



AN EXPERIMENTAL STUDY ON THE PREPARATION OF GREEN CONCRETE USING FLY ASH AND RECYCLED CONCRETE AGGREGATES

¹Aakash Srivastava, ²Rajneesh Kumar

¹M. Tech, ² Assistant Professor,

¹Department of Civil Engineering,

¹Lucknow Institute of Technology, Lucknow, India

Abstract: The green concrete term is not related to the color of the concrete. The term is related to the eco-friendly nature of the concrete, sustainable development, and decreasing the greenhouse effect. This research article discusses the significance of green concrete shortly. Most of the big construction companies are now focusing on green infrastructure. They are trying their best to decrease the load on the environment in various steps for sustainable development. Concrete is among the highest percentage of materials used at the construction site. We can utilize the waste and demolished concrete materials by crushing them and passing through the required sieve size, both fine aggregates and coarse aggregates were recovered. The mix is prepared with different percentage of fly ash replacing Portland Pozzolana Cement. Compressive Strength tests were performed at the lab for different Percentages of replacement of cement with fly ash.

Index Terms - Concrete, Sustainable Development, Green, materials, Compressive Strength

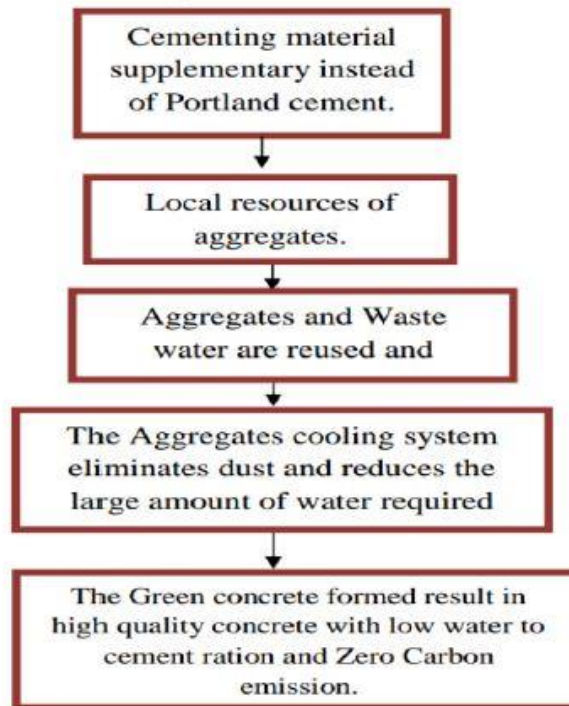
I. INTRODUCTION

Sustainable Development is the need of the present, to preserve the natural resources and maintaining the global temperature. we need to limit the extraction of the natural fine and coarse aggregates used in the preparation of conventional concrete. We should recognize and popularize the use of green concrete in construction activities. waste generated at the site poses a serious problem for solid waste disposal. Most of this waste can be easily and effectively used for the development of green concrete. Recycled concrete aggregates can be a stable replacement of the natural aggregates in conventional concrete construction. There will be the escape of taxes imposed by the government on the construction companies for solid waste disposal.

Concept of Green Concrete

The following are the basic factors that are used to decide if concrete is classified as "green.":

1. Quantity of Portland cement that can be replaced with replacement materials
2. Methods as well as processes for manufacturing
3. Endurance.
4. Life cycle sustainability impacts



II. LITERATURE REVIEW

Ms. Monica C. Dhoka has carried out a trial study on green concrete. She has researched the various strength and qualities of concrete impacted with the utilization of recycled waste materials. She described green concrete in which we can lessen the pollution in the environment. She also suggested appropriate percentage of materials like cement and fly ash can improve the stability of concrete under the examination situation.

Mr. Vardhan Nagarkar, in 2016 cited a paper on the study of green concrete. In which they derived that green concrete can be a very little energy consuming and resources intense material. It also diminishes environmental impacts and pollution reduction. The concept of green concrete is a sustainable one as it saves the natural resources for the future generations. He also researched about silica fume and derived that cement is one of the less available material used in the construction industry all over the world. Now a days, the usage of micro silica is in demand as it mixes with cement to modify the rigidity and cleanness of the cement.

