of the recycled fine particles.

- Recycled aggregate concrete will have higher water absorption than conventional concrete, it is mainly due to adhered mortar with recycled aggregates.

- Recycled aggregate concrete will have slightly higher drying shrinkage; this is mainly because of increase in water/cement ratio.

- Recycled aggregate concrete has better resistance to carbonation it is mainly due to porous recycled aggregates and presence of old mortar attached to crushed stone aggregate.

- Recycled aggregate concrete provides better resistance to freezing and thawingthan concrete produced by mixing natural aggregates.

- For concrete producers, the use of coarse RCA is unlikely to pose any problem in the production of concrete that is stable in the fresh state and able to develop properties comparable to the corresponding Normal Aggregate Concrete in hardened state. This is of great importance to reduce inhibition of concrete specifiers and producers towards using RCA.

- The key engineering anddurability properties of RCA concrete aresimilar to corresponding Normal Aggregate Concrete, providing the mixes are of equivalent strength achieved through adjustment in the w/c ratio

- Overall, the practical benefits resulting from the current work are not only on environmental and economical fronts, but they could also provide the construction industry with technical information on a marketable product, which is presently under-utilized.

IV. USE OF QUARRY DUST

Quarry dust is a waste obtained during quarrying process. It has very recently gained good attention to be used as an effective filler material instead of fine aggregate. In the present study, the hardened and durable properties of concrete using quarry dust were investigated. 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. Most of the developing countries are under pressure to replace fine aggregate in concrete by an alternate material also to some extent or totally without compromising the quality of concrete. Quarry dust has been used for different activities in the construction industry, such as building materials, road development materials, aggregates, bricks, and tiles.

Common river sand is expensive due to excessive cost of transportation from natural sources. Also large-scale depletion of these sources creates environmental problems. As environmental transportation and other constraints make the availability and use of river sand less attractive, a substitute or replacement product for concrete industry needs to be found. River sand is most commonly used fine aggregate in the production of concrete poses the problem of acute shortage in many areas. Whose continued use has started posing serious problems with respect to its availability, cost and environmental impact.

In such a situation the Quarry rock dust can be an economic alternative to the river sand. Quarry Rock Dust can bedefined as residue, tailing or other non-voluble waste material after the extraction and processing of rocks to form fine particles less than 4.75mm. Usually, Quarry Rock Dust is used in large scale in the highways as a surface finishing material and also used for manufacturing of hollow blocks and lightweight concrete prefabricated Elements. Use of Quarry rock dust as a fine aggregate in concrete draws serious attention of researchers and investigators. In the recent past good attempts have been made for the successful utilization of various industrial by products (such as fly ash, silica fume, rice husk ash, foundry waste) to save environmental pollution. In addition to this, an alternative source for the potential replacementof natural aggregates in concrete hasgained good attention. As a result reasonable studies have been conducted to find the suitability of granite quarry dust in conventional concrete. The utilization of Quarry rock dust which can be called as manufactured sand has been accepted as a building material in the industrially advanced countries of the west for the past three decades. As a result of sustained research and developmental works undertaken with respect to increasing application of this industrial waste, the level of utilization of Quarry Rock Dust in the industrialized nations like Australia, France, Germany and UK has been reached more than 60% of its total production. The use of manufactured sand in India has not been much, when compared to some advanced countries.

- The durability of quarry dust concrete under sulphate attack is higher compared to conventional concrete.

- The durability of quarry dust concrete under acid action is also better than conventional concrete.

- The effects of quarry dust on the elastic modulus property are good with conventional concrete containing natural sand.

- The fine quarry dust tends to increase the amount of super plasticizers needed for the quarry mixes in order to achieve therheological properties.

Replacement of natural sand with Quarry Rock Dust, as full replacement in concrete is possible. However, it is advisable to carry out trial casting with Quarry Rock Dust proposed to be used, in order to arrive at the water content and mix proportion to suit the required workability levels and strength requirement. However, more research studies are being made on Quarry Rock Dust concrete necessary for the practical application of Quarry Rock Dust as Fine Aggregate.

V. ADVANTAGES OF GREEN CONCRETE

- Much change is not required for the preparation of green concrete compared to conventional concrete.

- Reduces environmental pollution.

- Have good thermal and acid resistance.

- Compressive and split tensile strength is better with some materials compared to conventional concrete.

- Reduces the consumption of cement overall.

- Green concrete is economical compared to conventional concrete.

VI. DISADVANTAGES OF GREEN CONCRETE

- Structures constructed with green concrete have comparatively less

- Life than structures with conventional concrete.

- Compressive strength and other characteristics are less compared to conventional concrete.

- Water absorption is high.

- Shrinkage and creep are high compared to conventional concrete.

- Flexural strength is less in green concrete.

VII. CONCLUSIONS

- Aggregates with higher surface area are requiring more water in the mixture to wet the particle surfaces adequately and to maintain a specific workability. Obviously increasing in water content in the mixture will adversely affect the quality of concrete.

- The physical and chemical properties of quarry dust satisfy the requirements of fine aggregate.

- There is significant potential in waste materials to produce green concrete.

- The replacement of traditional ingredients of concrete by waste materials and by products gives an opportunity to manufacture economical and environment friendly concrete.

- Partial replacement of ingredients by using waste materials and admixtures shows better compressive and tensile strength, improved sulphate resistance, decreased permeability and improved workability.

- The cost per unit volume of concrete with waste materials like quarry dust is lower than the corresponding control concrete mixes.

- A detail life cycle analysis of green concrete by considering various parameters is very much necessary to understand theresultant concrete properties.

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