Mr. Vardhan Nagarkar, he also calculated the release of carbon dioxide from traditional cement and conclude that concrete is the most common material used in the construction industry and it release a large quantity of environmental concrete wastes. The carbon dioxide released from these activities adversely impacts the environment by global warming. There is a also rise in temperature of the earth planet.

Mr. Abhijeet Baikerikar researched the factors that impacted the environment. He concluded that during that period just about 1 ton of carbon dioxide is given out from 1 ton cement. Carbon dioxide is the major gas released during the production of cement which is greatly responsible for the Global Warming. In the absence of aggregates, concrete can never be produced.

III. MATERIALS USED FOR THE PREPARATION GREEN CONCRTEETE

Replacement Binders

Fly ash

- Fly ash is a waste material obtained from coal-fired thermal power plant.
- Fly ash can be used in the range of 15 to 50 percentage of weight of cement, this cement can be classified as green.

Non crystalline Silica

- Micro Silica is obtained as a byproduct of produce silicon metal / ferro-silicon alloys.
- Slag is a glass like materials obtained as a by product from metal extraction from the rocks.

Powdered Limestone

- ash from agricultural left over (example, ash from rice shell)
- Waste/by product obtained from Cement furnace.
- Geopolymers (alkali-activated cement and inorganic polymer cement.) are binders that are obtained by waste material such as fly ash and GGBS.
- Calcined clay can be used as supplementary cement material

Substitute Ingredients

Aggregate fine/coarse prepared from Recycling

- Recycled concrete comprises of concrete returned from the ready mixed concrete , crushed and recycled aggregates obtained by the demolition of structures and temporary offices built at site.
- Post-industrialized and post end user materials.
- Using crushed concrete can potentially reabsorb green house gases.
- Minimizing the use of fresh water and replacing it with recycled grey water of specified standards.

Materials use strategies

- Partial replacement of materials used in cement kiln .
- Using lower percentage of limestone as feed material in cement production minimises energy consumption and releases reduced calculations of Green house gases.
- alternative fuels are discovered and used during the production for the cement industry
- non-hazardous materials are used which are safe to deal with , stock up, transportation easily available materials in the same area of production reduces the cost of fuels for transportation and less pollution in the environment.

IV. METHODOLOGY USED FOR CALCULATION OF COMPRESSIVE STRENGTH

The following methodology was framed to incorporate all the aspects of the proposed thesis work:

- To collect and prepare the Demolition materials & Residual materials
- Binder materials as Fly ash & Portland pozzolana cement
- Sieve analysis and Grading of aggregates
- Preparation of green concrete at different proportions
- Preparation of cubes and
- Testing the compressive strength of cubes at 7 days and 28 days correspondingly.

V. FACTORS RESPONSIBLE FOR GREEN CONCRETE COMPRESSIVE STRENGTH

Green Concrete Compressive strength is affected by different factors;

- Type of mix.
- Quality of raw materials such as type of cement.
- Water /cement ratio.
- Ratio of coarse and fine aggregate
- Grading of aggregates
- Age of concrete
- Degree of compaction of concrete,
- Temperature during curing.
- Relative humidity in the atmosphere.
- Curing of concrete by moist curing and membrane curing.

VI. POSITIVE ASPECTS OF GREEN/ RECYCLED CONCRETE

- Green concrete has miscellaneous benefits over the conservative traditional concept concrete.
- Recycled Concrete make use of recycled trodden aggregates and materials as a replacement of natural aggregates.
- It minimizes the superfluous burden in landfills.
- Mitigate the depletion of natural aggregates.
- The overall CO₂ emission is reduced to a greater percentage.
- The reuse of waste materials also contributes to a greater extent to financial system of the individual.
- The waste materials and recycled aggregates are normally chosen from a nearby area.
- Fly ash is normally available at close proximity power plants and industries using coal . This will save the transportation cost of the raw materials used in the production of cement.
- Fly ash can be used in concrete to gain better workability and durability to some extent.
- Green concrete also involves the reduction of the percentage of cement in the mix replaced with other binder materials which have properties similar to that of cement.
- The use of waste materials at site of construction, cement manufacturing industry and at thermal power plants solves the crisis of disposing of the disproportionate amount of construction and industrial wastes.
- Green concrete concept can be well thought-out elemental to sustainable development in view of the fact that it is eco-friendly itself. Green concrete is being extensively used in eco friendly building practices.
- It also help the eco friendly infrastructure buildings to accomplish LEED as well as Golden Globe certifications.

VII. Potential Barriers in Implementing “Green” Concrete

Concrete basic properties: Utilization of waste material from the industries and recycled aggregates from the concrete waste as concrete basic elements could work on certain types of concrete properties whereas further properties are below expected value. For instance, Yang (2005) discovered that make use of trodden oyster shells maintain as well as enhanced the compressive strength of the green concrete but undermined the ease of workability.

Cost-effectiveness: Cost-effectiveness is one of the most important criteria for the industry to put into operation of the “green” concrete. Recycled reused materials demands more labor and greater energy need. Batayneh (2007) gave an idea that the cost among the recycled crushed wastes (e.g., glass, plastic, and Recycled Concrete Aggregates) and natural conventional aggregate (river sand and gravel) should be studied in management of the project.

Industry awareness/put into practice: The construction industry and building material production are old-fashioned in character due to the panic of merchandise disappointment, which leads to a blockade to the exploitation of squander resources as meaningful by Duxson (2007). They even points out the negative obligations and poor mindset of the production based on the non-conservative practices in concrete production methods. Industry does not want to take risk in their projects as they might not be successful.

RESULTS AND DISCUSSION

- The conventional natural coarse aggregate used in concrete can be replaced with green concrete partially mixed with fly ash to attain the essential compressive strength.
- The outcome of compressive strength tests for two mix (M7.5 and M15) subsequent to 7 days and 28 days, correspondingly, with different fly ash percentage of 15%, 20%, and 25% were take and recorded.
- The use of fly ash In place of PPC must be limited to some percentage as the green concrete has to keep with certain qualities.
- The increased usage of green aggregate in place cement concrete will lead to reduced cement usage and less coarse aggregate utilization in the extended run.
- The use of minimum coarse aggregate/grit may lead to minimum power consumption.
- The extended usage of green concrete will help in decreasing the percentage green house gases and carbon dioxide, thus it is having many environmental benefits,.

REFERENCES:

[1] Monica C. Dhoka 2013, "Green Concrete: Using Industrial Waste of Marble Powder, Quarry Dust and Paper Pulp", International Journal of Engineering Science Invention, Department of Civil Engineering, Bharati Vidyapith College of Engineering, Pune, India, Volume - 2, Issue - 10, Oct -2013. ISSN: 2319 - 6726.

[2] Abhijeet Baikerikar 2014, " A Review on Green Concrete ", Journal of Emerging Technologies and Innovative Research, Structural Engineering, Master of Technology in Structural Engineering, Belgaum, Karnataka, India, Volume 1, Issue 6, Nov 2014. ISSN: 2349 - 5162.

[3] Vardhan Nagarkar, Sanket Padalkar, Samruddhi Bhamre, Akshay Tupe 2017, "Experimental Study on Green Concrete ", International Journal for Research in Applied Science and Engineering Technology, U G students, Department of Civil Engineering, Anantrao Pawar College of Engineering and Research, Pune, India, Volume-5, Issue-4, April 2017. ISSN: 2322-9653.

[4] P. Duxson, A. Fernández-Jiménez, J. L. Provis, G. C. Lukey, A. Palomo & J. S. J. van Deventer “Geopolymer technology: the current state of the art” Journal of Materials Science volume 42, pages2917–2933 (2007)

[5] Malek Batayneh, Iqbal Marie, Ibrahim Asi “Use of selected waste materials in concrete mixes” Waste Management 27 (2007) 1870–1876

[6] Eun Ik Yang, Seong-Tae Yi, Young-Moon Leem “ Effect of oyster shell substituted for fine aggregate on concrete characteristics: Part I. Fundamental properties” November 2005 Cement and Concrete Research DOI:10.1016/j.cemconres.2005.03.016